MNES Management Plan

Olive Downs Coking Coal Project

Prepared for Pembroke
June 2023

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MNES Management Plan

Olive Downs Coking Coal Project

Report Number

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Client

Pembroke Olive Downs Pty Ltd

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5 June 2023

Approved by

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5 June 2023

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Abbreviations

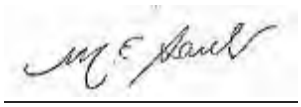
Acronym	Definition
CHPP	Coal handling and processing plant
CMSHA	Coal Mining Safety and Health Act 1999 (CMSHA)
CMSHR	Coal Mining Safety and Health Regulation 2017 (CMSHR)
CSG	Coal seam gas
DAF	Department of Agriculture and Fisheries (Queensland)
DAWE	Department of Agriculture, Water and the Environment (Commonwealth) (prior name)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DES	Department of Environment and Science (Queensland)
DPM Enviros ciences	DPM Enviros ciences Pty Ltd
EA	Environmental Authority
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Ltd
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EO	Environmental Officer
ESCP	Erosion and Sediment Control Plan
Ha	Hectares
ILF	In-line flocculation
km	kilometres
km/hr	Kilometres per hour
m	metres
ML	Mining Lease (ML700034, ML700035, ML700036, ML700032 and ML700033)
MMP	MNES Management Plan
MNES	Matters of National Environmental Significance
Mtpa	Mega-tonnes per annum
NC Act	Nature Conservation Act 1992
NSW	New South Wales
QCLNG	Qld Curtis LNG
Qld	Queensland
Pembroke	Pembroke Olive Downs Pty Ltd
The Project	Olive Downs Coking Coal Project and Access Road
RE	Regional ecosystem
REMP	Receiving Environment Monitoring Plan
RFS	Queensland Rural Fire Service
RMS	NSW Department of Roads and Maritime Services
ROM	Run of mine

Acronym	Definition
SECP	Sediment and Erosion Control Plan
SHMS	Safety and Health Management Systems (SHMS)
TEC	Threatened Ecological Community
TMR	Department of Transport and Main Roads (Queensland)
VHF	Very High Frequency
WoNS	Weeds of National Significance

Declaration of Accuracy

In making this declaration, I am aware that sections 490 and 491 of the *Environment Protection and Biodiversity Conservation Act 1999* make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all of the information and documentation supporting this MNES Management Plan is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at time of making this declaration.

Signature: Date: 5 June 2023



Full name: Melanie Saul

Position: Principal Environment & Community Relations Officer

1 Introduction

1.1 Background

Pembroke Olive Downs Pty Ltd (Pembroke) are the proponent for the Olive Downs Coking Coal Project (the Project). The Project is a greenfield metallurgical coal mine within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland (Figure 1.1).

The coal resource will be mined in stages by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal. The Project will produce up to 20 mega-tonnes per annum (Mtpa) of run of mine (ROM) coal over an anticipated operational life of approximately 79 years.

The Project was declared a 'Coordinated Project' for which an Environmental Impact Statement (EIS) was prepared that included detailed ecological studies and impact assessments on matters of state and national environmental significance. The Project was approved by the Queensland Coordinator-General in May 2019. The Project was declared a 'controlled action' due to potential for the mine to have a significant impact on matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An approval was granted by the Minister on 14 May 2020 (EPBC 2017/7867) for the Project components being the mine site and access road, which are the subject of this report.

Conditions 45 to 47 of the EPBC approval (EPBC 2017/7867) require the preparation of a MNES Management Plan that pertains to the mine site and access road. All applicable conditions of approval pertaining to this report, and where they are addressed, is summarised in Section 1.4.

Approval of this MNES Management Plan (MMP) was originally granted by the Federal Department of Agriculture, Water and Environment (DAWE) in December 2020. It was then updated in March 2022 associated with nest box installation requirements for Stage 1. Subsequent to this update Pembroke have been required to make changes to the Stage 1 boundaries which has flow on changes to Stage 2 and 3 boundaries. The boundary changes have slightly altered the extent of habitat impacts for MNES associated with each stage, but do not increase the total MNES impacts. Minor changes are proposed to some management measures for grazing in Section 5.2.3 and monitoring methods in Section 6. Therefore this MMP has been updated and approval is being sought from Department of Climate Change, Energy, the Environment and Water (DCCEEW).

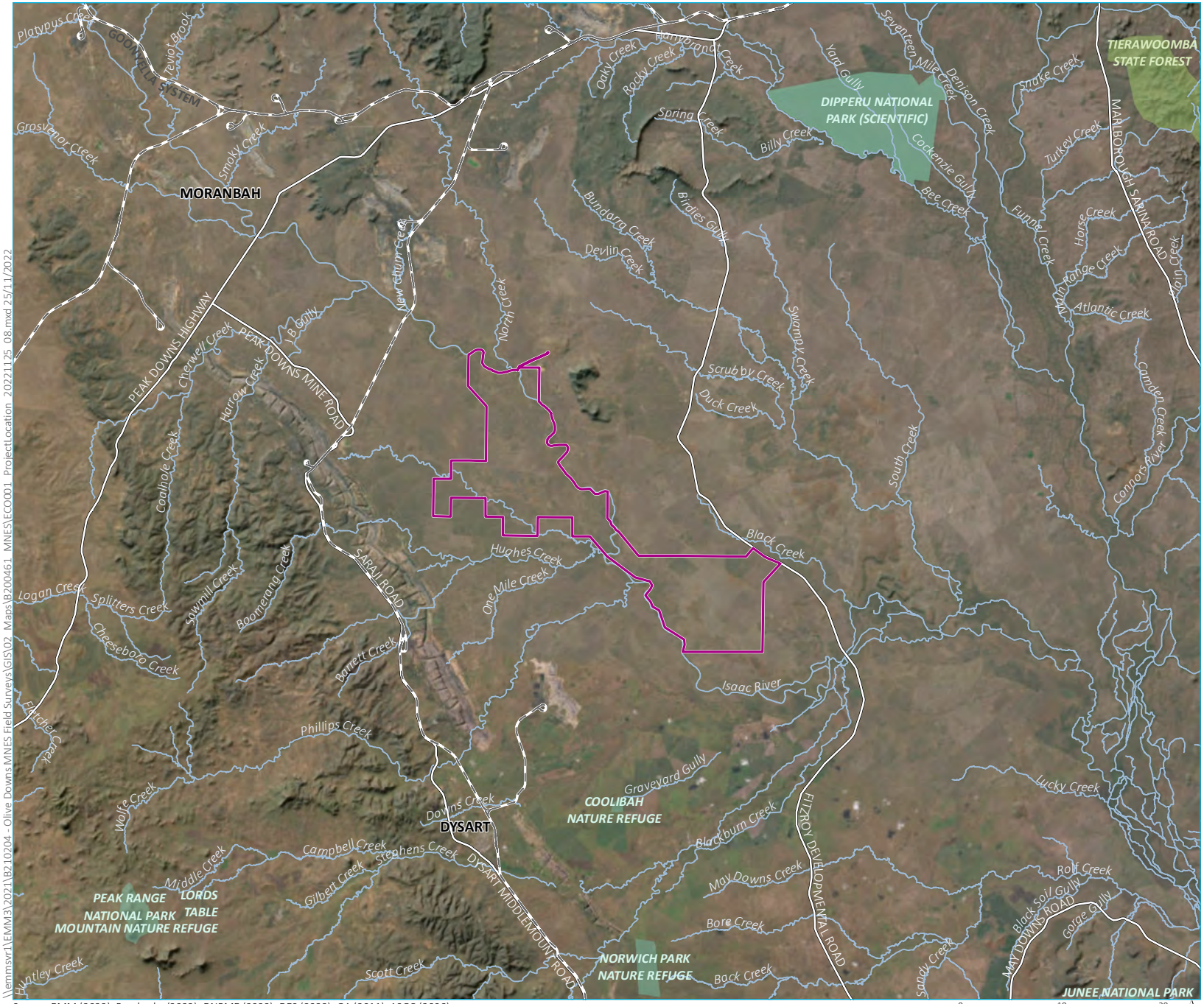
1.2 Purpose

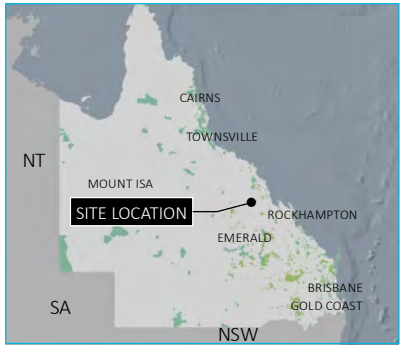
In accordance with EPBC approval (EPBC 2017/7867) the purpose of this MMP is to demonstrate how impacts on the 'listed threatened species and community' and their habitat, will be avoided, mitigated, and managed. The applicable 'listed threatened species and community' referenced in the approval are:

- Koala (*Phascolarctos cinereus*);
- Greater Glider (*Petauroides volans*);
- Squatter Pigeon (Southern) (*Geophaps scripta scripta*);
- Ornamental Snake (*Denisonia maculata*);
- Australian Painted Snipe (*Rostratula australis*); and
- Brigalow threatened ecological community (Brigalow TEC).

Pembroke is committed to develop and implement appropriate avoidance, mitigation and management measures during key phases of the Project being clearing, construction, operation and decommissioning, for the protection of the MNES. The MMP identifies these measures, the performance criteria to be achieved, and monitoring to ensure the actions are effective in attaining and maintaining the set 5-yearly interim targets and ecological outcomes.

The MMP has been developed in accordance with the Project's approval (EPBC 2017/7867), specifically addressing Conditions 2 and 45 to 47 as summarised in Section 1.4 and guidance material provided by representatives of the DCCEEW.





KEY

- Project area
- Rail line
- Major road
- Named watercourse
- National park/nature reserve
- State forest

Site locality

Olive Downs
MNES Management Plan
Figure 1.1

Source: EMM (2022); Pembroke (2022); DNRME (2022); DES (2022); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 55

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EMM creating opportunities

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1.3 Project description

The Project area is approximately 26,164ha in total, situated across five mining leases (ML700034, ML700035, ML700036, ML700032 and ML700033) (Figure 1.2). Open cut mining areas will be developed, and rehabilitated, in a progressive manner over the life of the Project. There are two main domains for the open cut pits being Olive Downs South Domain and Willunga Domain. The Olive Downs South Domain in the north of the Project area will be mined first, with operations progressively moving south to the Willunga Domain as part of stages three and four.

Access to the respective domains will be provided by two local access roads:

- from Annandale Road to the Olive Downs South Domain (including an approved crossing of the Isaac River); and
- from the Fitzroy Developmental Road to the Willunga Domain.

The Isaac River is on the eastern boundary of the Project area in the north, and also divides the two domains in the central portion of the Project area. The two domains will be connected by crossings of the Isaac River for vehicular access and transfer of crushed ROM coal via an overland conveyor. A third, separate crossing of the Isaac River would also be utilised (subject to weather permitting) for waste rock emplacement and vehicular access in the north-east of the Olive Downs South domain. The EPBC conditions pertaining to the three river crossings are summarised in Section 1.4.

1.3.1 Project activities

The construction and operation of the Project will include following activities:

- development of the Olive Downs South and Willunga domain open cut mine areas;
- exploration activities;
- progressive development of soil stockpiles, laydown areas and borrow areas (e.g. for road base and ballast material);
- drilling and blasting (daytime only) of competent waste rock material;
- progressive placement of waste rock in emplacements adjacent to and nearby the open cut mine extents;
- progressive backfilling of the mine voids with waste rock behind the advancing open cut mining operations;
- progressive rehabilitation of waste rock emplacement areas;
- construction of an access road from Annandale Road to the Olive Downs South domain infrastructure area including a crossing of the Isaac River;
- progressive development of new haul roads and internal roads, including an Isaac River road crossing to provide access between the Olive Downs South and Willunga domains;
- installation and operation of an on-site coal handling and processing plant (CHPP) at the Olive Downs South domain along western boundary;
- installation and operation of on-site ROM coal handling and crushing facilities at the Willunga domain;

- transfer of crushed ROM coal from the Willunga domain to the CHPP at the Olive Downs South domain, via either haul road or overland conveyor with an approved Isaac River crossing;
- storage and disposal of CHPP rejects (coarse and fine rejects) during the initial years (until in-pit containment facilities become available) in initial rejects storage facilities including In-line Flocculation (ILF) cells;
- disposal of CHPP rejects (coarse and fine rejects) on-site within appropriate in-pit containment facilities, including mine voids behind the advancing open cut mining operations and, where circumstances allow, disposal in other out-of-pit containment facilities; and
- progressive development of sediment dams and water storage dams (including the North Western Water Dam, Central Water Dam, mine affected water dams, raw water dams, etc.) and installation of pumps, pipelines and other water management equipment and structures (including up-catchment diversions and temporary levees).

The operational hours of the Project would be 24 hours a day, seven days a week. Construction rosters are expected to be 12 hour shifts with 21 days on and seven days off. Vegetation clearing and construction activities would be undertaken during daytime hours up to seven days per week.

Further detail on reviews and updates to the MMP is provided in Section 7.

1.3.2 Project stages

The Project will be developed and operated over four main stages. Therefore, a significant portion of the Project area will not be cleared and developed for over 30 years (particularly in the Willunga Domain). The Stage 1 and 2 areas, and surrounding areas on properties presently owned by Pembroke, are the focus for the current MMP and MNES management commitments. These areas of land owned by Pembroke are within ML700036, ML700035 and ML700032 as shown in Figure 1.2.

The intent for land outside of the approved disturbance footprint for Stage 1 and 2, within ML700036, ML700035 and ML700032, is that they are managed in their pre-existing (i.e. natural state) which may include some grazing outside of riparian zones. Existing patches of native vegetation and MNES habitats (outside Stage 1 and 2 impact footprints) will be maintained and managed as detailed in the MMP.

As Pembroke gain ML's for Stages 3 and 4 management of additional areas in the south will commence. Details will be added to future revisions of the MMP for approval by the Minister prior to the commencement of each stage.

Land clearing and construction is proposed to occur in the following four stages. Please note these years are indicative with clearing occurring progressively over a number of years and construction starting in some areas where priority infrstructure is needed. Construction is then likely to continue for a number of years across both Stages 1 and 2 at the same time.

- Stage 1- 2022 – 2026 (vegetation clearing) 2022 – 2032 (construction);
- Stage 2 – 2023 – 2028 (vegetation clearing) 2023 – 2033 (construction);
- Stage 3 – 2032 -2050 (18 years); and
- Stage 4 – all works until completion of the Project (30 plus years).

The four Project stages are illustrated in Figure 1.2.

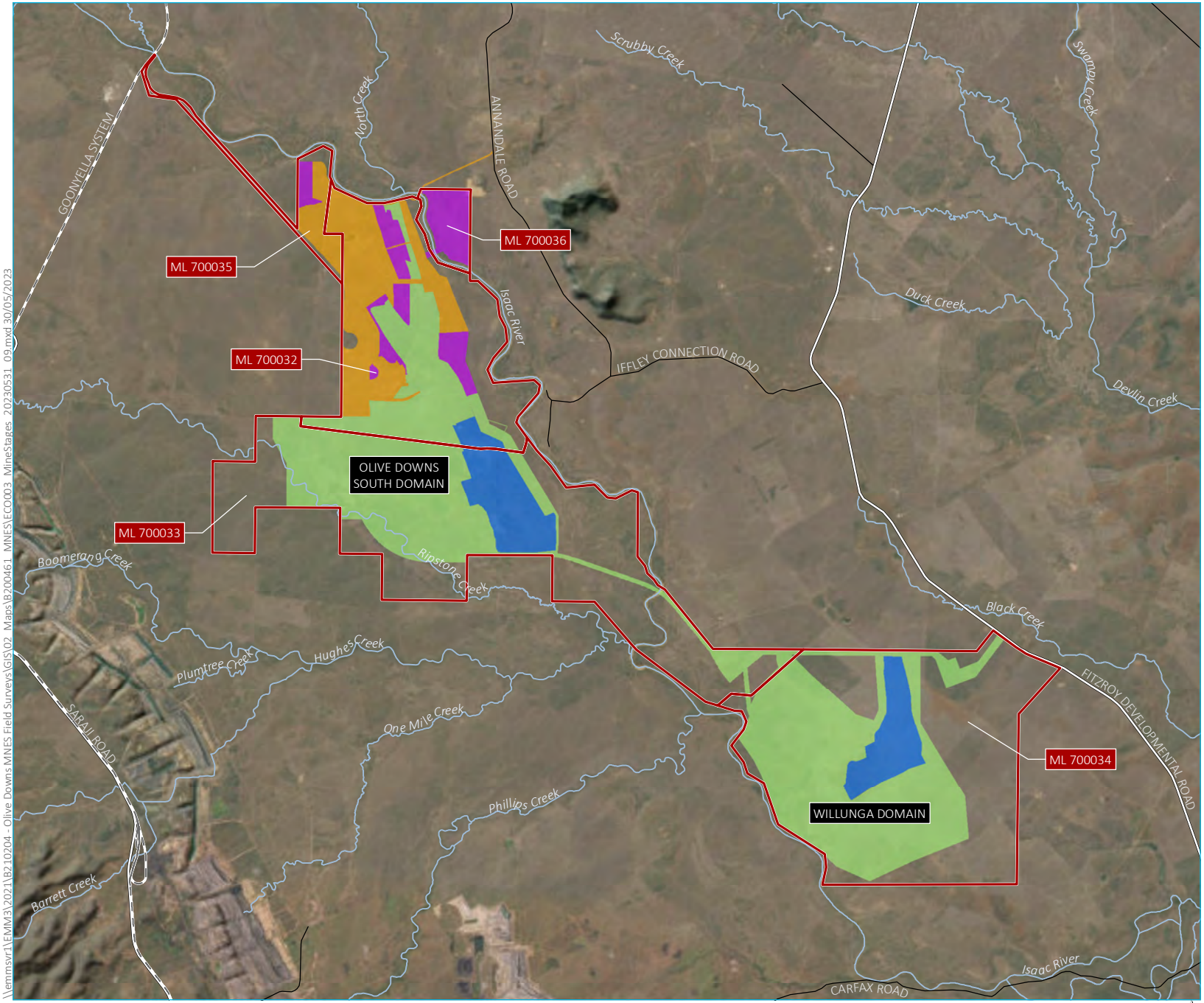
Stage 1 works commenced in early 2022 and have focused on vegetation clearing, constructing the main site access road from Annandale Road including crossing of Isaac River, and preparations for establishing essential infrastructure and facilities.

Stage 1 works will include:

- construction of the Olive Downs South access road, including the bridge crossing over Isaac River;
- clearing vegetation within areas required for infrastructure and first open cut pit. Vegetation clearing commenced in early 2022 and is predicted tocontinue over five years;
- construction of the mine infrastructure area (including offices, workshops, coal handling and processing plant (CHPP), ROM pad);
- development of the north-western waste emplacement;
- construction of temporary flood levees located within the Stage 1 boundary; and
- commencement of open cut mining in Pit 1.

Stage 2 works will allow the mine plan to move forward and predominantly consists of water infrastructure such as dams and open cut pits.

This MMP is currently focused on Stage 1, Stage 2 and land presently owned by Pembroke (within ML700032, ML700035 and ML700036) within the boundaries of the Project area as shown in Figure 1.2.



Source: EMM (2023); Pembroke (2023); DNRME (2022)

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Project stages

Olive Downs
MNES Management Plan
Figure 1.2

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1.4 Commonwealth approval

The EPBC approval (EPBC 2017/7867) for the Project was granted on 14 May 2020. The applicable listed species and ecological community that are addressed in the approval and subject of this MMP are:

- Koala;
- Greater Glider;
- Squatter Pigeon (Southern);
- Ornamental Snake;
- Australian Painted Snipe; and
- Brigalow TEC.

Conditions 2 and 45 to 47 of the EPBC Act approval are directly relevant to the development of this MMP and are discussed in Sections 1.4.1 and 1.4.2. It should be noted that the conditions pertaining to the Ripstone Creek Diversion (Conditions 41 to 44) are not included in this MMP. A separate report will be prepared 15 years prior to the proposed commencement of the diversion as required under Condition 41. If required, the MMP will be updated at that time to incorporate any applicable changes.

1.4.1 Condition 2 (EPBC 2017/7867)

Condition 2 of the EPBC Act approval relates to the maximum area of habitat for listed threatened species and ecological communities that Pembroke are permitted to impact over the life of the Project. The total impact areas are broken down across the four stages as summarised in Table 1.1.

Due to recent changes to the Stage 1 boundary the MNES impact areas for Stages 1, 2 and 3 have been updated and are summarised in Table 1.1. Stage 4 remains unchanged. The total area of clearing for each MNES across all four stages has not increased, and for some species there is a small reduction.

Pembroke will ensure that clearing of species habitats and Brigalow TEC do not exceed these approved disturbance limits for each stage. Vegetation clearing and disturbance to MNES habitats will also not occur outside the approved staged areas.

Table 1.1 Disturbance limits (ha) for MNES across the mine site and access roads

MNES	Stage 1 (ha)	Stage 2 (ha)	Stage 3 (ha)	Stage 4 (ha)	Total (ha)
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat	1099	406.16	3,899.81	354	**5,759**
Greater Glider (*Petauroides volans*) habitat	932.81	352.54	3,921.22	389	**5,595.6**
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) breeding habitat	810.45	262.73	3,084.11	322	**4,479.3**
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) foraging habitat	133.76	69.74	656.5	6.5	**866.5**
Ornamental Snake (*Denisonia maculata*) important habitat	973.9	367.74	5,094.11	1,307	**7,742.75**

Table 1.1 Disturbance limits (ha) for MNES across the mine site and access roads

MNES	Stage 1 (ha)	Stage 2 (ha)	Stage 3 (ha)	Stage 4 (ha)	Total (ha)
Australian Painted Snipe (*Rostratula australis*) breeding habitat	16	3	70	25	**114**
Brigalow TEC	0	0	13	0	**13**

1.4.2 Conditions 45 to 47 (EPBC 2017/7867)

Conditions 45 to 47 relate to the requirements to develop and have approved, a MMP for the MNES listed in Condition 2. These conditions and where they have been addressed in this MMP are outlined in Table 1.2.

Table 1.2 Conditions of approval relevant to the MNES Management Plan

Condition	Condition Requirement	Where addressed
45	To avoid, mitigate and manage impacts of the action on the listed threatened species and community and their habitat, the approval holder must submit a MNES Management Plan for the written approval of the Minister. The MNES Management Plan must be prepared by a suitably qualified ecologist and in accordance with the Department's Environmental Management Plan Guidelines (the Guidelines).	The purpose of this plan, consistent with condition 45 is outlined in Section 1.2. Qualifications of the MMP authors and their suitability is provided in Section 1.5. Curricula vitae of report authors are provided in Appendix A. The EMP Guidelines have been considered and incorporated as part of developing this MMP. The MMP has followed the Guidelines by adhering to: • The general principles for the preparation of an EMP; • The required content (outlined in section 3 of the guideline) including outlining impacts and risks, management measures (such as management activities, controls, performance targets, monitoring and corrective actions); • The evaluation of the risks using the 'qualitative risk assessment methodology'; • Roles and responsibilities; and • Auditing and reporting.
46(a)	The MNES Management Plan must include details of specific environmental outcomes to be achieved for the listed threatened species and community and their habitat.	Overarching environmental outcomes are specified in Section 5.1. Specific performance criteria and outcomes relating to each MNES species and Brigalow TEC, for each Project phase are provided in Tables 4.1, Table 4.2 and Table 4.3. Management measures to achieve environmental outcomes are described in Section 5, and interim milestones and corrective actions are detailed in Table 6.1.
46(b)	The MNES Management Plan must include interim milestones that set targets at 5-yearly intervals to track progress against achieving the environmental outcomes.	Interim milestones have been described in Table 6.1. Interim milestones have been based on actions to be achieved, or outcomes, based on Project stages. This MMP currently addresses milestones for Stage 1 and Stage 2. Due to the long duration of the Project, and that a number of activities may occur at different phases, interim progress reviews will be conducted at 5 yearly intervals as well as 12 months prior to the commencement of each stage. These reviews are to

Table 1.2 Conditions of approval relevant to the MNES Management Plan

Condition	Condition Requirement	Where addressed
		assess progress of the management plan actions, evaluate their effectiveness and apply adaptive management principles. The MNES Management Plan will be resubmitted to DAWE for approval prior to commencement of the next stage,and include new interim milestones for the next stage.
46 (c)	Details of the measures, and timeframes for implementation, that will be taken in the project area to avoid, mitigate and manage impacts on the listed threatened species and community and their habitat during clearance, construction, operation and decommissioning of the action, including but not limited to: i) clearance of one corridor, of a maximum 45 metres in width, in the riparian zone of the Isaac River; ii) clearance of two corridors, of a maximum 60 metres in width, in the riparian zone of the Isaac River; iii) clearance of two corridors, of a maximum 30 metres in width, in the riparian zone of Ripstone Creek; iv) no clearance in the riparian zones of the Isaac River and Ripstone Creek other than that specified in this approval; v) removal and exclusion of grazing from all riparian zones in the project area; vi) installation of rope ladder crossings of the cleared corridors in the riparian zones of the Isaac River and Ripstone Creek to maintain Greater Glider (*Petauroides volans*) habitat connectivity; vii) enforced vehicle speed limits of 60 kilometres/hour or less; viii) installation of Koala-proof fences, without barb-wire, in Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat and Greater Glider (*Petauroides volans*) habitat; and ix) installation of Koala poles at Koala-proof fences, with proposed spacing, in Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat.	• Specific details of the measures and timeframes for implementation of avoidance, mitigation and management of impacts on the listed threatened species and community are described in Sections 4 and 5. • Specifically Tables 4.1, 4.2 and 4.3 outline these measures by each Project phase, and then they are grouped into avoidance, mitigation and management. • Clearance corridor specifications i), ii), iii) and iv) are confirmed in Section 4 and Figure 4.1 for Stage 1. One 60m wide crossing of the Isaac River will be completed in Stage 1 which is the main access road in the north. This will be addressed in this version of MMP. A second 60m wide crossing will be constructed in Stage 2 and 45 m crossing of Isaac River and 30m crossings of Ripstone Creek are part of Stage 3. These will be addressed in future revisions of the MMP as outlined in Section 7. Indicative locations for river crossings are shown in Figure 4.4. • Exclusion of grazing (v) has been noted in Section 4.3 and outlined in Section 5.2.3. Grazing exclusion areas as part of Stage 1 are shown in Figure 4.2. Areas where grazing will be excluded as part of future stages will be specifically addressed in future revisions of the MMP as outlined in Section 7. • Details on the installation of rope ladder crossings of the cleared corridors in the riparian zones (vi) are outlined in Section 5.2.10 and monitoring Section 6.2. Locations of rope ladder crossings for Stage 1 and indicative locations for subsequent stages are shown in Figure 4.4. • Details on enforced speed limits (vii) and associated signage and speed humps are given in Section 4.3. • Details on the installation of Koala-proof fences (viii) and Koala poles (ix) are given in Section 5.2.9 and Figure 4.3 for Stage 1 and 2. Koala-proof fences for subsequent stages will be addressed in future revisions of the MMP as set out in Section 7.
46(d)	Details on the specific timing, frequency and duration of the measures to be implemented.	The specific timing, frequency and duration of avoidance, mitigation and management measures are summarised in Sections 4 and 5. Specific timing, frequency and duration of monitoring is described in Section 6 and Table 6.1.
46(e)	Evidence of how the measures are based on best available practices, appropriate standards, and supported by scientific evidence	References are provided in Section 4 and 5 in terms of how the measures are based on best available practices and standards and/or guidelines.

Table 1.2 Conditions of approval relevant to the MNES Management Plan

Condition	Condition Requirement	Where addressed
46(f)	Details on how the measures have been developed with consideration of the S.M.A.R.T principle	Section 4.2 states MMP has been developed in accordance with S.M.A.R.T principles and example of how this was achieved. For example avoidance, mitigation and management actions are specific, measurable, relevant and timing is clear.
46(g)	Details of the nature, timing and frequency of monitoring to inform progress against achieving the 5-yearly interim milestones (the frequency of monitoring must be sufficient to track progress towards each set of milestones, and sufficient to determine whether the milestones are likely to be achieved in adequate time to implement all necessary corrective actions)	Details on the nature, timing and frequency of monitoring to inform progress against performance criteria and interim targets are given in Section 6, Table 6.1 and Appendix C.
46(h)	Timing for the submission of internal monitoring reports which provide evidence demonstrating whether the interim milestones have been achieved	Details on the timing for submission of internal monitoring reports are addressed in Section 7.1.
46(i)	Timing for the implementation of corrective actions if monitoring indicates the interim milestones will not or have not been achieved	Details on corrective actions, triggers for corrective actions and timing for implementation of corrective actions are given in Table 6.1.
46(j)	Risk analysis and a risk management and mitigation strategy for all risks to the successful implementation of the MNES Management Plan and timely achievement of the environmental outcomes, including a rating of all initial and post-mitigation residual risks in accordance with the risk assessment matrix	Details on risk analysis, risk management and mitigation strategy are provided in Section 8. The risk assessment includes pre and post-mitigation risk rankings.
46(k)	Evidence of how the measures and corrective actions take into account relevant approved conservation advices and are consistent with relevant recovery plans and threat abatement plans.	Reference to conservation advices, applicable recovery plans and literature are provided in Table 2.1 and Section 5 summarises how measures are consistent with these advices and plans etc.
47	The approval holder must not commence the action until the MNES Management Plan has been approved by the Minister. The approved MNES Management Plan must be implemented.	Noted in Section 7.1.

1.5 Suitably qualified ecologists

EMM have been engaged by Pembroke to prepare this MMP due to their expertise and experience in designing and implementing surveys for threatened ecological communities and species under EPBC Act, and preparing comprehensive impact assessments and environmental management plans. In particular EMM has experience working on some of Australia's largest resource and infrastructure projects, including the implementation of detailed field ecology surveys, habitat assessments and developing practical and sound avoidance, mitigation and management measures for threatened species and communities.

Five experienced ecologists have authored the preparation of this MMP, four of which have over 10 years' experience designing and implementing surveys for the applicable listed threatened species and community and their habitat, as well as developing comprehensive avoidance, mitigation and management strategies.

EMM's ecologists can give an authoritative assessment and advice on the presence and habitat requirements of the listed threatened species and community using relevant protocols, standards, methods and/or literature. The report authors also have a detailed understanding of effective strategies to manage impacts on threatened species during various Project phases, as well as developing effective monitoring programs.

Authors Berlinda Ezzy, Andrew Jensen and Ben Nottidge meet the definition of "suitably qualified ecologists" under the EPBC approval which states "**Suitably qualified ecologist"** means a person who has professional qualifications and at least 3 years of work experience designing and implementing surveys for the "**listed threatened species and community"** and their habitat, and can give an authoritative assessment and advice on the presence and habitat requirements of the "**listed threatened species and community"** using relevant protocols, standards, methods and/or literature".

The experience of each ecologist involved in preparation of this MMP is summarised in Table 1.3. Curricula vitae are provided in Appendix A.

Table 1.3 Suitability qualified ecologists

Ecologist	Qualifications and relevant experience
Nathan Garvey (Associate Ecologist and Divisional Leader – Bushfire, Ecology, Heritage and Spatial Solutions)	Nathan is an experienced ecologist with over 17 years' practice in ecological assessment. Nathan has delivered projects across a diverse range of sectors including mining, oil and gas, linear infrastructure, renewable energy and residential development. Nathan has vast field work experience and is a practitioner of biodiversity assessment and approvals, including biodiversity assessment for major projects and EPBC Act referrals. He is one of NSW's leading experts in biodiversity offsetting. Nathan has greater than 3 years' experience designing, implementing and conducting surveys for MNES species, including Koalas and Gliders, across NSW and Victoria. Other MNES species Nathan has performed Ecological monitoring and Management plans on include the Green and Golden Bell Frog, Southern Bent-wing Bat and the Growling Grass Frog. Nathan was the lead ecologist on the Snowy 2.0 project in NSW which required Nathan to develop and lead a comprehensive terrestrial and aquatic surveys across the project area. Targeted surveys for threatened species were completed including Smoky Mouse (listed under EPBC Act) . Nathan then led the impact assessments for the project at a State and Commonwealth level. Nathan is currently developing detailed monitoring programs going forward and finalising offset strategies. Nathan has prepared numerous threatened species monitoring and management plans including: • Dunmore Hard Rock Quarry, flora and fauna management plan, Dunmore (Boral) • Beryl Solar Farm, biodiversity management plan, Beryl (Geolyse and Downer) • Mona Vale Road, biodiversity monitoring plan and implementation, Sydney NSW (Roads and Maritime Services) • Walgett Solar Farm, biodiversity management plan, Walgett (Geolyse and Epuron)
Berlinda Ezzy (Ecology Team Lead & Associate Ecologist)	Berlinda is an Associate Ecologist with 20 years of professional experience. She has worked for local and state government in Queensland, as well as the private sector, across a range of environmental disciplines. Berlinda's areas of expertise include environmental planning and approvals, threatened species management, coordinating delivery of field ecology surveys and reporting, impact assessments and biodiversity offsets. Berlinda led the Koala Conservation Unit at Department of Environment and Science (DES) for a number of years which included implementing a range of Koala conservation programs, developing an offset policy and assessing development applications to ensure measures were being put in place to avoid and mitigate impacts on Koalas. Berlinda has led complex projects as an environmental consultant for over 10 years and successfully managed a large number of ecology, impact assessment and offset projects for resource and infrastructure companies across Queensland and New South Wales. Berlinda's experience includes preparation of Threatened Species Management Plans for the Woolgoolga to Ballina Pacific Highway Upgrade, QCLNG and APLNG projects. Berlinda has more than 3 years of experience in designing and implementing surveys for Greater Glider, Squatter Pigeon (southern), Ornamental Snake, Koala and

Table 1.3 Suitability qualified ecologists

Ecologist	Qualifications and relevant experience
	the Australian Painted Snipe. Projects in which Berlinda was involved in designing and implementing surveys for these species included Blackwater mine, Kevin's Corner, Boulder Creek and Specimen Hill wind farms, APLNG and Bowen Gas Project. Berlinda has also prepared a number of offset management plans and is engaged and consulted with by government agencies on biodiversity offsets due to her long standing experience in this area.
Andrew Jensen (Associate Ecologist)	Andrew has 15 years' ecological experience across a range of disciplines and industries including mining, renewables, and oil and gas. Key aspects of his work have included project management, client liaison, preparation of environmental impact statements, preparation of management plans, ecological reporting and surveying and ecological offset plans. Andrew routinely reviews environmental technical studies and has developed environmental management plans and negotiated environmental approval conditions for clients. Andrew has also been responsible for conducting a number of species impact significance assessments at both Commonwealth and state level and is familiar with the requirements of this process. Andrew has also been responsible for managing, coordinating and undertaking fieldwork campaigns across Queensland. Andrew has greater than 3 years' experience in designing, implementing and conducting surveys for MNES species. He has recently completed targeted fauna surveys at a proposed mine expansion in central Qld which included surveys for Koalas, Greater Glider, Ornamental Snake, Australian Painted Snipe and Squatter pigeon. Boulder Creek and Specimen Hill wind farms involved surveys for Koalas, Greater Glider and Squatter pigeon.
Ben Nottidge (Associate Ecologist)	Ben is a Senior Ecologist with over 15 years' experience conducting fauna surveys throughout Queensland in a consultancy context. During this time, Ben has worked on various CSG projects throughout Queensland including the Arrow Bowen Pipeline, Arrow Surat Pipeline, Arrow Curtis Island CSG Processing Site, Origin Coal Seam Gas Project and APLNG Curtis Island CSG Processing Site. He has worked on a range of components of these projects including the initial ecological assessments for wells and pipelines, pre-clear surveys, wildlife spotter-catching, targeted surveys for threatened fauna, environmental impact statements for fauna, EPBC referrals and pre-clearance surveys. Ben has undertaken numerous surveys, and has greater than 3 years' experience in designing and implementing surveys for fauna and flora species listed as threatened under State and Commonwealth legislation. Much of his experience has been for large mining and infrastructure projects including the Blackwater Mine Expansion Project, Olive Downs Coal Project, Woolgar Gold Project, Columboola to Wandoan South Transmission Line, Trackstar Alliance Caboolture to Beerburrum Rail Upgrade, Hail Creek Mine Expansion Project, Moranbah South Coal Project, Abbot Point Coal Terminal Expansion Project, Conner's River Dam Project. Ben's survey experience has included all target species including Greater Glider, Squatter Pigeon (southern), Ornamental Snake, Koala and the Australian Painted Snipe. Ben has expertise in: • fauna and flora surveys using a range of methodologies • fauna taxonomy and ecology • targeted threatened species surveys and management • habitat assessments • fauna surveys including surveys consistent with DAWE and other relevant survey guidelines • rehabilitation and revegetation • wildlife radio-telemetry, translocations and home range analysis • wildlife spotter-catching Ben has significant expertise, understanding in Koala ecology and experience leading Koala surveys and Koala monitoring. Ben was involved in undertaking Koala monitoring associated with the Moreton Bay Rail Link and Toowoomba Second Range Crossing projects in south east Qld where Koalas have been radio-tracked. This has included carrying out Koala surveys to identify if any individuals were in the project area, tagging and tracking individuals by radio-telemetry to identify Koalas dispersal in the

Table 1.3 Suitability qualified ecologists

Ecologist	Qualifications and relevant experience
	local area, and assessing their health. Over 100 Koalas were tracked by Ben Nottidge and results published on a monthly basis. Diseased Koalas were taken to a vet to be treated and once well enough released at agreed release sites. The monitoring also allowed Koala deaths to be confirmed and cause identified such as by dogs and cars.
Patrick Finnerty (Ecologist)	Patrick is an ecologist with 5 years project experience across a range of sectors including utilities, infrastructure, construction and energy. Patrick has been involved in the successful delivery of numerous projects including ecological impact assessments, ecological and threatened species monitoring, management plans and stewardship feasibility studies. Patrick has project managed and has been the technical lead on some major ongoing biodiversity monitoring projects within NSW including a glider monitoring program for Roads and Maritime. He has a wide range of skills including complex survey logistics and planning, data management and report writing along with biodiversity assessments.

1.6 Relationships to other plans

Pembroke are required to prepare various management plans that address a range of environmental matters associated with the construction, operation and decommissioning of the Project. A number of these plans will be regulated under the Environmental Authority (EA) for the mine administered by the Department of Environment and Science (DES) and have an inter-relationship to this MMP. For example Pembroke will prepare a Weed and Pest Management Plan as part of the EA requirements which will tie in with the identified management actions in this MMP.

Pembroke will ensure all documents prepared are consistent with this MMP.

The following management plans to be prepared that are relevant to this MMP are:

- Fauna Species Management Program (addressing management of animal breeding places under *Nature Conservation Act 1992*);
- Weed and Pest Management Plan;
- Erosion and Sediment Control Plan;
- Air Quality Management Plan (consistent with the dust mitigation activities presented in the Coal Dust Management Plan (QR Network 2010));
- Noise Management Plan;
- Blast Management Plan;
- Waste Management Plan;
- Water Management Plan & Receiving Environment Monitoring Program;
- Rehabilitation Management and Monitoring Plan;
- Groundwater dependent ecosystem and Wetland Monitoring Program; and
- Stage 1 Offset Area Management Plan.

2 Matters of national environmental significance (MNES)

As part of the Project's EIS to support State and Commonwealth approvals processes, detailed ecological assessments including targeted surveys for threatened species and communities were undertaken. These surveys and results are summarised in Appendix B – Terrestrial Fauna Assessment of the EIS (Pembroke 2018). The report was prepared by DPM Enviros ciences in August 2018 titled 'Olive Downs Coking Coal Project – Terrestrial Fauna Assessment'. The purpose of the report was to:

- determine the presence/absence of threatened flora and fauna species within the Project area;
- assess the vegetation characteristics and the presence of ecological communities within the Project area;
- describe the likely adverse impacts on MNES within the Project area;
- describe measures that would be implemented to avoid and mitigate impacts on those MNES; and
- assess the baseline habitat quality of habitats and ecological communities within the impact areas.

This section provides a summary of the key findings from the field ecology surveys for each MNES required to be addressed in this MMP. Detailed information including habitat quality within the Project area for each of the MNES and habitat quality plot data is outlined in Appendix E of the Terrestrial Fauna Assessment Report (DPM Enviros ciences 2018).

2.1 Ecology survey effort

The field ecology surveys incorporated both dry season and wet season fauna surveys. A comprehensive fauna survey was undertaken within the mine site in Spring from 1-14 November 2016. A follow-up fauna survey was undertaken within the mine site in Autumn from 23 April to 4 May 2017 and again in Spring 4-9 September 2017. Habitat quality assessments were undertaken to provide preliminary data to support the offset strategy and EPBC offset calculator inputs and also to obtain initial baseline data on the habitat quality within the Project area.

A variety of flora and fauna survey methods were used to detect MNES during the impact assessment surveys. Flora surveys were undertaken in accordance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2 (Neldner et al. 2012) and Queensland Flora Survey Guidelines – Protected Plants (DEHP 2016). Assessment sites were undertaken across the entire Project area including 227 vegetation assessment sites in total comprising 222 quaternary sites and five tertiary sites.

Fauna assessments used across the Project area included systematic trap sites (Elliot, pitfall and funnel), spotlighting, call playback, camera trapping, active searching, harp traps, Anabats, Koala transects and observation (e.g. bird surveys and opportunistic observations). Survey methods undertaken were in accordance with applicable Commonwealth and Queensland threatened species and communities survey guidelines including:

- Commonwealth guidelines
  - EPBC Act survey guidelines for Australia's threatened reptiles (DSEWPC 2011a);
  - EPBC Act survey guidelines for Australia's threatened birds (DEWHA 2010a);
  - EPBC Act survey guidelines for Australia's threatened bats (DEWHA 2010b);

- EPBC Act survey guidelines for Australia's threatened mammals (DSEWPC 2011b);
- EPBC Act draft referral guidelines for the nationally listed Brigalow Belt reptiles (DSEWPC 2011c);
- EPBC Act referral guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DoE 2014a);
- Draft referral guidelines for nationally listed Brigalow Belt reptiles (DSEWPaC 2011c);
- SPRAT databases for relevant EPBC Act listed species and communities (as of July 2016);

- Queensland guidelines;
  - Flora Survey Guidelines – Protected Plants Nature Conservation Act 1992 (DEHP 2019); and
  - Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2018).

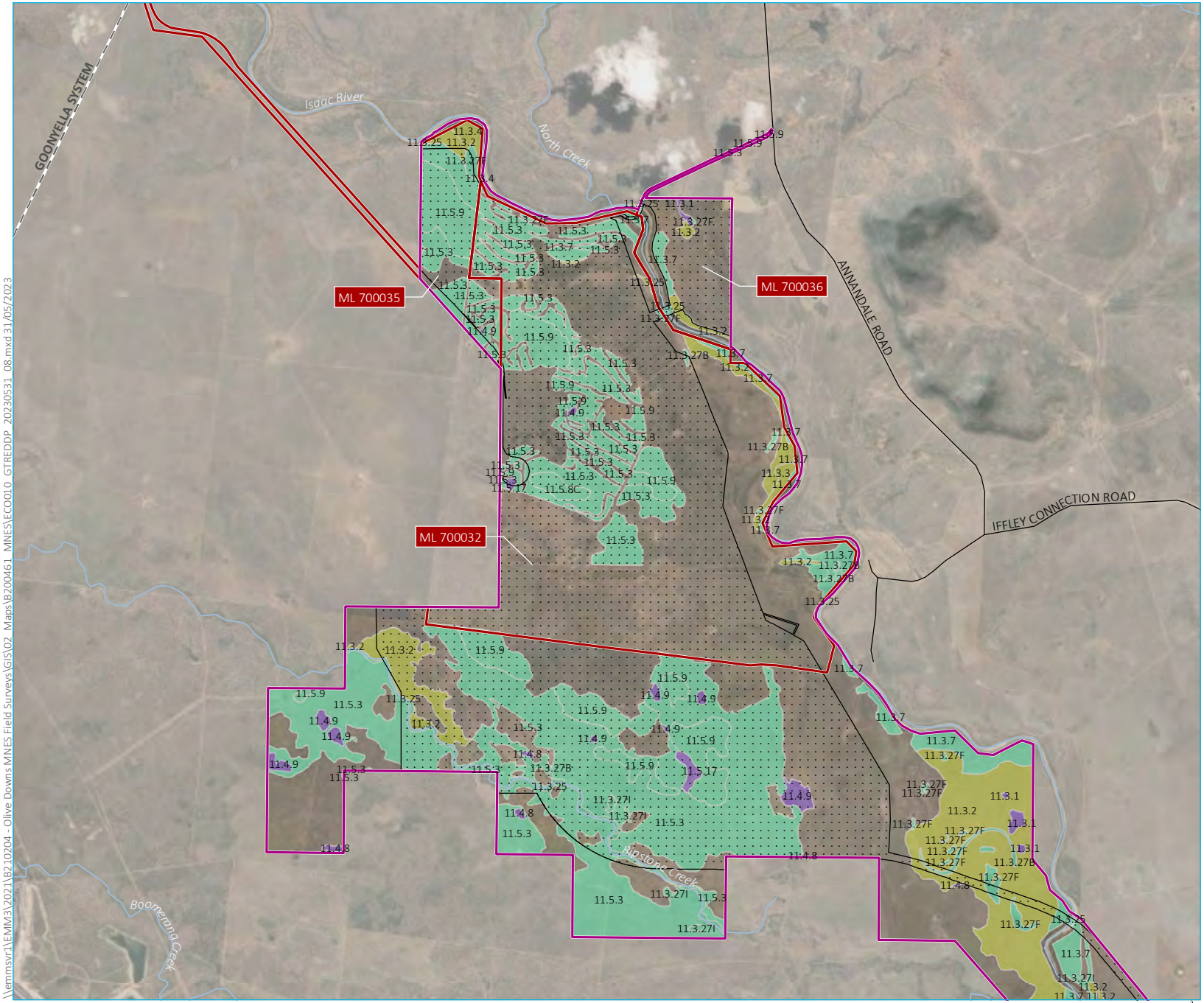
2.2 Characteristics of the Project area

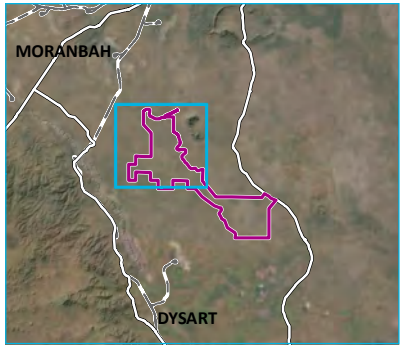
The Project area contains both remnant and regrowth forest and woodland, as well as broad open grazed grasslands. There is approximately 17,838 ha of cleared land that is not associated with any remnant native vegetation. These areas are classified as 'agricultural grasslands dominated by Buffel Grass (*Cenchrus ciliaris*)'. Buffel Grass is an introduced perennial pasture species that is highly productive, relatively palatable, and persistent under heavy grazing conditions, making it a useful pasture species for cattle. Buffel Grass dominates the ground layer. Trees are largely absent but generally consist of isolated acacias and eucalypts. The fauna habitat value of agricultural grasslands across the Project area is typically low, owing to the relative lack of shelter / cover and food resources.

Cattle grazing and associated agricultural practices have impacted and caused degradation to the vegetation (including fauna habitats) across the Project area to varying extents. The different habitats across the Project area include:

- eucalypt dry woodlands on inland depositional plains dominated by Poplar box (*Eucalyptus populnea*) and Narrow-leaved ironbark (*E. crebra*);
- eucalypt open forests to woodlands on floodplains (predominantly occurring in riparian corridors of Isaac River and parts of Ripstone Creek);
- acacia dominated open forests, woodlands and shrublands which are only a small portion of area;
- palustrine wetlands (swamps);
- lacustrine wetlands (dams); and
- waterways (watercourses and drainage features).

Further detail on these habitat types are provided in Section 5 of the Terrestrial Fauna Assessment (DPM Enviroscienes 2018). Ground-truthed regional ecosystems (GTRE) within the Project area are illustrated in Figure 2.1.





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Impact footprint (all stages)
- Rail line
- Major road
- Minor road
- Named watercourse

Ground-truthed regional ecosystems (VM status)

- Endangered
- Of Concern
- Least Concern

Ground-truthed regional ecosystems map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.1

EMM creating opportunities

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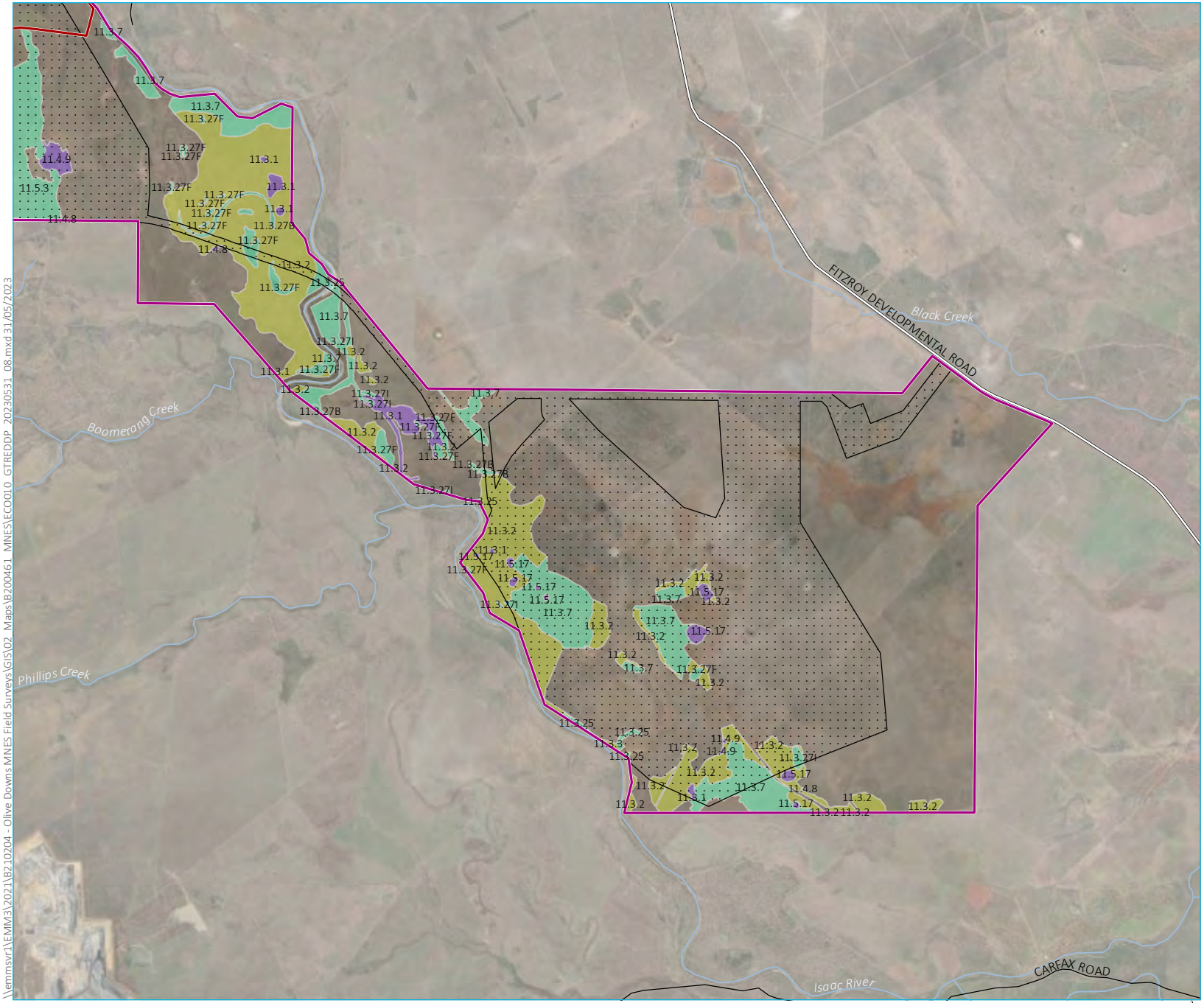

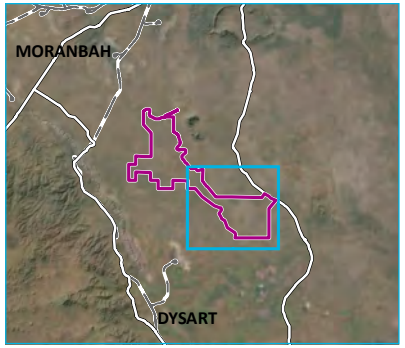

KEY

- Project area
- Mining lease boundary (containing stage 1)
- Impact footprint (all stages)
- Rail line
- Major road
- Minor road
- Named watercourse

Ground-truthed regional ecosystems (VM status)

- Endangered
- Of Concern
- Least Concern

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

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Ground-truthed regional ecosystems map 2 of 2

Olive Downs
MNES Management Plan
Figure 2.1

EMM
creating opportunities

2.3 Threatened species habitat mapping

Seasonal fauna surveys confirmed the presence of four threatened fauna species listed as vulnerable under the EPBC Act on site. They were; Greater Glider, Squatter Pigeon, Ornamental Snake and Koala. One fauna species listed as endangered under the EPBC Act was also observed on site being the Australian Painted Snipe. Records of the species in proximity to the Project area are shown in Figure 2.2.

Post field surveys habitat mapping was undertaken as part of the ecological assessments and based on detailed vegetation mapping and presence of micro-habitats (e.g. gilgai for Ornamental Snake) to assign areas of potential habitat based on known species habitat preferences and field observations. Habitat mapping for each species in the Project area is provided in Figure 2.3 to Figure 2.8. Habitat mapping was refined in consultation with DAWE representatives as part of finalising the EPBC approval and informed the final Project offset requirements.

Further detail on each species and their habitats in the Project area are provided below.

2.3.1 Greater Glider

Within the Project area, the Greater Glider was recorded on numerous occasions along the Isaac River and associated tributaries and around wetland habitats (DPM Envirosciences 2018) (Figure 2.3). Recordings included direct observation and identification of scats within Eucalypt dry woodlands on inland depositional plains and Eucalypt open forest to woodlands on floodplains and wetlands. Majority of records along the Isaac River and Ripstone Creek.

Within the Project area it was determined that Greater Glider habitat includes remnant and regrowth forest or woodland which contain suitable hollow bearing trees (Figure 2.3). This includes:

- all areas of eucalypt open forests to woodlands on floodplains (i.e. REs 11.3.3, 11.3.4, 11.3.7 and 11.3.25);
- eucalypt dry woodlands on inland depositional plains (i.e. REs 11.3.2, 11.5.3, 11.5.8c, 11.5.9, 11.5.9b and 11.9.2);
- vegetation surrounding and within the lacustrine and palustrine wetlands (i.e. REs 11.3.27f, 11.3.27i, 11.3.3c and 11.5.17);
- Acacia woodland dominated / codominated by *E. cambageana* (i.e. RE 11.4.8); and
- patches of regrowth eucalypt forest or woodland with suitable hollow-bearing trees (primarily stags) (DPM Envirosciences 2019).

The species is known to have limited dispersal ability across vegetation that does not incorporate feeding or denning trees (TSSC 2016).

Habitat mapping for the Greater Glider has been undertaken in accordance with information contained in the conservation advice for this species and results of field ecology surveys, which determined that 5,595.6 ha of potential Greater Glider habitat will be directly impacted across the life of the Project.

2.3.2 Squatter Pigeon (Southern)

Within the Project area, the Squatter Pigeon (southern) was identified on ten occasions within Eucalypt dry woodlands on inland depositional plains (Figure 2.4). The Squatter Pigeon (southern) occurs mainly in grassy woodlands and open forests that are dominated by eucalypts (DAWE 2020a). Areas of Eucalypt dry woodlands on inland depositional plains and Eucalypt open forests to woodlands on floodplains are considered potential habitat for this species (DPM Envirosciences 2018).

Squatter Pigeon (southern) habitats were divided up into breeding, foraging and dispersal. REs 11.5.3, 11.5.8c, 11.5.9, 11.5.9b, 11.5.18 and 11.7.2 provide breeding habitat (where within 1 km of a waterbody) because they contain suitable soils, vegetation structure and composition. In addition, REs 11.3.2 and 11.3.7 (on Land Zone 3) are considered suitable for breeding (where within 1 km of a waterbody) based on site observations of habitat usage, as most observations of Squatter Pigeon (southern) in the Project area were from these REs.

In the Project area, dispersal habitat includes:

- all woodland without suitable groundcover for breeding or foraging;
- woodland on land zones not suitable for breeding or foraging; and
- areas of cleared land less than 100 m wide linking areas of breeding and/or foraging habitat.

Habitat mapping for the Squatter Pigeon (southern) within the Project area has been undertaken in accordance with information contained in the conservation advice for this species and feedback from DAWE which determined that 4,479.3 ha of Squatter Pigeon (southern) breeding habitat and 866.5 ha of foraging habitat will be directly impacted across the life of the Project. Breeding, foraging and dispersal habitat for Squatter Pigeon (southern) is illustrated in Figure 2.4.

2.3.3 Ornamental Snake

Within the Project area four Ornamental Snake were recorded at three locations within the Olive Downs South Domain and a further five locations within the Willunga Domain (Figure 2.5). These records occurred within agricultural grasslands on cracking clays, around palustrine wetlands, within Acacia dominated open forests, woodland and shrublands, and one record within Eucalypt dry woodlands on inland depositional plains (expected to be a transient individual) (DPM Envirosciences 2018).

Ground-truthed soils mapping produced for the Olive Downs Coking Coal Project Soil and Land Suitability Assessment by GT Environmental (2018) across the Project area identified areas of gilgai relief, which are the most accurate reflection of potential habitat for this species. Brigalow TEC has also been identified as potential habitat for the Ornamental Snake. Mapping in the Project area identified two patches (13 ha) as being Brigalow TEC (*DSEWPC 2011c*). Other patches of Brigalow regrowth have been mapped as potential habitat where suitable habitat features are present (i.e. gilgais, wetlands and suitable prey habitat). It was determined that all areas of mapped gilgai soils (encompassing all Brigalow TEC) represent potential 'known important habitat' for the Ornamental Snake, as do all palustrine and lacustrine wetland REs (11.3.3, 11.3.27 and 11.5.17). REs known to be associated with this species (REs 11.4.8 and 11.4.9) (DSEWPC 2011) because the species was recorded on several occasions within these habitats across the Project area, and these habitats were found to support populations of native frogs (dominated by burrowing frogs), a food source for Ornamental Snake were also included. Ornamental Snake habitat areas are illustrated in Figure 2.5.

The riparian vegetation along the Isaac River, where the access road and proposed overland conveyor cross the river, is not identified as important potential habitat for the Ornamental Snake. Although there is some potential for the species to opportunistically take frogs in the area, the species is more likely to use the gilgai soils (as evidenced by the location of species records throughout the Project area) (DPM Envirosciences 2019).

Habitat mapping for the Ornamental Snake within the Project area has been undertaken in accordance with information contained in the conservation advice for this species, habitat descriptions provided in the SPRAT database (DAWE 2020b) and other relevant sources, such as the *Draft Referral Guideline for the Nationally listed Brigalow Belt Reptiles* (DSEWPC 2011a). Habitat mapping has determined that 7,742.75 ha of potential Ornamental Snake habitat will be directly impacted across the life of the Project.

2.3.4 Koala

Within the Project area the Koala was recorded on numerous occasions along the Isaac River and associate tributaries. Recordings included direct observation and identification of scats and scratches within Eucalypt dry woodlands on inland depositional plains, Eucalypt open forest to woodlands on floodplains, and around wetlands (DPM Enviros ciences 2018b) (Figure 2.6).

From observations made during field surveys of the Project area, Koalas were observed more frequently along waterway corridors, particularly the Isaac River and Ripstone Creek. The potential habitat connections along the waterways (primarily the Isaac River and Ripstone Creek) provide movement corridors and refuge habitat for this species in an otherwise cleared and generally unsuitable landscape (DPM Enviros ciences 2018).

As outlined in the EIS, Koala habitat in the Project area met the definition of Critical Koala Habitat within the *EPBC Act Referral Guidelines for the Vulnerable Koala* (DoE 2014a). Within the Project area it was determined that Koala habitat includes all areas of remnant woodland with known Koala food trees or shrublands with emergent Koala food trees. Koala habitat included:

- eucalypt open forests to woodlands on floodplains (i.e. REs 11.3.3, 11.3.4, 11.3.7 and 11.3.25);
- eucalypt dry woodlands on inland depositional plains (i.e. REs 11.3.2, 11.5.3, 11.5.8c, 11.5.9, 11.5.9b and 11.9.2);
- vegetation surrounding and within the lacustrine and palustrine wetlands (i.e. REs 11.3.27f, 11.3.27i, 11.3.3c and 11.5.17); and
- regrowth woodland or shrubland with known Koala food trees or shrublands with emergent Koala food trees (Figure 2.6) (DPM Enviros ciences 2018).

Koala food trees in the Project area include:

- River Red Gum (*Eucalyptus camaldulensis*);
- Queensland Blue Gum (*E. tereticornis*);
- Brown's Box (*E. brownii*);
- Yapunyah (*E. ochrophloia*);
- Coolabah (*E. coolabah subsp. coolabah*);
- Mountain Coolibah (*E. orgadophila*);
- Poplar Box (*E. populnea*);
- Narrow-leaved Ironbark (*E. crebra*);
- Silver-leaved Ironbark (*E. melanophloia*); and
- Broad-leaved Ironbark (*E. fibrosa*).

It should be noted that preferred, breeding and foraging habitat for this species are typically the same (i.e. very hard to distinguish between the three) and, as such, have not been separately assessed. Further to this, given the highly mobile nature of this species dispersal habitat would not necessarily be limited to areas of suitable habitat (i.e. it is known to disperse over cleared land to reach areas of suitable habitat).

Habitat mapping for the Koala within the Project area has been undertaken in accordance with information contained in the conservation advice for this species and feedback from DCCEEW which determined that 5,759 ha of potential Koala habitat will be directly impacted across the life of the Project.

2.3.5 Australian Painted Snipe

Within the Project area a single Australian Painted Snipe was observed during the field surveys in a small wetted gilgai within the agricultural grasslands habitat type in the Willunga Domain (DPM Envirosciences 2018) (Figure 2.7).

Within the Project area, it was determined that all areas of lacustrine and palustrine wetlands (including wetland REs 11.3.27, 11.3.3 and 11.5.17) represent potential breeding habitat for the Australian Painted Snipe, particularly as water levels changed seasonally and islands or mounds and bare earth would be exposed (DPM Envirosciences 2019). Gilgai soils within the Project area would provide intermittent foraging habitat for this species when the gilgai depressions contain water. Habitat areas for the species are illustrated in Figure 2.7.

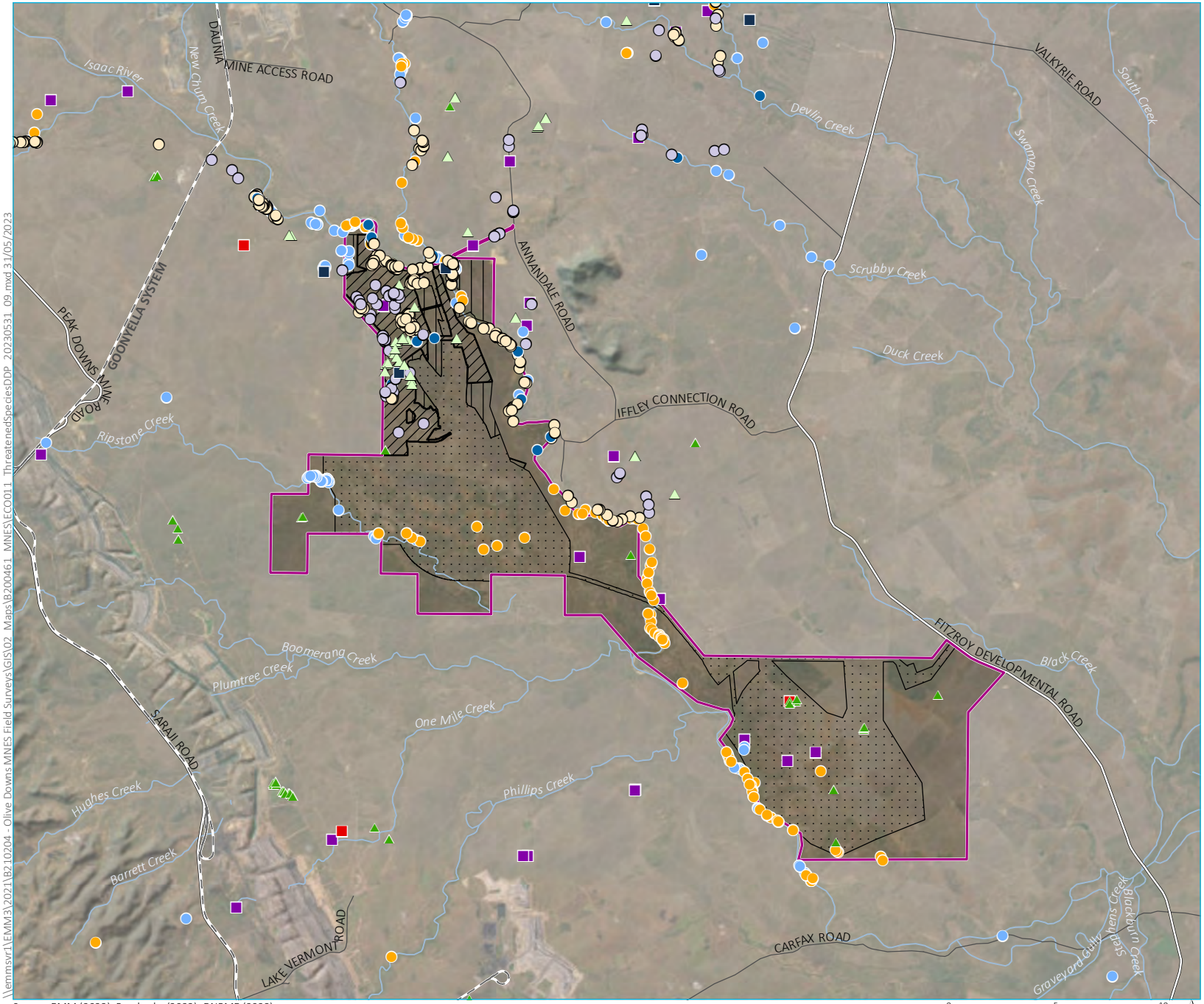
It should be noted that preferred, breeding and foraging habitat for this species are typically the same (i.e. very hard to distinguish between the three) and, as such, have not been separately assessed.

Habitat mapping for the Australian Painted Snipe within the Project area has been undertaken in accordance with information contained in the conservation advice for this species, habitat descriptions provided in the SPRAT database (DAWE 2020c) and field survey results. It has been determined that 114 ha of potential Australian Painted Snipe habitat will be directly impacted across the life of the Project.

2.4 Threatened ecological communities

Only one TEC under the EPBC Act was recorded within the Project area, namely Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (Brigalow TEC). A total of approximately 13 ha of Brigalow TEC, across two patches, will be cleared for the proposed mine site and access road in Stage 3. A further patch of Brigalow TEC will be avoided (as it is outside of the approved staging areas) (Figure 2.8) and will be managed to ensure both direct and indirect impacts don't occur.

The Brigalow TEC patches in the Project area are illustrated in Figure 2.8.



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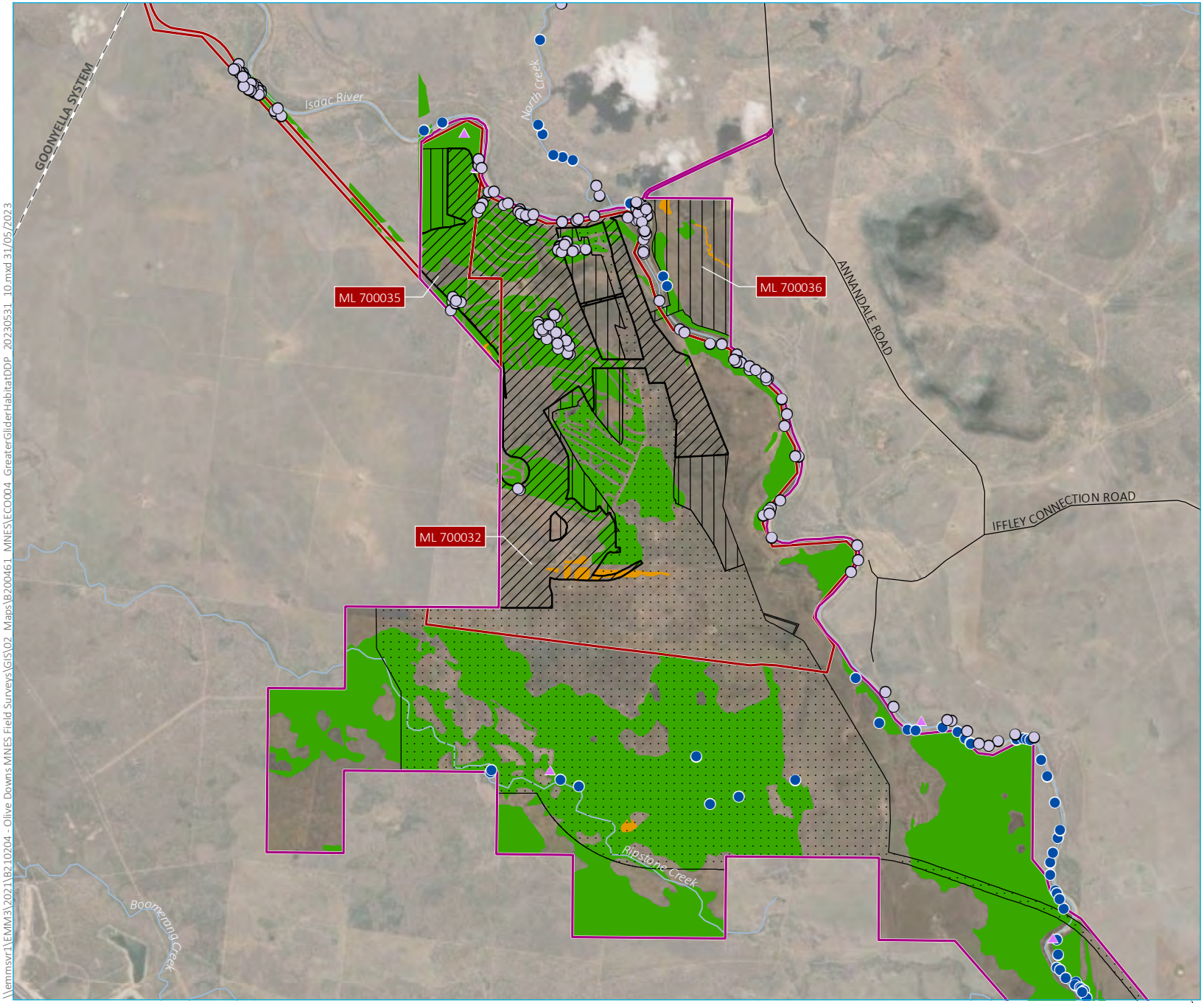
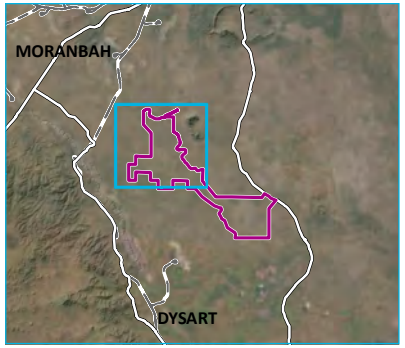
Source: EMM (2023); Pembroke (2023); DNRME (2023)

Threatened species records

Olive Downs
MNES Management Plan
Figure 2.2

EMM
creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Greater Glider records (ALA/BMA/DMP Enviroscienses)

- Observed
- Indirect evidence

Greater Glider records (EMM)

- Observed

Greater Glider habitat

- Remnant
- Regrowth

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Greater Glider habitat map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.3

EMM creating opportunities

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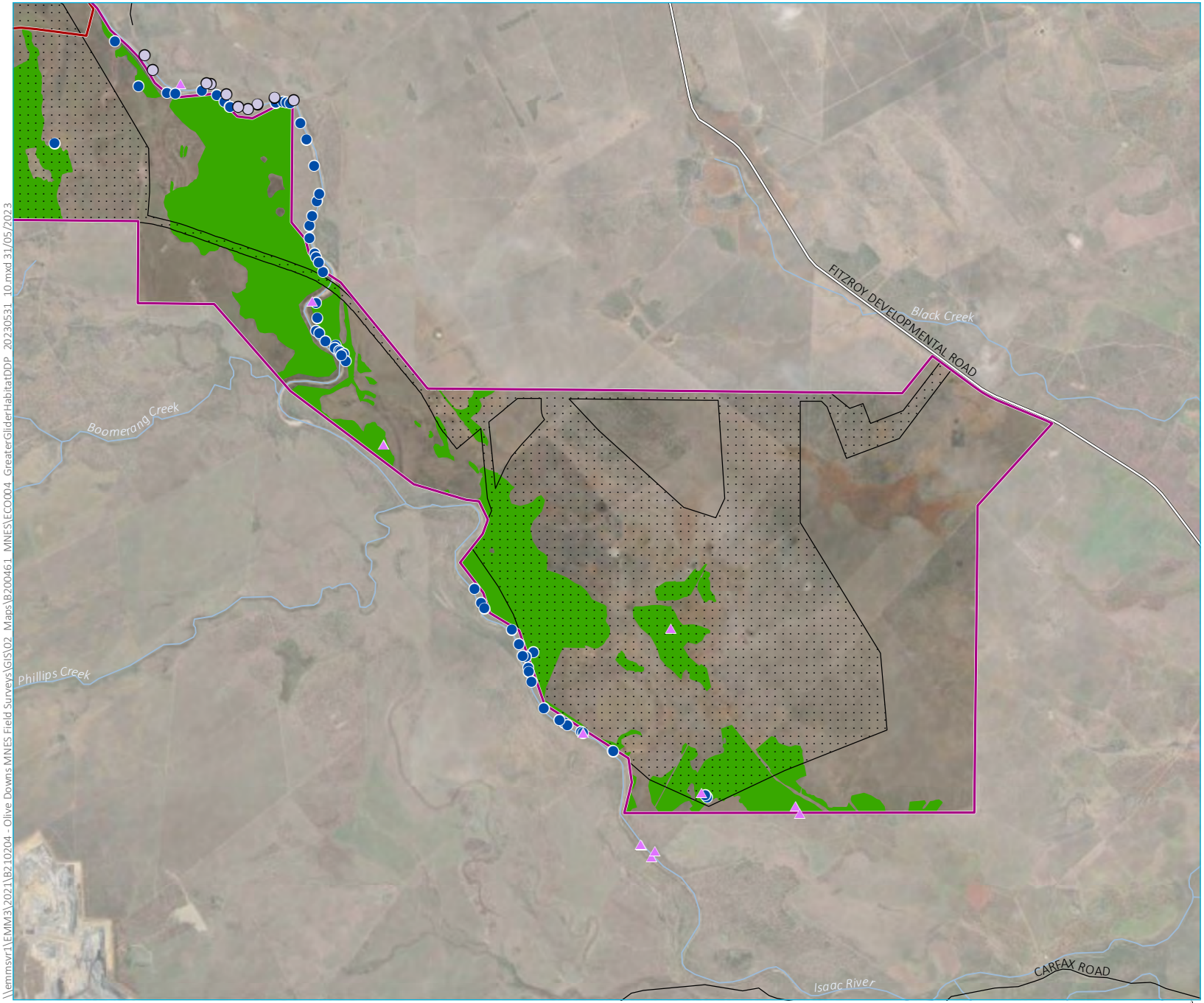

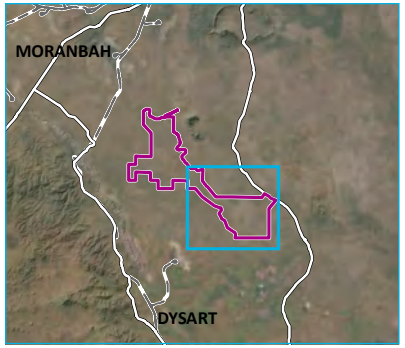

KEY

- Project area
- Mining lease boundary (containing stage 1)
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Greater Glider records
(ALA/BMA/DMP Enviroscience)

- Observed
- Indirect evidence

Greater Glider records (EMM)

- Observed

Greater Glider habitat

- Remnant

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

Greater Glider habitat
map 2 of 2

Olive Downs
MNES Management Plan
Figure 2.3

EMM
creating opportunities

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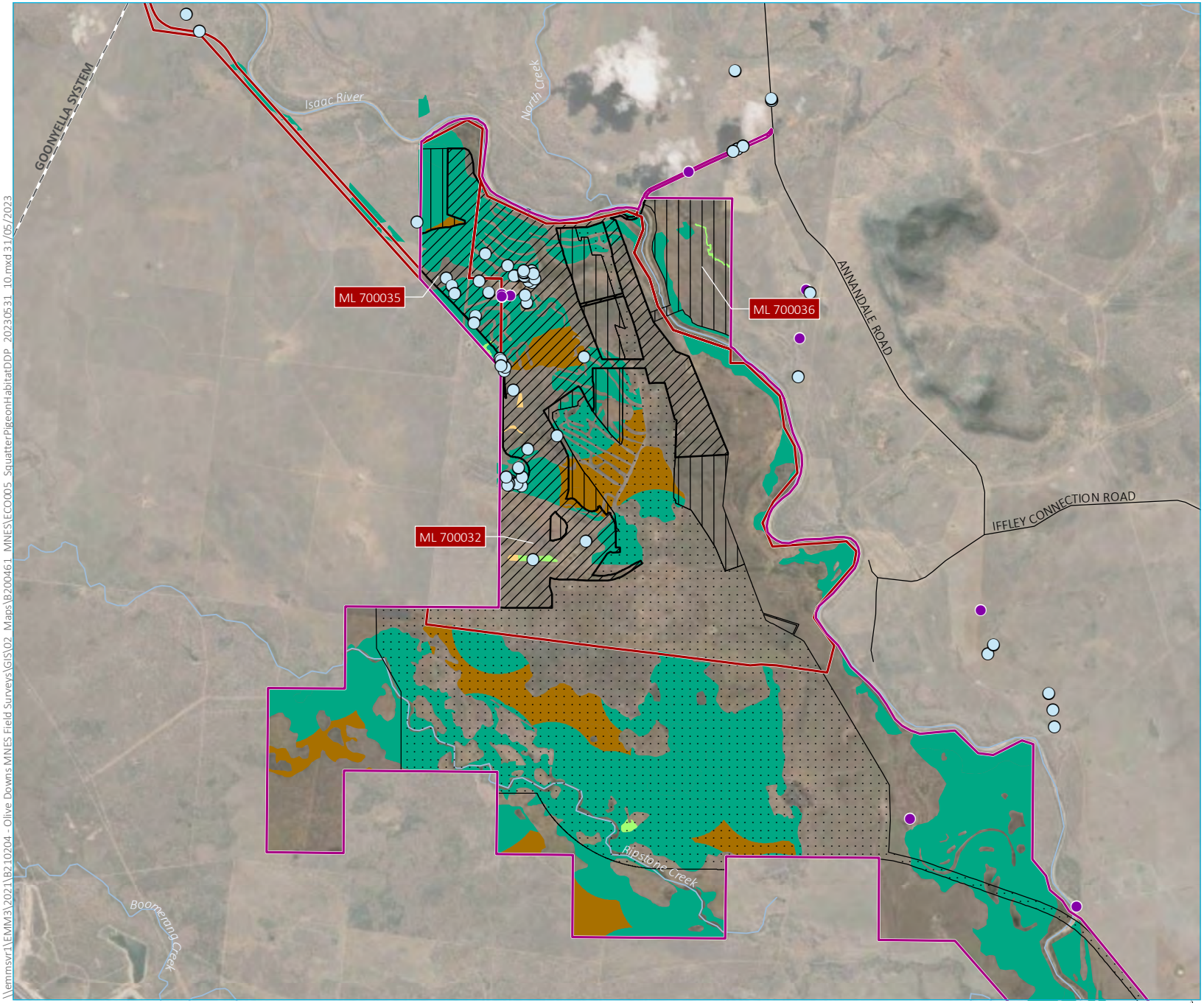

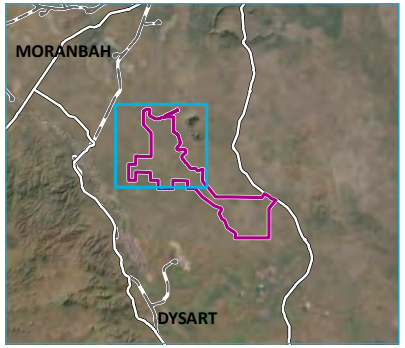

KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Squatter Pigeon record

- ALA/BMA/DMP Enviros ciences
- EMM

Squatter Pigeon habitat

- Breeding (remnant)
- Breeding (regrowth)
- Foraging (remnant)
- Foraging (regrowth)

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

N

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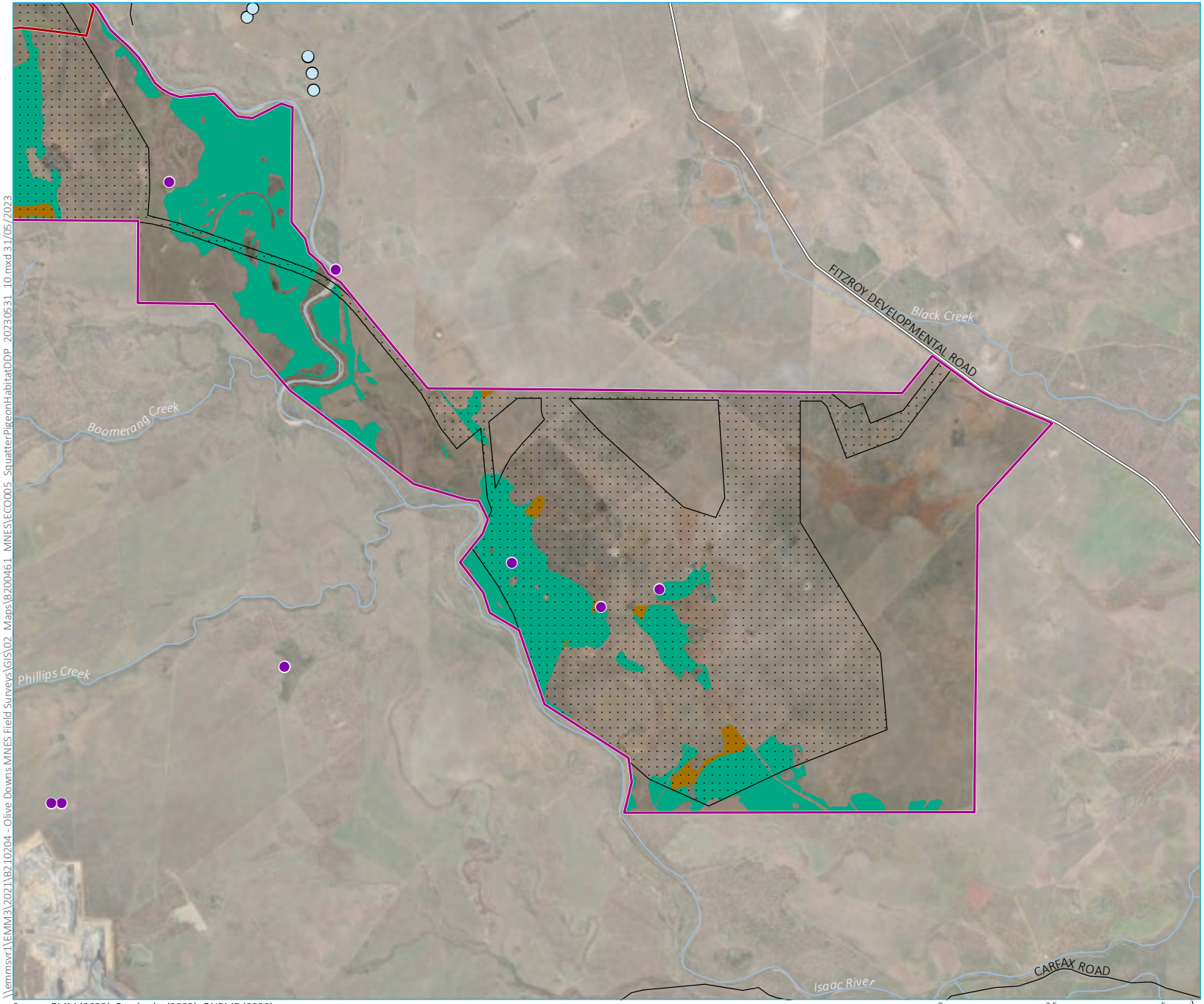
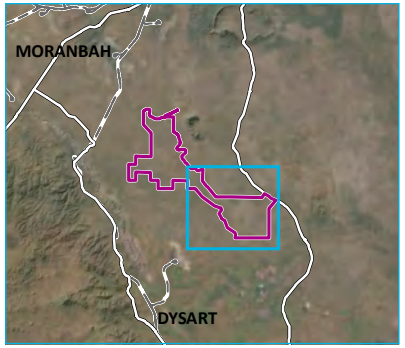
Squatter Pigeon habitat map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.4

EMM creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Squatter Pigeon record

- ALA/BMA/DMP Enviroscienses
- EMM

Squatter Pigeon habitat

- Breeding (remnant)
- Foraging (remnant)

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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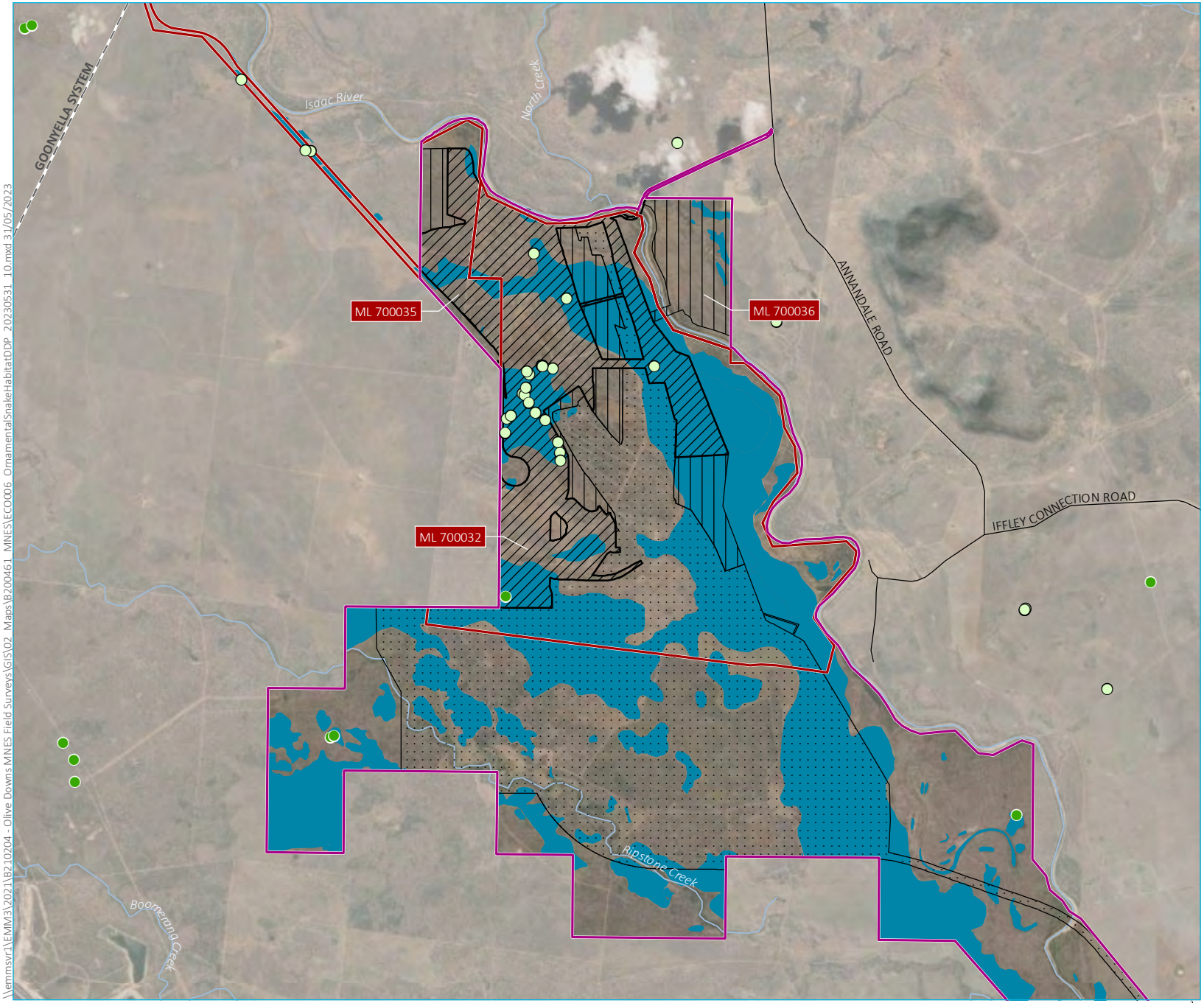
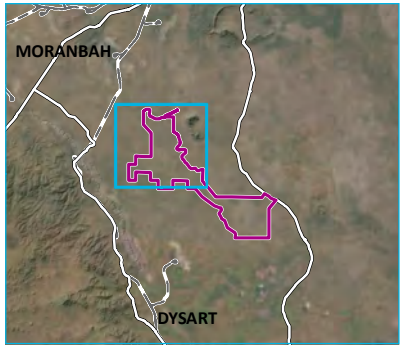
Squatter Pigeon habitat map 2 of 2

Olive Downs
MNES Management Plan
Figure 2.4

EMM
creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Ornamental Snake record

- ALA/BMA/DMP Enviros ciences
- EMM
- Oramental Snake habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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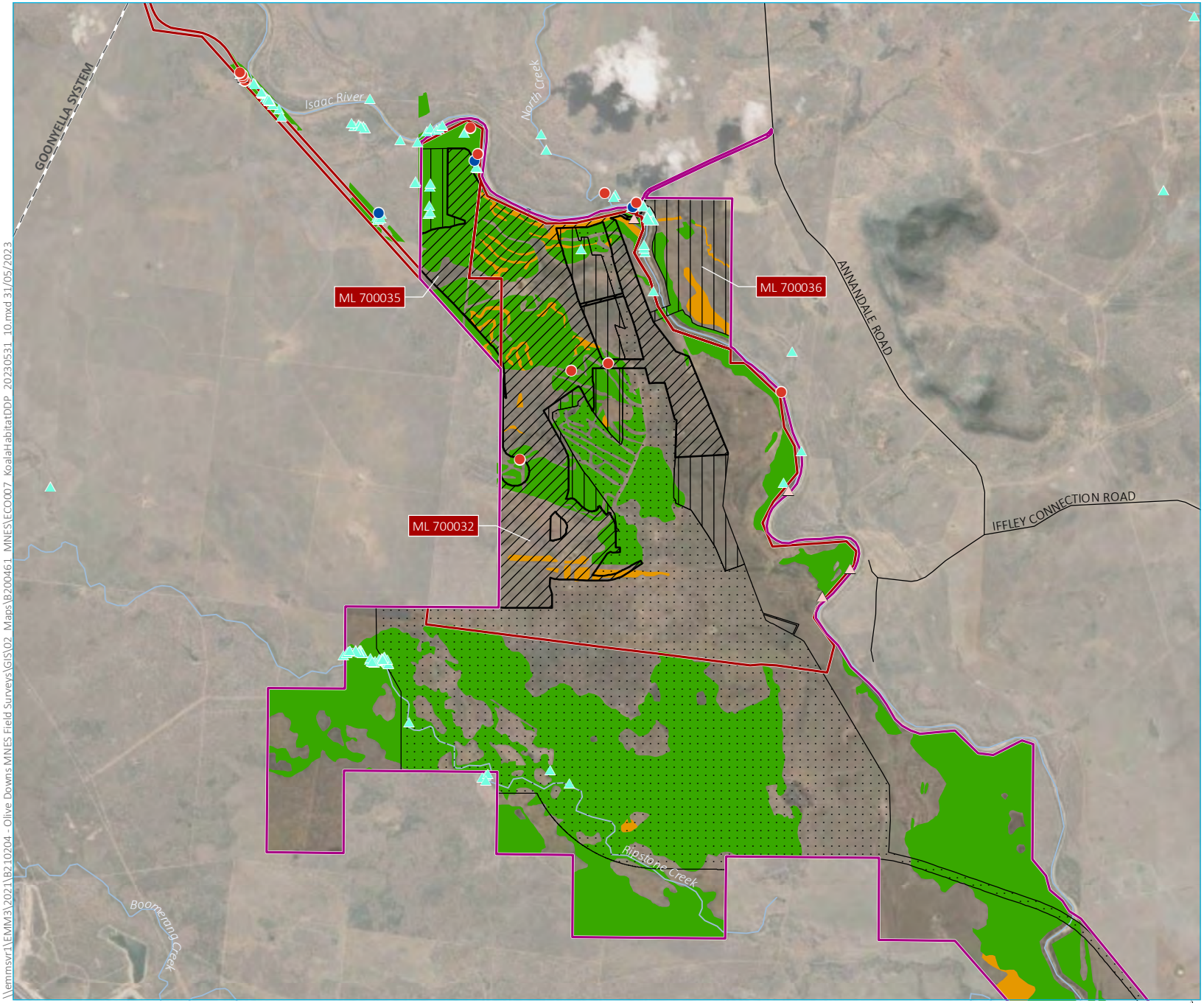
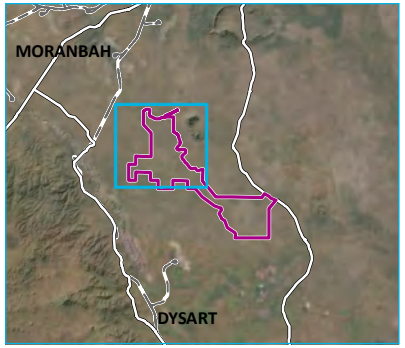
Ornamental Snake habitat
map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.5

EMM
creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Koala records (ALA/BMA/DMP Enviroscienses)

- Observed
- Indirect evidence

Koala records (EMM)

- Observed
- Indirect evidence

Koala habitat

- Remnant
- Regrowth

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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Koala habitat map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.6

EMM creating opportunities

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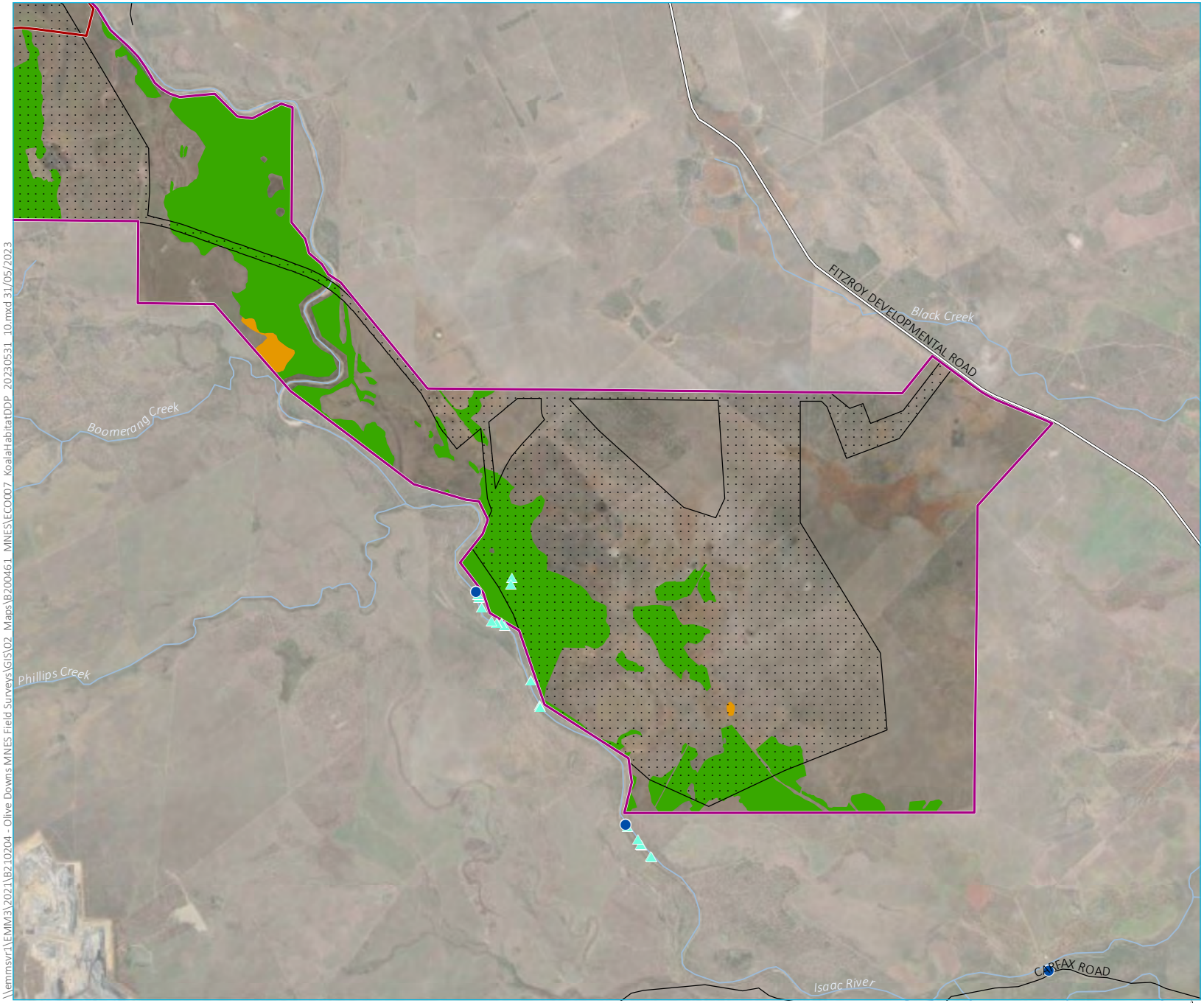

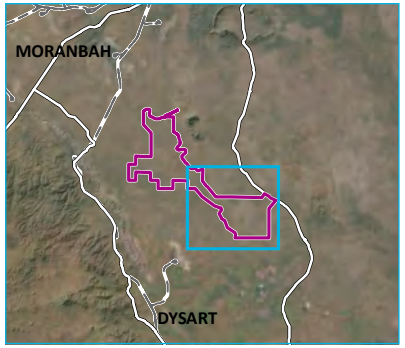

KEY

- Project area
- Mining lease boundary (containing stage 1)
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Koala records (ALA/BMA/DMP Enviroscience)

- Observed
- Indirect evidence

Koala habitat

- Remnant
- Regrowth

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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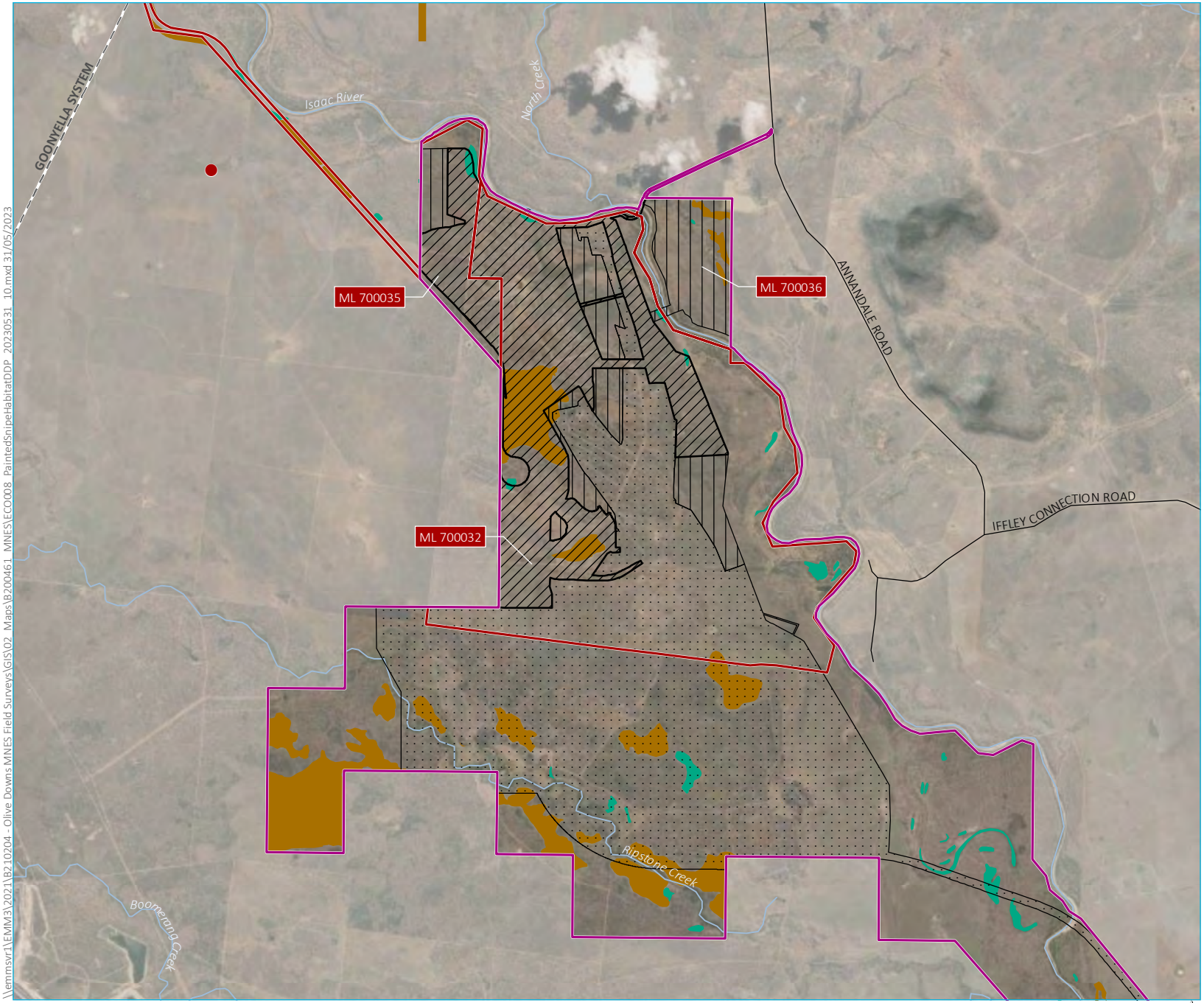
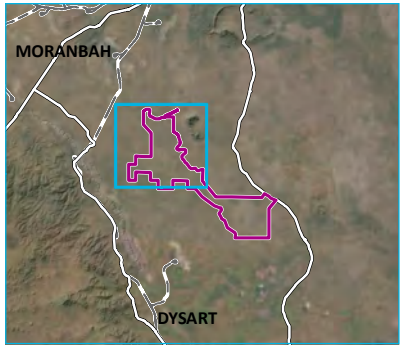
Koala habitat map 2 of 2

Olive Downs
MNES Management Plan
Figure 2.6

EMM creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse
- Australian Painted Snipe record (ALA/BMA/DMP Enviroscienses)

Australian Painted Snipe habitat

- Breeding
- Foraging

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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Australian Painted Snipe habitat map 1 of 2

Olive Downs
MNES Management Plan
Figure 2.7

EMM creating opportunities

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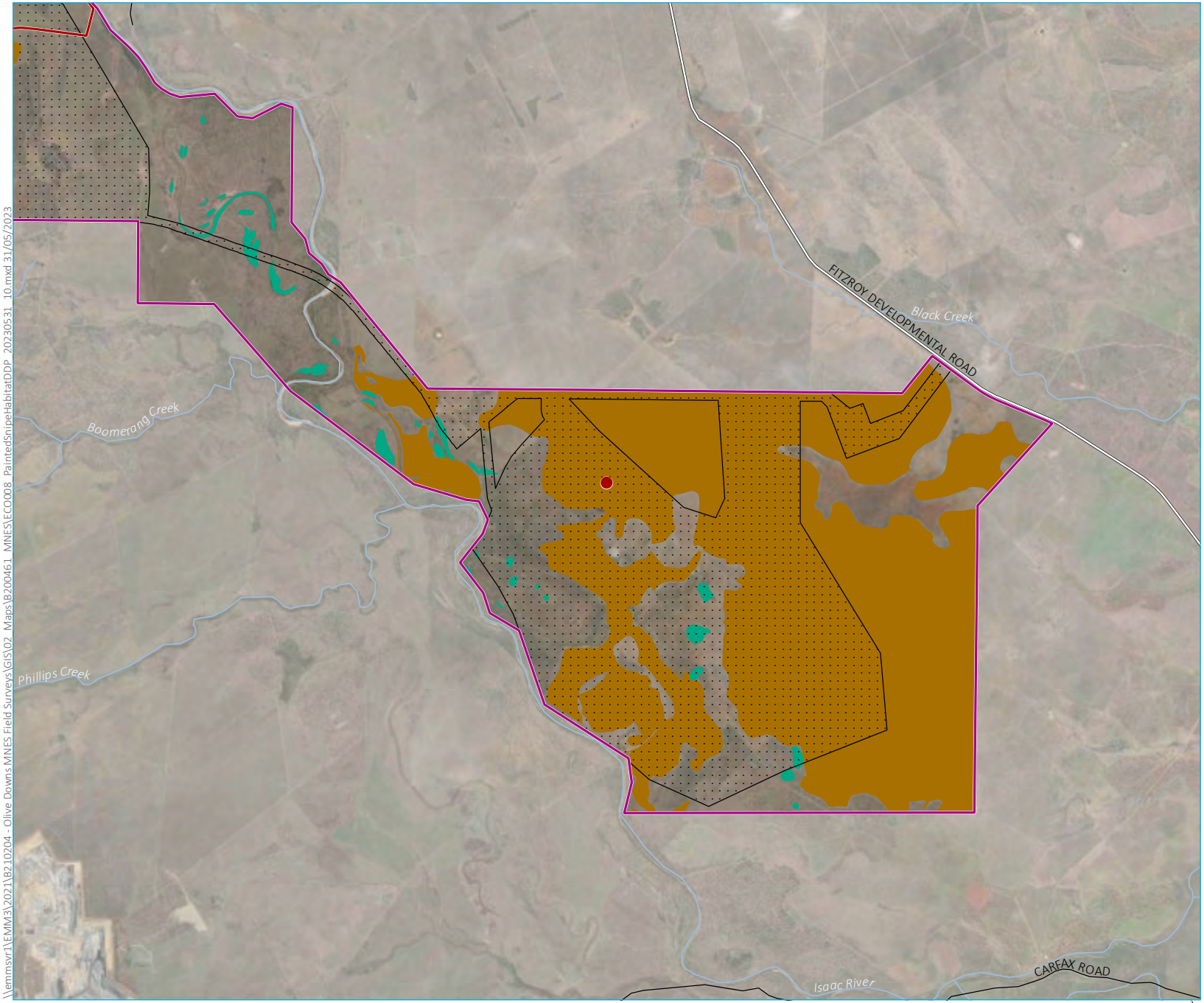

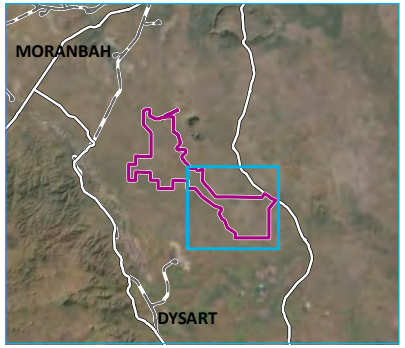

KEY

- Project area
- Mining lease boundary (containing stage 1)
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse
- Australian Painted Snipe record (ALA/BMA/DMP Enviroscences)

Australian Painted Snipe habitat

- Breeding
- Foraging

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 2.5 5 km

GDA 1994 MGA Zone 55

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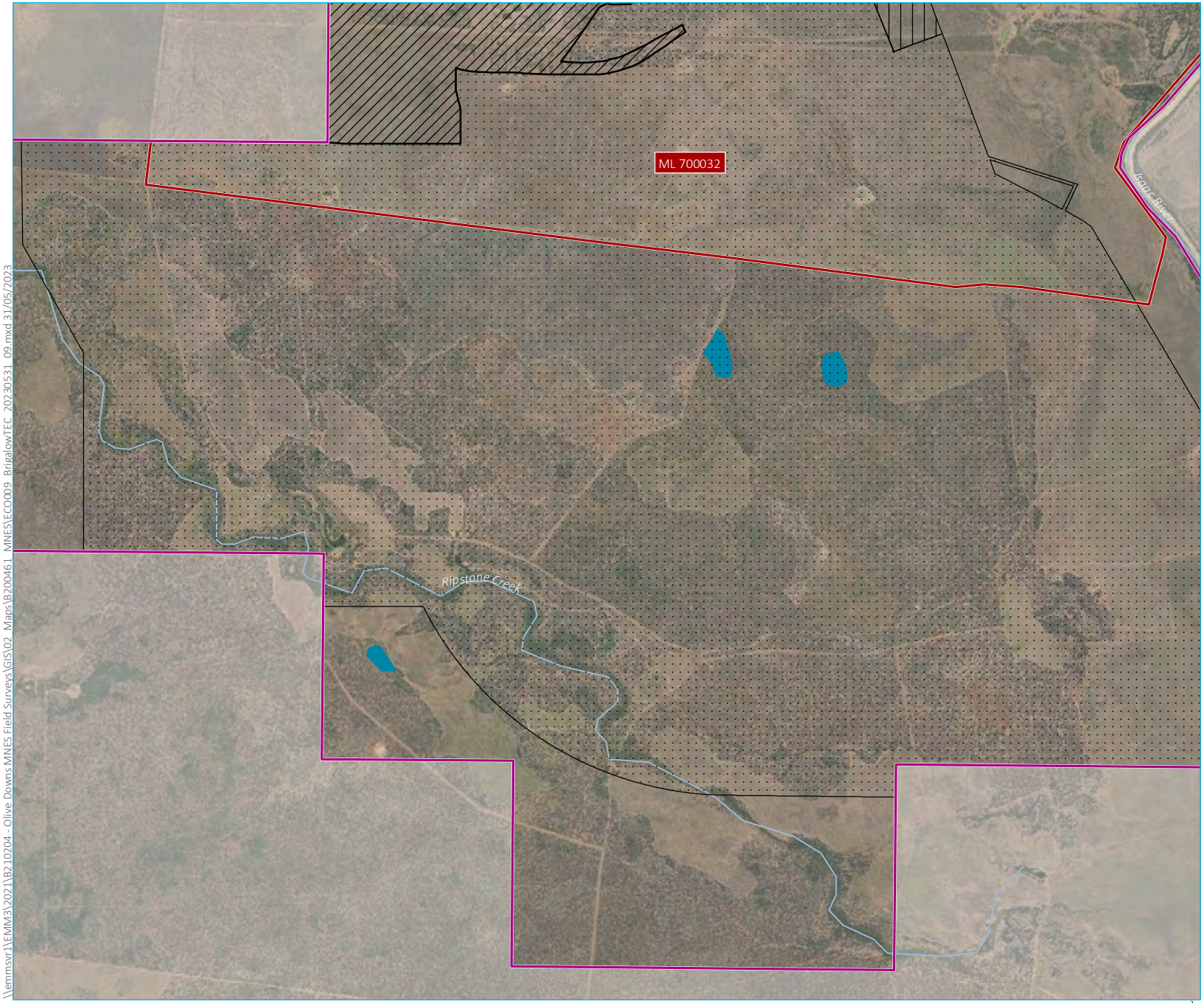
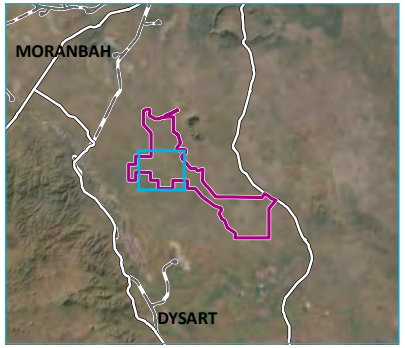
Australian Painted Snipe habitat map 2 of 2

Olive Downs
MNES Management Plan
Figure 2.7

EMM creating opportunities





KEY

- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Stage 2 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse
- Brigalow threatened ecological community

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 1 2 km

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Brigalow TEC areas

Olive Downs
MNES management plan
Figure 2.8

EMM
creating opportunities

2.5 Relevant plans and guidelines

Table 2.1 lists the conservation advice, guidelines and management plans relevant to each of the MNES fauna species and TEC covered by this MMP. These documents have been reviewed in preparing the MMP to inform the development of performance criteria, management measures (Tables 4.1 - 4.3) and corrective actions (Table 6.1).

Table 2.1 Relevant conservation advice, recovery plans and threat abatement plans

MNES	Relevant conservation advice and plans	Recognised threats
Koala (*Phascolarctos cinereus*)	• Conservation Advice for *Phascolarctos cinereus*, Koala (combined populations in Queensland, New South Wales and the Australian Capital Territory), (DAWE 2022) • EPBC Act referral guidelines for the vulnerable koala (DoE 2014a) (*noting this was in place at time of approval but is no longer applicable*)	• Habitat loss • Habitat fragmentation • Vehicle strike • Predation by domestic or feral dogs • Disease
Greater Glider (*Petauroides volans*)	• Conservation Advice for *Petauroides volans*, Greater Glider (DCCEEW2022) • Guide to greater glider habitat in Queensland Department of Environment and Science (State of Queensland 2022)	• Habitat loss • Habitat fragmentation • Too intense or frequent fires • Logging • Barbed wire fencing (entanglement) • Predation from owls • Phytophthora root fungus • Climate change
Squatter Pigeon (Southern) (*Geophaps scripta scripta*)	• Approved Conservation Advice for *Geophaps scripta scripta* (Squatter Pigeon (southern)) (TSSC 2015); • Threat abatement plan for predation by feral cats (DoE 2015); • Threat abatement plan for competition and land degradation by rabbits (DoEE 2016); and • Threat abatement plan for predation by the European red fox (DEWHA 2008)	• Habitat clearing • Habitat degradation through overgrazing by livestock and feral herbivores such as rabbits • Thickening of understorey • Predation by feral cats and foxes
Ornamental Snake (*Denisonia maculata*)	• Approved Conservation Advice for *Denisonia maculata* (Ornamental Snake) (DoE 2014b). • Draft referral guidelines for nationally listed Brigalow Belt reptiles (DSEWPaC 2011c) • Priority threat management for imperilled species of the Queensland Brigalow Belt (Reyes et al 2016)	• Habitat clearing and degradation • Degradation of habitat including wetland and frog habitat by feral pigs and livestock • Cane toad ingestion
Australian Painted Snipe (*Rostratula australis*)	• Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (TSSC 2013a) • Information Sheet	• Loss and degradation of wetland habitat • Grazing and associated trampling of wetland vegetation • Replacement of native wetland vegetation by invasive weeds • Predation by feral cats and foxes.

Table 2.1 Relevant conservation advice, recovery plans and threat abatement plans

MNES	Relevant conservation advice and plans	Recognised threats
Brigalow TEC	• Approved Conservation Advice for the Brigalow (*Acacia harpophylla* dominant and co-dominant) ecological community (TSSC 2013b) • Information Sheet: Brigalow regrowth and the EPBC Act (Queensland Herbarium 2003)	• Clearing • Fire • Weeds • Feral animals • Inappropriate grazing.

3 Impacts to MNES

This section of the MMP describes the potential impacts that may occur to the prescribed MNES (listed in Section 1.4) as a result of the Project. Potential impacts may come from direct impacts (such as vegetation clearing, vehicle strike) or indirect impacts (such as weeds, increased noise and lighting). Impacts have the potential to occur in all Project phases being; clearing phase, construction, operation and decommissioning.

Below is a summary of the potential direct and indirect impacts that could occur to MNES as a result of the Project.

3.1 Direct impacts

3.1.1 Vegetation clearance and habitat loss

The Project will progressively establish infrastructure on the site and commence open cut mining. Development and operation of the mine will be completed over four stages over a mine life of 79 years and vegetation clearing will occur progressively.

The Project area is a total of approximately 26,164 ha and within that approximately 8,761 ha is remnant vegetation. Across all four stages up to approximately 5,757.08 ha of native vegetation will need to be cleared for the Project to establish infrastructure, access roads and open cut mining activities.

Impacts to threatened fauna species as a result of clearing may include:

- potential for individual species to be injured or killed during vegetation clearing;
- loss of habitat thereby requiring individuals to mobilise from the area and find new breeding and/or foraging habitats; and
- fragmentation of habitat reducing a species ability to move between habitats in the local area and region.

i Approved staged clearance and MNES impact limits

The approved extent of clearing MNES habitat for each Project stage is summarised in Table 3.1. The areas of MNES habitat within the approved disturbance areas are shown in Figure 2.3 to Figure 2.8.

Table 3.1 Disturbance limits (ha) for MNES across the mine site and access roads

MNES	Stage 1 (ha)	Stage 2 (ha)	Stage 3 (ha)	Stage 4 (ha)	Total (ha)
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) habitat	1,099	406.16	3,899.81	354	**5,759**
Greater Glider (*Petauroides volans*) habitat	932.81	352.54	3,921.22	389	**5,595.6**
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) breeding habitat	810.45	262.73	2,941.04	322	**4,479.3**
Squatter Pigeon (Southern) (*Geophaps scripta scripta*) foraging habitat	133.76	69.74	656.5	6.5	**866.5**
Ornamental Snake (*Denisonia maculata*) important habitat	973.9	367.74	5,094.11	1,307	**7,742.75**

Table 3.1 Disturbance limits (ha) for MNES across the mine site and access roads

MNES	Stage 1 (ha)	Stage 2 (ha)	Stage 3 (ha)	Stage 4 (ha)	Total (ha)
Australian Painted Snipe (*Rostratula australis*) breeding habitat	16	3	70	25	**114**
Brigalow TEC	0	0	13	0	**13**

Pembroke will record and report on the extent of vegetation clearing each year as part of annual reporting, and then within the 5 yearly interim reports, as summarised in Section 7.1. At the completion of each mine stage a final report will be issued to DCCEEW showing final disturbance footprints for all MNES including spatial files. Monitoring is summarised in Section 6, and reporting Section 7.

3.1.2 Vehicle strike

Vehicles and trucks coming into the Project area, and moving within it (such as trucks and vehicles on mine haul roads) have the potential to result in fauna mortality. Road mortality has been implicated in the decline of wildlife populations, including species of conservation significance (Taylor & Goldingay 2004; Rowden, Steinhardt & Sheehan 2008). Koalas and gliders are known to be particularly susceptible to vehicle strike when attempting to cross road corridors whilst migrating between areas of habitat (DEHP 2012).

The rail spur that comes into the Project area may also have potential to impact on fauna species if individuals are able to get onto the railway corridor and be hit by the coal trains. The Project rail corridor has been located through areas of relatively low habitat value, i.e. primarily agricultural grasslands and regrowth vegetation. The frequency of services, the speed of the trains and rail embankment height indicates that the likelihood of incidents of fauna strike is low (DPM Enviroscences 2018).

Vehicle strike has the potential to occur in all Project phases as there will be vehicles and machinery during vegetation clearing, construction, operation and decommissioning. Larger truck movements will be greatest during the operational phase.

3.1.3 Predation from pest animals

Field surveys recorded the presence of a variety of exotic fauna (i.e pest animals), including species identified as restricted matters under the Queensland *Biosecurity Act 2014*, namely:

- Cane Toad (*Rhinella marina*);
- Wild Cat (*Felis catus*);
- Dog (*Canis lupus familiaris*);
- Hare (*Lepus europaeus*);
- European Rabbit (*Oryctolagus cuniculus*);
- House Mouse (*Mus musculus*); and
- Feral Pig (*Sus scrofa*).

Most pest animal species are assumed to have resident populations in the Project area and surrounds, though their abundance is likely to vary with the seasons. Pest species threaten populations of native wildlife in two main ways:

- direct predation (for example by foxes and cats). The Greater Glider, Squatter Pigeon, Ornamental Snake, Australian Painted Snipe and Koala all suffer from predation to varying degrees and predation is listed as a threat in their respective species EPBC Act conservation advice.
- competition for limited resources (rabbits, rodents and feral pigs); and
- habitat degradation such as feral pigs in gilgai and wetland habitats.

The mine activities have the potential to increase feral animal populations as there will be an increase in disturbance which may make it easier for feral animals such as feral cats and wild dogs to predate on wildlife, and mine personnel may leave food and/or rubbish that attract feral species to the site such as wild dogs, foxes and cats. Koalas will incur increased susceptibility to predation whilst dispersing from habitat being cleared, or whilst attempting to return to habitat that has been cleared. Pest animals have the potential to impact on MNES threatened fauna species during all Project phases.

3.2 Indirect Impacts

3.2.1 Weeds

Declared pest plants under the Qld *Biosecurity Act 2014* were recorded within the Project area during field inspections. Key weed species observed were:

- Rubbervine (*Cryptostegia grandiflora*);
- Harrisia Cactus (*Harrisia martini*);
- Bellyache Bush (*Jatropha gossypiifolia*)
- Lantana (*Lantana camara*);
- Creeping Lantana (*Lantana montevidensis*);
- Common Pest Pear (*Opuntia stricta*);
- Velvety Tree Pear (*Opuntia tomentosa*);
- Parkinsonia (*Parkinsonia aculeata*);
- Parthenium (*Parthenium hysterophorus*);
- Fireweed (*Senecio madagascariensis*); and
- Prickly Acacia (*Vachellia nilotica* subsp. *indica*).

With the exception of Harrisia Cactus, each of these introduced species is also listed as a weed of national significance (WoNS).

Exotic flora species are concentrated in areas suffering some form of disturbance, mostly clearing for cattle grazing (DPM Enviroscience 2018). The EPBC Act lists weed invasion as a 'key threatening process' to biodiversity due to the impact on wildlife and the landscape (DAWE 2020d). During clearing and construction there would be the potential for disturbing weeds in the Project area from disturbance to vegetation and soil resulting in the movement

of weeds within and outside of the Project area. This could increase the level of infestation in the Project locality and potentially facilitate the spread of weeds to adjacent areas.

Reduction of food resources and cover from the establishment and maintenance of Buffel Grass pastures have been identified as a threat to the Squatter Pigeon (southern) (DAWE 2020a) and is often seen to increase in response to disturbance (TSSC 2015). Weeds have the potential to degrade the condition of fauna habitat, compete with regenerating native flora species and increase fuel loads thereby increasing intensity of bushfires. Weeds such as lantana can reduce fauna species ability to move through areas such as Koalas, and vines that get a hold in riparian communities can impact on species ability to utilise these areas. Aquatic weeds also have potential to degrade wetlands which is an impact to Australian Painted Snipe.

Weeds have the potential to impact on MNES threatened fauna species and Brigalow TEC during all Project phases.

3.2.2 Pest animal habitat degradation

A number of pest animals have the ability to degrade the condition of MNES habitats and are a recognised threat for a number of target threatened species.

The main identified threat to the Ornamental Snake is a continued legacy of past broadscale land clearing and habitat degradation. Destruction of wetland habitat by feral pigs is also a threat, along with the associated destruction of frog habitat and direct competition for their food source (frogs) (DoE 2014b).

Rabbits are a recognised threat to Squatter Pigeon. Their preferred habitats of open grassy woodland can be degraded due to overgrazing by feral herbivores such as rabbits (TSSC 2015).

3.2.3 Noise and vibration

During construction and operation of the Project there will be activities that will increase noise levels from the current baseline. At present the site would experience noise from agricultural activities in the local area, however these are infrequent and occur during the day. Noise levels will be increased from vegetation clearing operations, topsoil stripping, blasting of overburden and interburden, ROM coal mining and transport, coal handling and processing, overland conveyors and site rehabilitation. As the mining operation will be 24hrs, 7 days a week there is potential for threatened fauna species to be affected by noise in particular nocturnal species such as Greater Glider and Koalas due to their sensitivity to noise (DPM Enviros ciences 2018).

The Project will result in ongoing and localised increases in noise and vibration disturbance in habitats that occur directly adjacent to these areas. The extent of this impact would depend on the distance between the activities and the adjacent habitat, the level of noise emanating, the type of habitat (dense forest is more resilient) and the hours of operation.

Noise impacts have potential to occur in all Project phases due to the range of activities that will occur over the life of the mine. Vegetation clearing and construction phases are likely to have increased noise levels only during the day while the operational phase will have elevated noise levels both during the day and night, as well as blasting activities.

3.2.4 Artificial lighting

Impacts to fauna associated with artificial lighting are expected to include avoidance of lit areas and disturbance to activity levels (particularly for birds and amphibians). Some species may be attracted to lit areas. For example, insectivorous bats may be attracted to swarming insects that congregate around lit areas at night. The Project would result in an increase in the use of artificial lighting within the Project locality (DPM Enviros ciences 2018).

Artificial lighting is only likely to be an issue during the operational phase and decommissioning phase. Night work will not occur during vegetation clearing or construction phases.

3.2.5 Dust

Dust from mining consists primarily of larger particles generated through the handling of rock and soil, as well as through wind erosion of stockpiles and exposed ground. Larger particles (measured as dust deposition) are mostly associated with dust nuisance or amenity impacts in residential areas, through settling or deposition of the particles. Dust settling may also occur on native vegetation which has potential to impact on growth and health of the plant. Excessive dust build up may also impact on micro-habitats such as gilgai which support Ornamental Snake. Dust levels may be increased due to haul roads being used in dry conditions where native vegetation close to the road could be impacted, the stripping of top soil and clearing of vegetation also has the potential to increase dust levels in that area. Dust is generally a localised and temporary impact. Rainfall can also help remove dust from vegetation, reduce dust coming up from dirt roads and increases ground cover which also helps minimise dust.

Dust has the potential to impact on MNES threatened fauna species habitats and Brigalow TEC during all Project phases.

3.2.6 Fire

A fire starting in the Project area may be caused by sparks originating from machinery, or an accident (such as a collision), scheduled burns getting out of control, hot works, spontaneous combustion of coal or from operators and personnel dropping matches or cigarette butts in the Project area where it can create a bushfire.

Too frequent fires, or intense bushfires have potential to kill wildlife, degrade or result in loss of habitat and foraging resources. Over time fire can also alter the structure of vegetation communities. Brigalow TEC is particularly vulnerable to hot fires and fire is a recognised threat. Brigalow may be killed by fire (Benson et al. 2006), although in Queensland only high intensity fires kill the root systems (Johnson 1964). A number of tree and shrub species that live in Brigalow communities are susceptible to hot fires.

Too intense or frequent fires is a recognised threat to Greater Glider. Population loss or declines have been documented in and after high intensity fires (Lindenmayer et al. 2013). Fire has the potential to impact on MNES threatened fauna species and Brigalow TEC during all Project phases.

3.2.7 Impact summary

A summary of the potential impacts to MNES as a result of the Project(and the relevant Project phase) that will be addressed in the MMP, is provided in Table 3.2.

Table 3.2 Summary of potential impacts to MNES

Impacts	Potential impacts to MNES	Impacted MNES	Applicable project phase
Vegetation clearing/habitat loss	Removal of vegetation that provides foraging and/or breeding habitat for a threatened species and ecological communities. Injury or death during clearing.	All	Clearance
Habitat fragmentation	Reduction in ability for threatened MNES species to disperse to adjacent habitat and move safely through the area	Squatter Pigeon, Ornamental Snake, Koala, Greater Glider, Australian Painted Snipe	All phases

Table 3.2 Summary of potential impacts to MNES

Impacts	Potential impacts to MNES	Impacted MNES	Applicable project phase
Habitat degradation from feral animals	Loss of food resources and habitat degradation can occur from feral animals (i.e. wild pigs and rabbits).	Squatter Pigeon, Australian Painted Snipe and Ornamental Snake	All phases
Introduced plants	Dispersal of weeds throughout the Project area by vehicles, machinery, and people leading to habitat degradation. Weeds can also increase fuel load increasing likelihood of hot fires.	All	All phases
Predation by invasive fauna	Loss of individuals to predation by European Foxes, Feral Dogs and Feral Cats, which are known to increase in abundance around human habitation in dryland areas. Food waste attracting fauna pests to the Project Area. Cane toads are poisonous to Ornamental Snake.	Koalas, Squatter Pigeon, Ornamental Snake, Australian Painted Snipe	All phases
Noise and vibration	Loss of useable habitat in, and adjacent to, the Project Area due to noise and vibration disturbance.	All fauna. Particularly Koalas and Greater Glider due to being nocturnal.	All phases (predominantly construction and operation)
Air quality and dust	Dust deposition may impact on vegetation near to dust sources such as dirt access roads and during vegetation clearing if conditions are dry. Dust may reduce habitat quality such as gilgai.	All	All phases
Light	Loss of useable habitat in and adjacent to the Project Area due to light disturbance at night.	Greater Glider, Australian Painted Snipe, Ornamental Snake and Koala	Construction, operation, decommissioning
Vehicle strike	Mortality and injury from vehicle strike, due to an increased number of vehicles, machinery and access routes.	Squatter Pigeon, Ornamental Snake, Koala, Greater Glider	All phases
Erosion and sedimentation	Increased erosion of disturbed surfaces and increased sedimentation of waterways. Severe erosion can alter surface water flows and local hydrological regimes.	All	All phases (predominantly vegetation clearing and construction)
Fire	Fires can start from machinery, activities occurring on site and/or personnel. Fire may get into adjacent bushland being retained and result in loss or degradation of habitat and foraging resources. Increase in fuel load can increase the chance of bushfires occurring and their intensity. Hot bushfires can cause temporary and permanent losses of habitats such as hollows, fallen woody debris and Brigalow communities. They can also result in injury/mortality of threatened fauna species.	All	All phases

4 MNES management measures

A range of measures will be implemented to avoid, mitigate and manage direct and indirect impacts on the listed threatened fauna species and ecological community identified in Table 3.2. These measures may be specific to a particular Project phase, or will be implemented over the life of the Project as it is applicable to all Project phases.

Planning and management of disturbances for the Project were assessed taking into consideration a set of hierarchical management principles as outlined in State and Commonwealth offset policies, that are designed to firstly avoid impacts, then mitigate and manage impacts to the environmental values.

This MMP has been developed considering these management principles (in order of preference) with relevance to impacts on MNES:

- Avoidance: Avoiding direct and indirect adverse impacts where possible through Project design;
- Mitigate: Mitigating direct and indirect adverse impacts where impacts cannot be avoided through actions to reduce likelihood or severity of impacts occurring such as modifying design (eg designing river crossings to allow fauna movement, glider rope crossings, employing specialist clearing and construction methods, reducing vehicle speed limits);
- Manage: Implement management actions to prevent or reduce impacts occurring such as weed and feral animal control, fire management. These actions are often over a longer timeframe;
- Remediation and rehabilitation: Actively and progressively remediate and rehabilitate impacted areas to promote and maintain long-term recovery; and
- Provide offsets: Pembroke are delivering environmental offsets for significant, residual impacts to MNES which are addressed in a separate Offset Strategy and offset management plan in accordance with the EPBC Act approval conditions.

4.1 MNES management measures

EMM has summarised the proposed avoidance, mitigation and management measures by Project phase and clearly identified:

- performance criteria;
- action to be undertaken;
- how it will be done;
- where it will be implemented in relation to the MNES and/or habitat and impact/action;
- when it will be implemented in relation to the impact/action, the Project stage and where relevant time of year and at what frequency/duration; and
- who is responsible for taking that action.

4.2 SMART principle

All MNES management measures have been developed to be consistent with the S.M.A.R.T principle, to ensure that measures are:

- **S**pecific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation.
- **M**easurable – the status (i.e. success or failure) and outcomes/results can be measured.
- **A**chievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe.
- **R**elevant – to the action/impact being controlled and to the protected matter.
- **T**ime bound – Measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

For example:

Measure	Method	Where	Timing	Responsible party
Installation of delineation structures	Clearly identify the approved clearing limits and exclusion zones via installation of temporary fencing, signage, flagging tape and barricades.	The boundary of approved clearing areas for each stage as illustrated in Figure 1.2 and Figures 2.3-2.8 for each MNES.	Prior to any vegetation clearing occurring for that stage.	Pembroke Site Manager

Plate 4.1 Excerpt from Table 4.1, row 1, Installation of Delineation Structures

- **S**pecific – Detail has been provided to the responsible personnel (Pembroke Site Manager) for implementation of the task, the timing of the task is specified, frequency and location of implementation (the boundary of approved clearing areas for each project stage), as well as the purpose (to clearly identify approved clearing limits and exclusion zones) which will ensure clearing does not go above limits specified in approval. Methodology is also given (installation of temporary fencing, signage etc.), to ensure the measure is prescriptive and unambiguous to achieve the result.
- **M**easurable – the outcome is clear which is to install delineation structures prior to any vegetation clearing occurring for that stage. How it is to be done is specified which is through use of measures such as temporary fencing, signage and barricades.
- **A**chievable – the task is achievable as it sets out who is responsible (Pembroke Site Manager), when and how it should occur (prior to clearing for that stage and through use of measures such as temporary fencing, signage and barricades).
- **R**elevant – task is relevant as it will ensure vegetation clearing stays within the approved impact areas for that stage, and total area of disturbance to MNES does not exceed approved thresholds. It will also ensure any adjacent areas are not directly or indirectly impacted from machinery going into these areas.
- **T**ime bound – the installation of delineation structures are to be installed prior to any vegetation clearing occurring for that particular stage.

4.3 Adaptive management

The implementation of this Management Plan will use an adaptive management framework.

Adaptive management includes two key phases:

- establishment of the key components of a management framework including engaging stakeholders, developing clear and measurable objectives and performance criteria, identification and selection of potential management actions and the development of monitoring protocols which enable the evaluation of progress towards achieving objectives, and which will effectively contribute to the adaptive management decision making process; and

- an iterative learning phase which involves utilisation of the management framework to learn about the natural resource system and iteratively adapt management strategies and approaches based on what is learned (Williams & Brown 2016).

If a performance criteria or interim target has not been achieved, corrective actions will be implemented. Where there is uncertainty as to the cause of the management trigger (e.g. failure to achieve the interim performance target), the event or circumstance triggering corrective action will be reviewed, and management actions in this MMP may be revised accordingly.

4.3.1 Vegetation clearing phase

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
Avoidance						
1.	No clearing of native vegetation and/or disturbance to MNES habitats occurs outside of the approved disturbance limits for each stage (detailed in Table 3.1 of this MMP).	Installation of delineation structures Clearing limit inspection Delivery of the Olive Downs induction program	Clearly identify the approved clearing limits and exclusion zones via installation of one or more of these measures; temporary fencing, signage, flagging tape, barricades, survey pegs. Walk the boundary of clearing areas with a GPS that shows approved clearing extent to ensure the extent of clearing areas is accurate and compliant with the EPBC approval. Clearing machinery will have approved clearing extents in GPS also. Internal training will occur for all personnel involved in the vegetation clearing phase to be ensure they are aware of the approved works areas. Summarised at criterion 10.	The boundary of approved clearing areas for each stage as illustrated in Figure 1.2 and Figures 2.3-2.8 for each MNES.	Prior to any vegetation clearing occurring for that stage.	Pembroke Site Manager
2.	Avoid impacts to MNES habitat	Where practical, retain areas of MNES habitats and/or mature, large trees, hollow-bearing trees or large stags as potential nesting and roosting habitat.	When finalising areas required for the mine and associated infrastructure, identify opportunities to reduce clearing and retain individual trees with high ecological value or habitats such as gilgai. This would only be appropriate where the trees and/or habitat are situated on the boundaries of the site near other retained vegetation, and wildlife can safely utilise these areas. The trees or habitats to be retained are to be clearly marked and identified with GPS. These will be inspected and approved by the Pembroke Environmental Manager.	Within approved disturbance areas for each stage as illustrated in Figure 1.2 and Figures 2.3-2.8 for each MNES.	Prior to any vegetation clearing occurring for that stage.	Pembroke Environmental Manager
3.	Maintain and protect a 200 m riparian corridor along Isaac River (Figure 4.1).	Establish an exclusion zone at the Isaac River riparian corridor	No mining works or vegetation clearing will occur within 200m from the Isaac River except for approved crossings within riparian corridors (see Figure 4.1). This riparian corridor will be an exclusion zone, including no grazing permitted, and clearly identified on site plans.	Riparian corridors along Isaac River and approved river crossings are shown in Figure 4.1.	During all Project phases	Pembroke Site Manager Pembroke Environmental Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
		Installation of temporary delineation structures for when river crossings are being constructed	During clearing activities for approved river crossings and any works proposed near the riparian corridor exclusion zone, high-visibility, temporary plastic bollards will be installed and connected by high-visibility tape throughout, to delineate the limits of clearing and ensure no impacts occur to the riparian vegetation or river. These exclusion zones will be communicated in on-site inductions as part of Olive Downs induction program, toolbox talks and shown on on-site maps.			
		Implement erosion and sediment control measures	Erosion and sediment control measures will be in place to ensure sediment runoff does not occur into watercourses including the Isaac River riparian corridor. Erosion control measures. Will be installed including sand bags and sediment fences to catch sediment post any rainfall event. Spreading mulch from cleared vegetation over disturbed areas as soon as possible, particularly in higher risk areas with steep slopes, will be conducted to stabilise landforms and prevent soil runoff.			
		Manage weeds and feral animals in Isaac River riparian corridor to maintain MNES values				
		Installation of grazing exclusion fencing	Isaac River crossings to be limited to those specified within the EPBC approval which are: • clearance of one corridor, a max. of 45m in width for the conveyor crossing (Figure 4.1); and • clearance of two corridors, a max. of 60m in width for two road crossings including haul road to eastern waste rock emplacement (Figure 4.1). Indicative crossing locations are shown in Figure 4.1. The clearing widths will not be exceeded. Within land that is owned by Pembroke (ML700032, ML700035 and ML700036), and outside of the Stage 1 and 2 impact area, Pembroke will conduct weed and feral animal management. Further detail is provided in Section 5.2.1 and 5.2.2.			

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			Remove and exclude grazing from the Isaac River riparian corridor. Measures are summarised at criterion 15.			
Mitigation						
4.	Identify MNES utilising the site prior to clearing	Conduct pre-clearance ecology surveys	Pre-clearance ecology surveys will include conducting targeted surveys to identify presence of MNES species in the area including Koalas, Greater Glider and Ornamental Snake. This will include spotlighting to increase detectability of the species over a number of consecutive nights, and may include drone surveys for Koalas. Further detail for pre-clearance surveys is provided in Section 5.2.14 including tailored methods for each target MNES species.	Within the approved clearing area for each stage as shown in Figure 1.2.	At least 3 weeks prior to clearing commencing in a designated area. Daytime breeding place surveys prior to vegetation clearing.	Suitably qualified ecologists with experience in undertaking targeted surveys for these MNES species and pre-clearance surveys for threatened species in particular Koalas, Greater Glider and Ornamental Snake. Daytime breeding place surveys can be undertaken by fauna spotter catchers and/or ecologists with experience identifying animal breeding places.
5.	Reduce impacts on native wildlife through relocation to adjacent habitats.	Identify appropriate release sites for MNES species.	During pre-clearance surveys a suitably qualified ecologist will identify suitable release sites for native wildlife that may be required. This will include areas for release of Greater Glider once they have been captured out of hollows as summarised in Criteria 4. The release sites will be within the Project area, but outside of approved disturbance areas for the Project. They will support suitable habitat for the species and be well connected to adjacent habitats. The release sites will be GPS and notes recorded. This will be provided to fauna spotter-catchers.	Within the Project area, but outside of approved disturbance limits.	During pre-clearance surveys. Sites will be confirmed prior to clearing commencing.	Suitably qualified ecologist Pembroke Environment Manager
6.	No injury or mortality to Koalas during clearing	Pre-clearance surveys	A proposed clearing area will firstly be searched with a drone to detect presence of Koalas to assist locate them.	Koalas to be tracked will come from the proposed Stage 1 clearing area.	At least 3 weeks prior to clearing commencing in a designated area and for	Pembroke Environmental Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
		Koala tagging and monitoring for Stage 1	Monitoring of Koalas using radio-tracking prior to clearing, during clearing and post clearing for Stage 1. Through such monitoring, the definitive locations of all monitored Koalas will be known during the vegetation clearing process. If there are Koalas present which are not being monitored these will be identified during surveys by fauna spotter-catchers and managed accordingly. Tracking will assist project ecologists/fauna spotter-catchers and other on ground personnel to modify clearing activities in areas where Koalas have been identified and will also help to understand a range of other Koala population information. Further detail on Koala tracking and monitoring prior to, during and post clearing is provided in Section 5.2.8. Trees identified as containing Koalas will be demarcated with flagging tape and/or marking spray and managed in accordance with the sequential clearing, summarised at criteria 11 and detailed at section 5.2.13.		at least 3 months post clearing.	Suitably qualified ecologists with experience in Koala tracking and appropriate permits in place.

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
7.	Habitat features are retained for rehabilitation.	Salvage and reuse of habitat features such as hollows	During pre-clearance surveys all hollow-bearing trees and other habitat features such as nests, burrows, fallen logs and other micro-habitats will be identified. Any habitat features to be salvaged will be clearly marked and GPS location recorded. A report will be produced post survey summarising the number of hollows recorded which were suitable for Greater Glider, and their GPS location. Some large tree hollows will be salvaged and installed in identified recipient sites. The hollow will be cut from the tree post felling and necessary fauna checks. Recipient sites will include areas that have suitable foraging habitat for Greater Glider and some existing hollows, as well as areas of suitable habitat with no hollows. They will also be areas to be retained by the Project and include areas in the proposed Stage 1 offset. Further detail on nest box installation is provided in Section 5.2.5. Fallen woody debris, large rocks etc will be moved to adjacent habitats. Eligible trees will be reused for Koala poles.	Within approved clearing areas and selected recipient sites.	Habitat features to be salvaged will be identified during pre-clearance surveys. Movement of salvaged items to occur during clearing phase.	Suitably qualified ecologists to identify values for salvage. Pembroke Environmental Manager
8.	Native seeds are salvaged for rehabilitation.	Seed collection within the project area.	Native seed will be collected (where available and possible) prior to clearing occurring. The seed will be appropriately stored and used for future rehabilitation.	Within approved clearing areas and more broadly within the Project area (focusing on vegetation in seed) at different times of year.	Seed collection to occur in areas prior to clearing.	Third party contractor with appropriate permit for seed collection.

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
9.	Greater Glider breeding habitat is supplemented.	Install nest boxes for Greater Glider	As a part of the Stage 1 trial, nest boxes suitable for Greater Gliders will be installed at a ratio of 1:4 as far as practicable with consideration to the characteristics of the recipient sites. Nest boxes will replace hollows lost that have been determined to meet Greater Glider specifications, and that occur in mapped Greater Glider habitat. For further detail on nest boxes refer Section 5.2.5. Nest boxes will be installed at a minimum of 8m from the ground, in trees suitable within Greater Glider habitat via an elevated work platform. Nest boxes will be installed using the Habisure system.	Isaac River corridor. Potential recipient habitat for Greater Glider nest boxes is shown in Figure 4.1. Final locations are to be validated during pre-clearance surveys.	50% of required nest boxes will be installed as much as practicable prior to clearing commencing. All required nest boxes will be installed prior to the completion of clearing for Stage 1.	Suitably qualified ecologists and third party contractor to install Greater Glider nest boxes.
10.	All site personnel are trained and aware of MNES.	Delivery of the Olive Downs induction program	All site personnel (including sub-contractors) will be inducted on the potential threatened species and TEC and sensitive environmental areas occurring within the Project area. Training will include inductions, toolbox talks, pre-starts and targeted training as required. Topics will include, but not be limited to, the two stage habitat removal process, clearing limits, no go zones, fauna descriptions and handling procedures and hygiene protocols. All site personnel working in the Project area will be informed of exclusion zones in place and where they occur. All site personnel will be required to sign the induction form to state they have read and understand all relevant material.	Training will occur in the office and on-site during toolbox talks.	Inductions will be required to be completed prior to works commencing on site. Training and education should occur on a regular basis during clearing phase.	Pembroke Site Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
11.	MNES species are handled safely and correctly.	Supervision of clearing by Fauna spotter catcher Fauna relocation by suitably qualified fauna spotter catchers	A suitably qualified fauna spotter catcher will be present during clearing and will direct clearing in a manner that encourages and allows fauna to safely move from the clearing area to adjacent habitats. The spotter catcher will ensure there are safe exits for native fauna and that clearing is occurring towards habitat that will be retained. Fauna exclusion fencing will be erected where necessary to ensure fauna do not move towards high risk areas such as a busy road. Where animals are unable to move out of the area on their own, they will be captured and placed in adjacent areas of equivalent habitat. In the event that fauna handling is required, the Fauna Handling and Rescue Procedure will be implemented (Appendix B). Fauna spotter catcher is to check the clearing area for presence of native fauna including threatened species. Any captured fauna will be released into a pre-approved area. These release areas will be suitable habitat for the species, larger habitat areas that are being retained, with good connectivity. These release areas will have been identified during pre-clearance surveys. Any injured wildlife will be taken to a local vet or wildlife carer for treatment. This will be done in accordance with the Fauna Handling and Rescue Procedure provided in Appendix B. There will be at least one fauna spotter catcher present for each machine clearing vegetation.	In areas marked for clearing to occur.	Fauna spotter-catcher to survey an area immediately prior to clearing commencing. Fauna spotter-catcher to be present during vegetation clearing to monitor and check for any wildlife during the clearing process.	Suitably qualified fauna spotter catcher working under a Qld Rehabilitation Permit.,
12.	Vegetation is cleared sequentially	Two phase clearing of vegetation	Vegetation clearing will only occur within the approved clearing area (Criterion 1) and post pre-clearance surveys, salvage works and fauna spotter catcher survey of the area (Criterion 7). Clearing will occur sequentially in two phases with 48 hours of no-clearing between each phase. Phase 1 will consist of	The approved disturbance area for each stage.	During clearing works.	Pembroke Site Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			clearing understorey and juvenile vegetation and with large trees being cleared in phase 2. Or all trees can be cleared if the larger trees and hollow-bearing trees have been checked with an elevated work platform (EWP) on that day. 'Slow drop' techniques and hollow inspections via elevated work platforms will also be utilised. Further detail is provided in Section 5.2.13.			
13.	Reporting to be submitted post clearing phase. Report to document mitigation measures implemented, any injuries or mortality and key learnings.	Post Clearing Report	A Post-Clearing Report containing a summary of the results of pre-clearance surveys, descriptive notes taken throughout clearing activities and any fauna rescues, injuries or mortalities during clearing activities. The Post-Clearing Report will be reviewed by the Pembroke Environmental Manager. The report will include: • name and qualifications of ecologists that completed pre-clearance surveys and results; • name and qualifications of fauna spotter catcher/s present during clearing; • assessment of the habitat and handling of fauna; • information on clearing operations, dates, procedures, areas that were cleared; • number and size of hollows contained in trees removed; • live fauna sightings, captures, any releases or injured/shocked wildlife; • any damage to trees to be retained, nests or other fauna habitat features; • injury or mortality of fauna; • photographs of rescued fauna; and	Areas approved for clearing	The report will be provided every six months to the Pembroke Environment Manager.	Subcontractor responsible for overseeing pre-clearance surveys and fauna spotter-catchers. Pembroke Environment Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			• records of all fauna rescue events, including locations to where fauna have been relocated. This report will form an appendix to the Annual Report for that applicable 12 month period.			
14.	Prevent vehicle strike on MNES.	Reduce and enforce speed limits Install wildlife signage	All vehicles to maintain designated speed limit when on site of 60km/hr or lower. Speed limit signs to be installed on all project roads at 1km intervals, and at high risk locations such as roads near, or crossing, riparian zones. The enforcement of the site speed limit will be communicated in toolbox talks and site inductions. Wildlife signage to be installed at key fauna habitat areas such as the main access road into site to identify potential for wildlife to be present and crossing the road.	All Project internal roads to have reduced speed limits of 60km/hr or lower.	Signage to be installed on existing project roads or access tracks during early works. On newly constructed project roads and access tracks, signage will be installed prior to road utilisation.	Pembroke Site Manager with input from Pembroke Environmental Manager regarding high-risk locations
15.	Grazing is excluded from riparian zones (outside of construction areas).	Installation of grazing exclusion fencing	Livestock will be removed from the riparian zones which are on properties associated with Stage 1 and 2, outside of construction areas. Riparian zones include entire area within 100m from the defining bank of any watercourse and/or wetland. Riparian areas are illustrated in Figure 4.2. Those riparian sections which will be cleared and have construction occur will not be fenced as they will not provide ecological function. Cattle have already been removed from the northern watercourse shown in Figure 4.2. Watercourses have been defined using the Department of Natural Resources and Mines (DNRM) watercourse and drainage feature spatial dataset (2020), detailed at section 5.2.3. Wetlands were mapped based on Department of Environment and Science (DES) wetland environmental value mapping, detailed at section 5.2.3. Watercourses and wetlands are illustrated in Figure 4.2.	Those sections of watercourse that are outside of approved construction areas. Exclusion fencing along Isaac River is shown in Figure 4.2.	Fencing to exclude livestock from riparian areas will be installed during the first 24 months of the Project.	Pembroke Site Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			Fencing to exclude livestock will be installed along the riparian zones being at least 100m from the defining bank of watercourses and wetlands. Fences will not have barbed wire and will be wildlife friendly (except for areas that may need to be fauna exclusion fencing due to adjacent mine development). For fences that are required in areas for future development temporary fencing will be installed. This may include electric fencing as it prevents livestock from entering the area, but also native wildlife can go underneath bottom strand. Fencing specification for livestock exclusion is provided in Section 5.2.7.. The fences will be regularly checked and maintained to ensure they haven't been damaged and livestock aren't getting through. Monitoring of fences is outlined in Section 6.1.			
16.	Prevent the introduction and/or spread of weeds and/or disease within the Project area.	Hygiene protocols	All vehicles and machinery to be washed down prior to entering the site. Install wheel wash and rumble grids at site entry and egress points. Disinfectant to be placed into wash water to kill any bacteria. A designated wash bay will be established where vehicles and machinery can be cleaned on site before leaving site. The wash bay will be located away from MNES habitats and any wastewater will be captured through bunds. Bunds will also divert surface rainwater runoff entering the wash bay and becoming contaminated. No wastewater will runoff into watercourses or wetlands in the Project area, the wash bay floor will be graded to drain towards a collection point or channel. The wastewater will go to an	Applicable to all Project areas	To be implemented throughout all Project phases.	Pembroke Site Manager Pembroke Environmental Manager

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

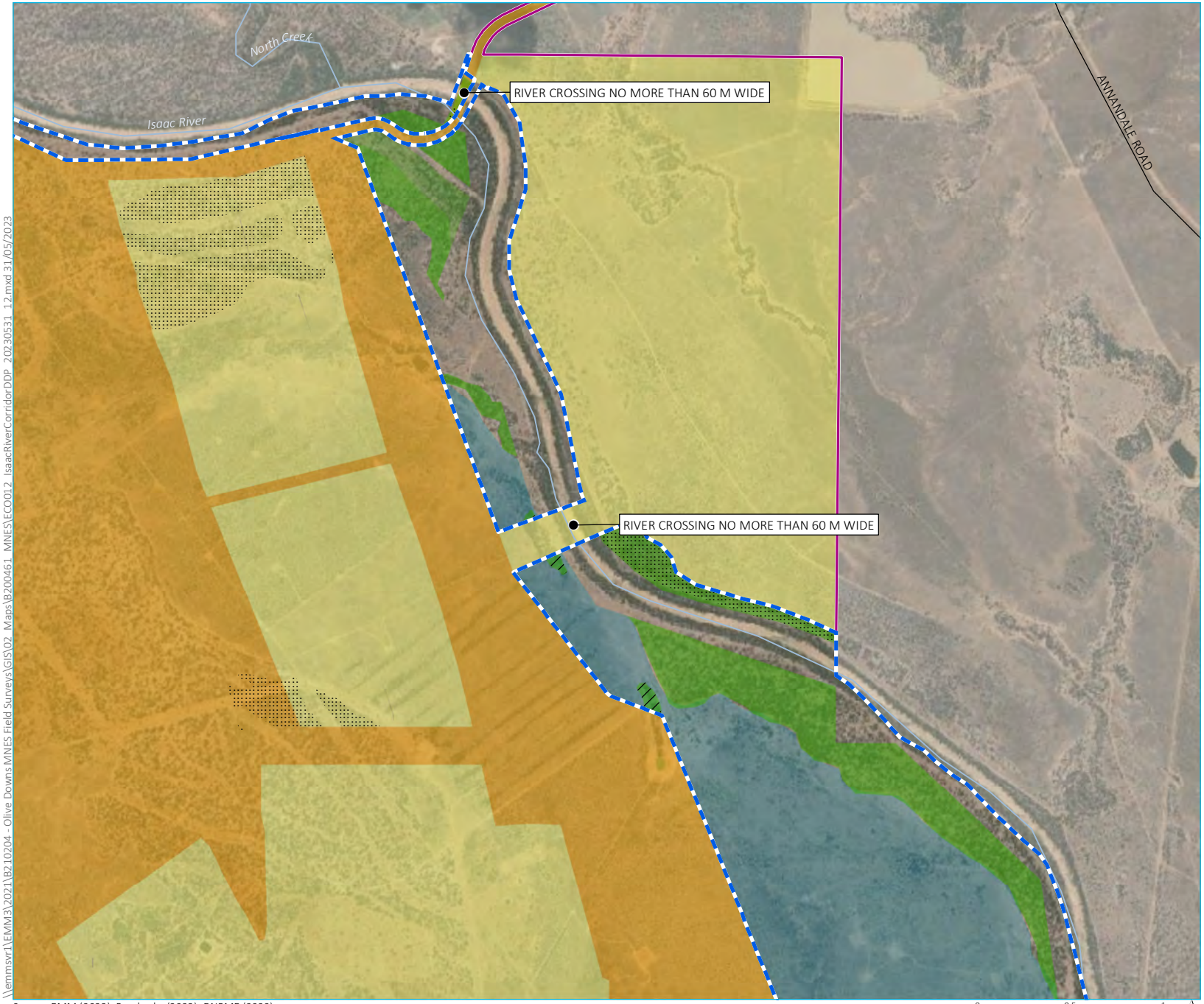
Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			enclosed holding tank to be treated, and may be reused or disposed of appropriately post-treatment. Soil and other materials brought into site (eg gravel) are to be accompanied by a weed free certification, issued by the material provider and will not be accepted without this certification. The Site Manager is to inspect and confirm certification prior to material being brought on site. The induction program will be utilised to ensure all personnel are aware of their responsibilities and are appropriately trained to wash down their vehicles, equipment and clothing to ensure weed seeds and bacteria are not spread. The induction program is summarised at criterion 9. Regular audits to be conducted to ensure vehicles and machinery have been washed down and are weed free.			
17.	Prevent soil runoff into watercourses.	Erosion and sediment control measures are implemented.	Put in place effective erosion and sediment control methods during vegetation clearing to ensure that if a rainfall event occurs sediment does not run off the site into adjacent watercourses and/or wetlands. Mitigation measures will include: • stockpiling topsoil and subsoil separately, with stockpiles having sediment fencing to prevent runoff to adjacent areas • stockpiling and mulching cleared vegetation for spreading over disturbed areas • minimising time soil is left exposed to erosion through progressive ground cover revegetation • use of sediment traps and sediment basins • use of sediment fences and sand bags to slow overland flow and catch runoff • stabilisation of any batters with jute matting or seeding with sterile grasses	In areas where vegetation clearing is occurring and soil is exposed. Particular focus in areas adjacent to watercourses and wetlands..	Install sediment and erosion control measures prior to, and during the clearing phase.	Pembroke Site Manager

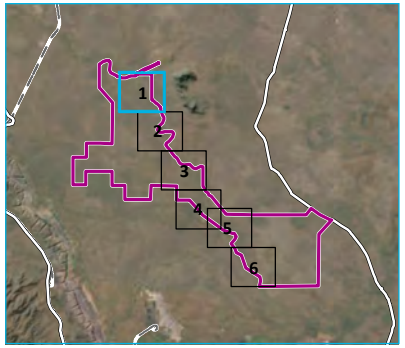
Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			• use of erosion blankets (i.e. jute matting) as an alternative to mulching in drainage lines or areas with overland flow This information will be detailed further in an Erosion & Sediment Control Plan prior to clearing commencing.			
18.	Prevent increase levels of dust.	Dust monitoring Watering of dirt tracks Reduce and enforce speed limits	Pembroke will implement proactive and reactive dust control measures. These measures would include the use of weather forecasting and real-time measurement of dust levels and meteorological conditions to modify mining operations as required in order to achieve compliance with applicable air quality objectives at the nearest privately-owned receivers. Water down dirt tracks if dust plumes are arising. Speed limits of 60km or less to be put in place and enforced.	In areas where vegetation clearing is occurring and soil is exposed.	To be implemented throughout all Project phases.	Pembroke Site Manager
Management						
19.	Maintain habitat for MNES outside of the approved disturbance limits.	Habitat quality is maintained in MNES habitats outside of approved clearing areas for Stage 1 and 2	Areas of mapped habitat for the MNES species (outside of approved disturbance limits for Stage 1 and 2) will be retained and managed for their habitat values. Management actions will occur on land owned by Pembroke which includes the Stage 1 and 2 areas. Active management will occur in these areas including weed management, feral animal management, grazing management and fire management. Management will aim to ensure these areas of habitat are retained and continue to support the species and habitat quality is not degraded over time. Further detail is provided in Section 5. Monitoring to track habitat quality is outlined in Section 6.3.	MNES habitats to be retained (outside of approved disturbance limit for Stage 1 and 2) are shown in Figure 2.3 to Figure 2.8. Management actions are limited to land owned by Pembroke.	Management activities in these retained habitats will commence in Year 2 of the Project and apply during all Project phases.	Pembroke Environmental Manager Suitably qualified and experienced personnel or contractors will be used to assist in management activities.

Table 4.1 Avoidance, mitigation and management measures for vegetation clearing phase

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
20.	No uncontrolled fire events as a result of project activities.	Maintain access tracks and fire breaks Maintain and use fire fighting equipment Manage fuel loads	The purpose of fire management will be to avoid and reduce the risks of an uncontrolled fire event occurring. In particular to avoid a hot bushfire occurring in the Project area as this has potential to result in death of MNES species, loss of habitats and Brigalow TEC. Fire management will include: • establish and maintain access tracks and fire breaks; • implement measures to minimise mining activities starting a fire and having an emergency response plan to control any unplanned fires; • fire-fighting equipment will be installed, inspected and serviced in accordance with risk assessments and relevant legislation and standards; • manage fuel loads (this may be through grazing in some areas, cool mosaic burns and slashing where exotic grassland only). Further detail is provided in Section 5.2.4; and • manage activities that could start a fire such as mulch stockpiles, machinery etc.	Access tracks and fire breaks will be established within approved disturbance areas. Areas outside of approved disturbance areas existing access tracks and fence boundaries will be maintained on land owned by Pembroke.	Access tracks and fire breaks to be installed during vegetation clearing phase. Access tracks and fire breaks to be maintained during all phases.	Pembroke Site Manager





KEY

- Project area
- Project stage 1
- Project stages 2 to 4
- River crossing location
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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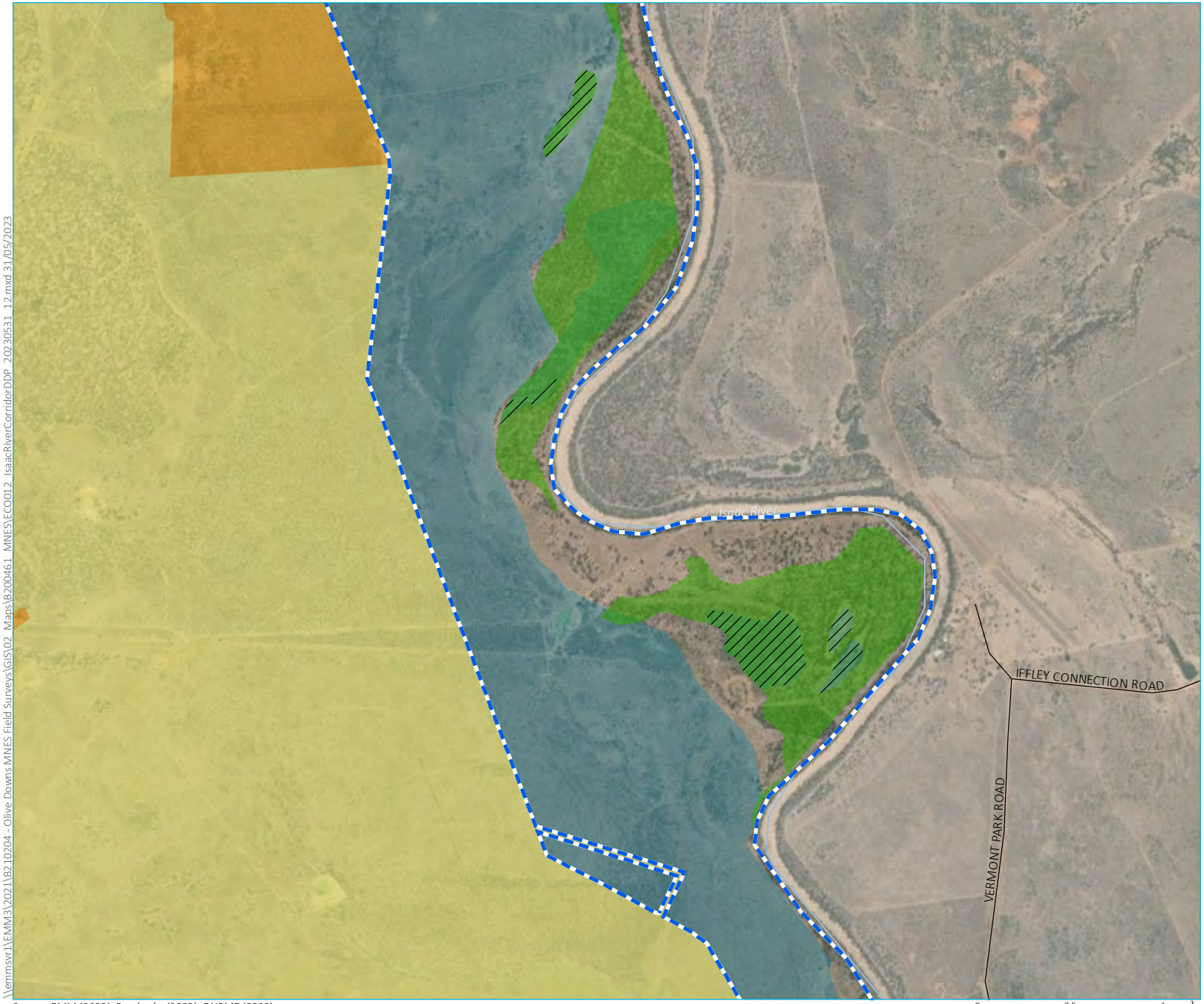
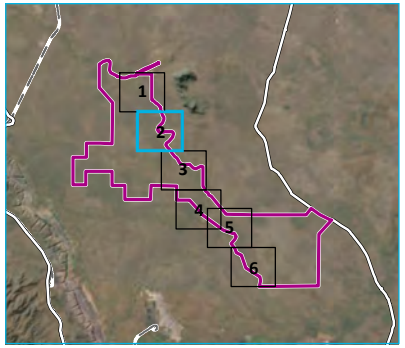
Isaac River corridor to be retained
map 1 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities





KEY

- Project area
- Project stage 1
- Project stages 2 to 4
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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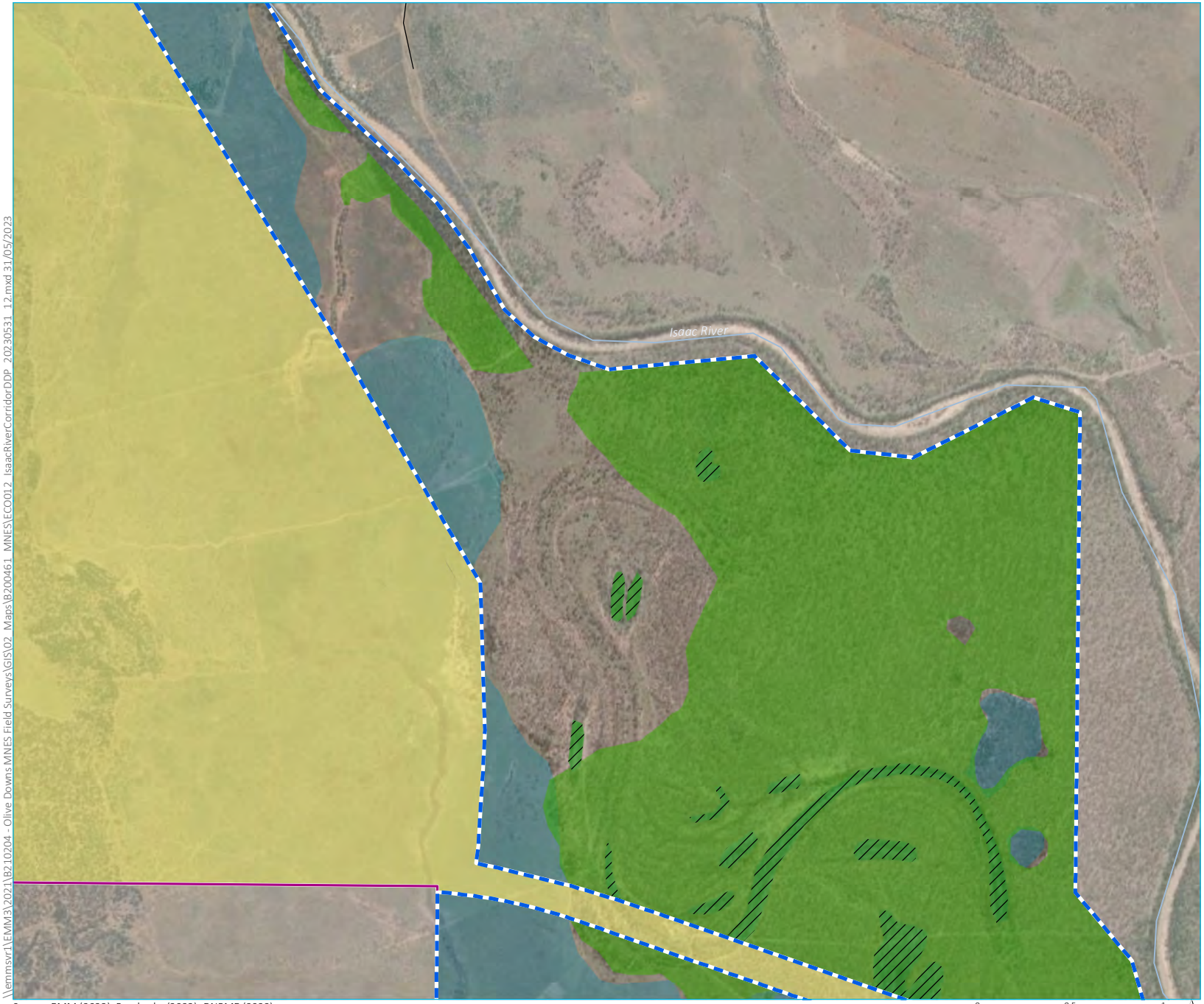
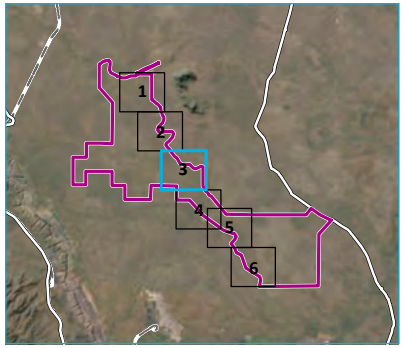
Isaac River corridor to be retained
map 2 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities





KEY

- Project area
- Project stages 2 to 4
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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Isaac River corridor to be retained
map 3 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities

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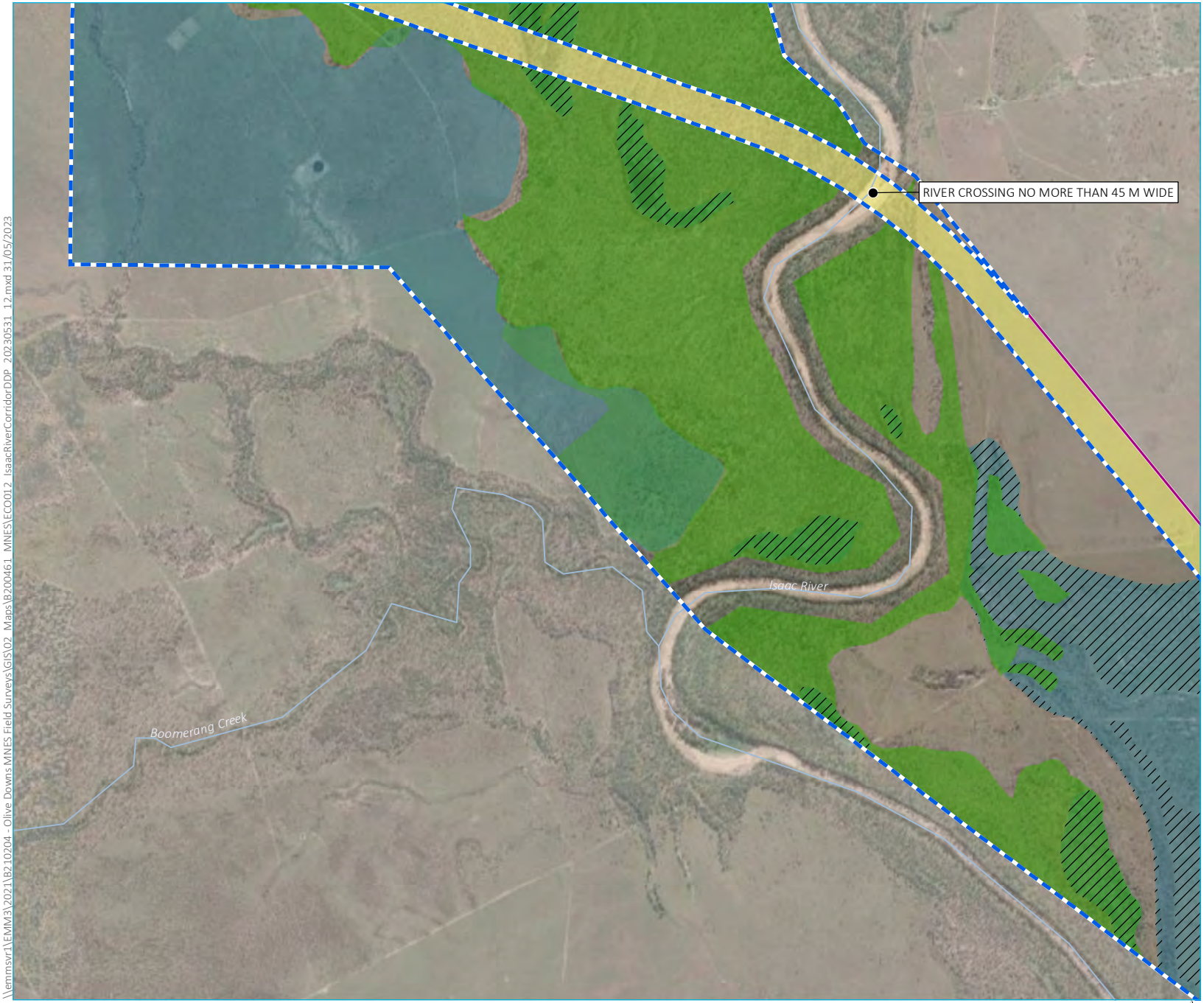

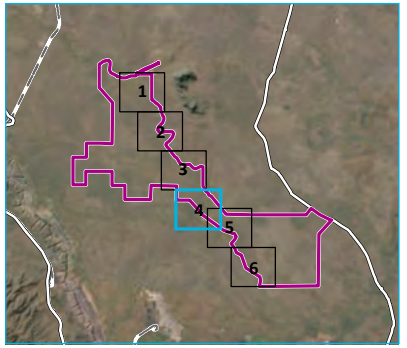

KEY

- Project area
- Project stages 2 to 4
- River crossing location
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

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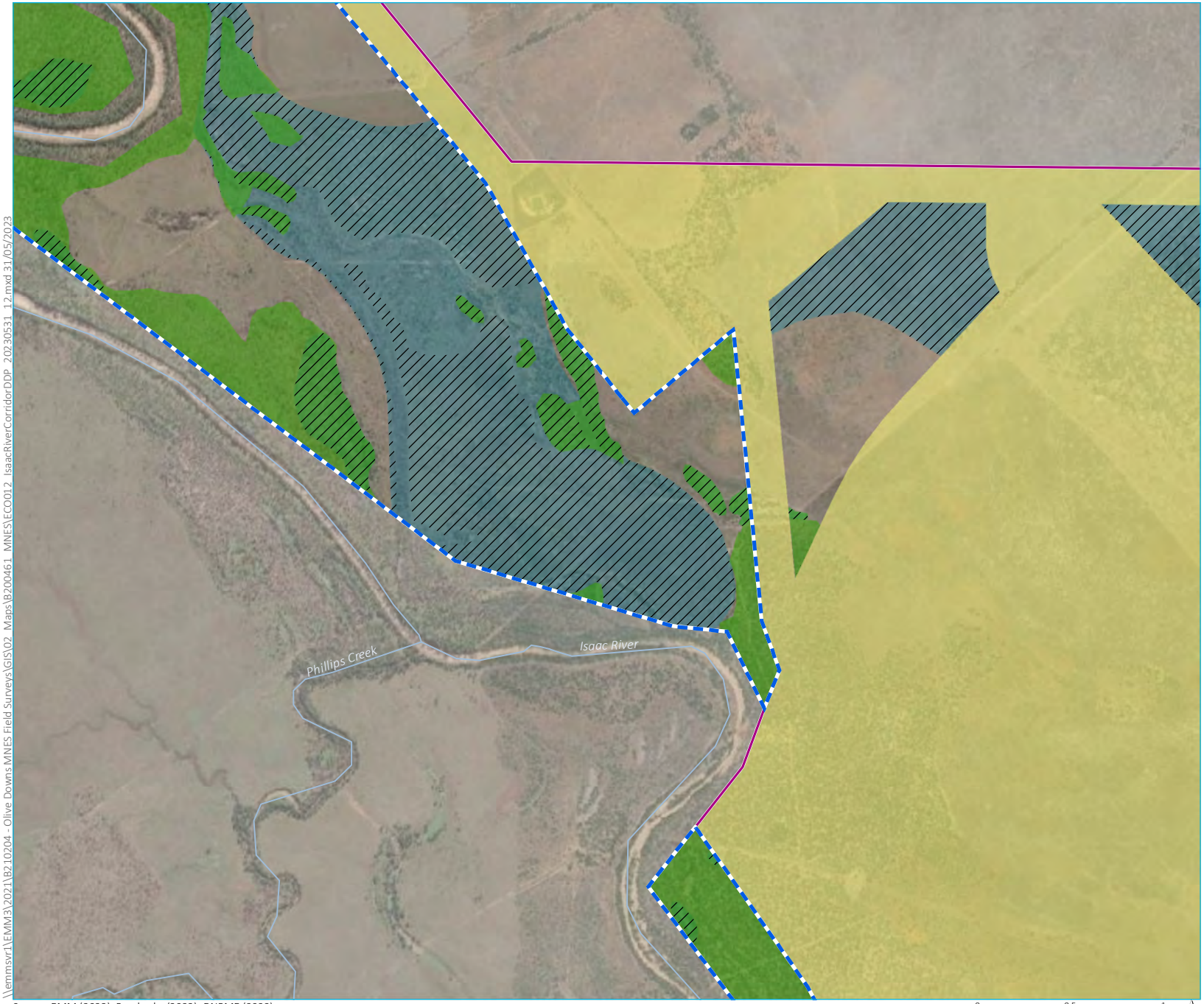
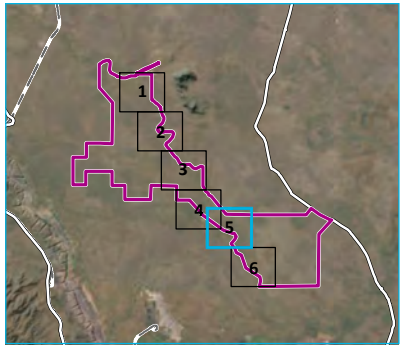
Isaac River corridor to be retained
map 4 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities





KEY

- Project area
- Project stages 2 to 4
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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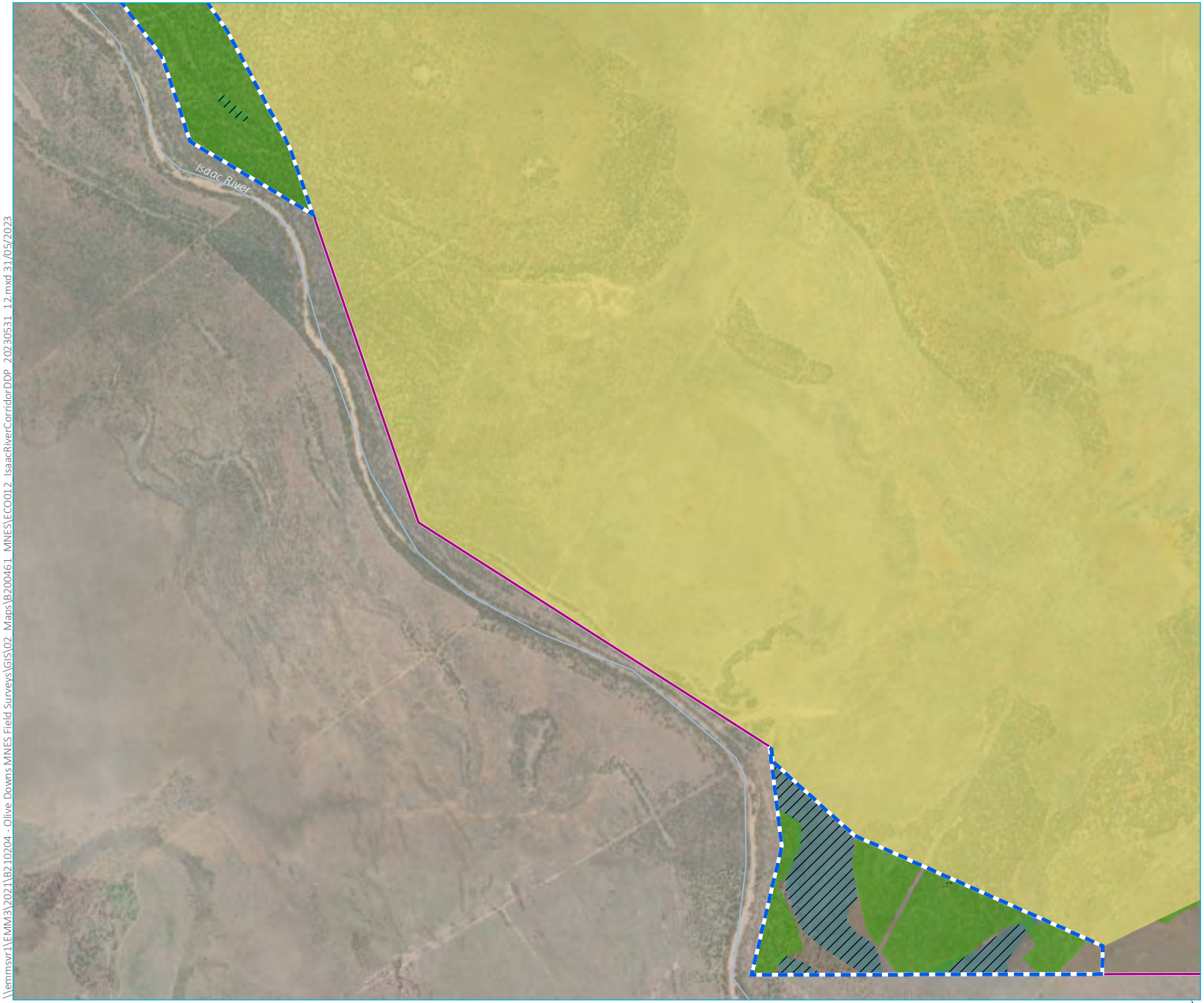
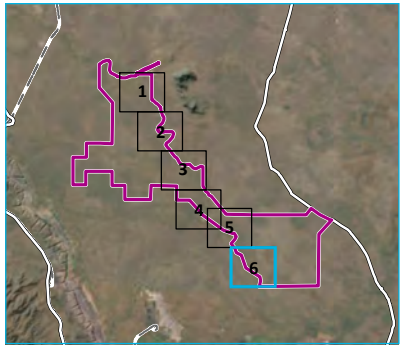
Isaac River corridor to be retained
map 5 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities





KEY

- Project area
- Project stages 2 to 4
- Rail line
- Major road
- Minor road
- Named watercourse
- Isaac River corridor

Threatened species habitat (in corridor)

- Greater Glider/Koala habitat
- Oramental Snake habitat
- Australian Painted Snipe habitat
- Squatter Pigeon habitat

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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Isaac River corridor to be retained
map 6 of 6

Olive Downs
MNES Management Plan
Figure 4.1

EMM
creating opportunities

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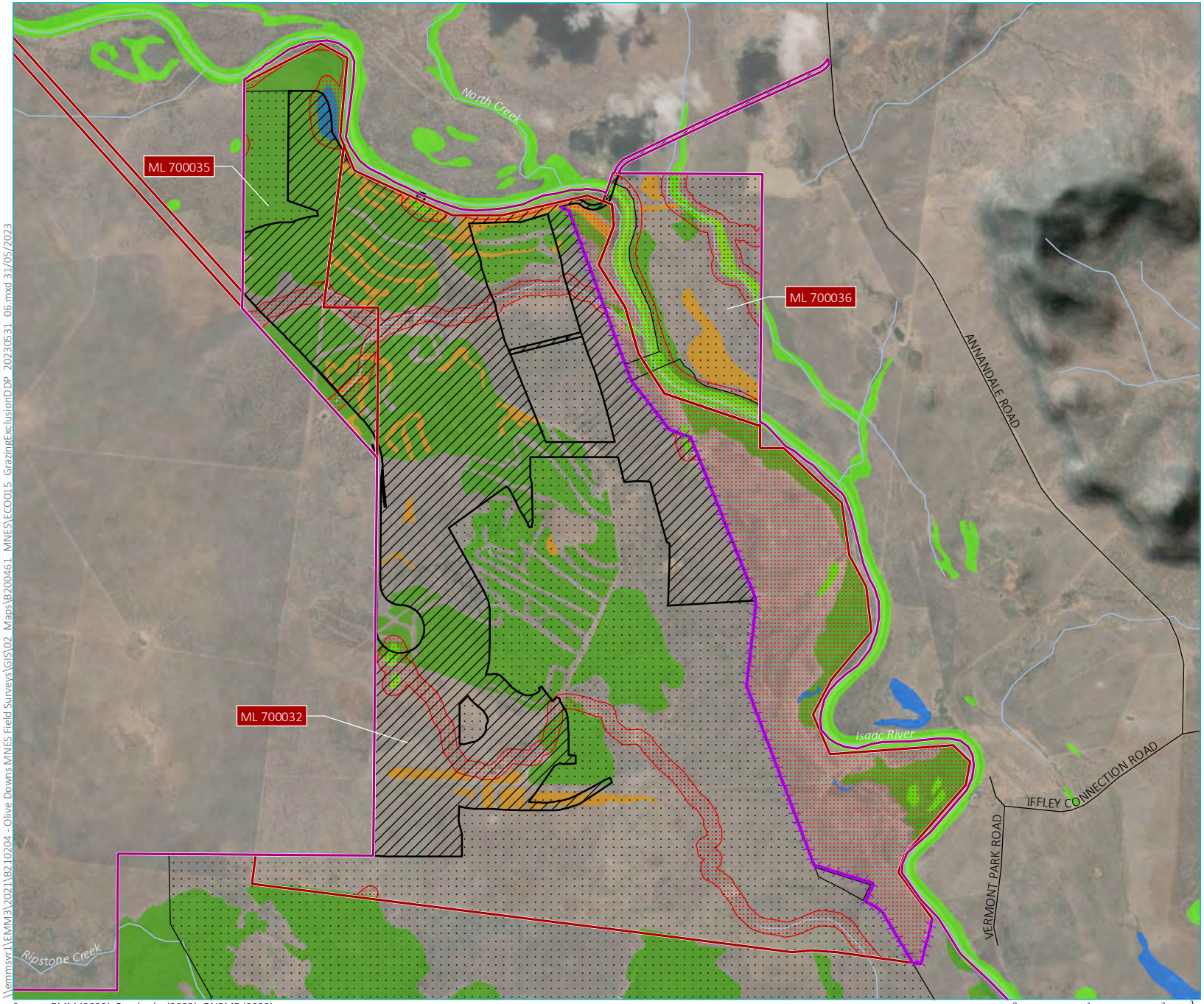

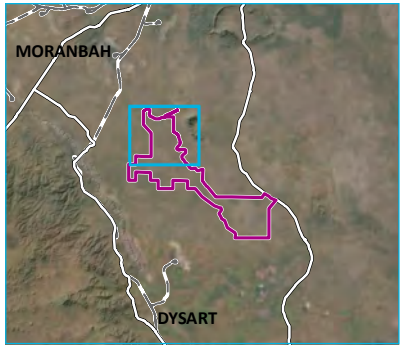

KEY

- Livestock exclusion fencing
- Grazing exclusion area
- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Watercourse/drainage line
- Remnant vegetation
- Regrowth vegetation

Wetland environmental values

- GBR wetland of high ecological significance
- Wetland of general ecological significance

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 1 2 km

GDA 1994 MGA Zone 55

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Grazing exclusion areas

Olive Downs
MNES Management Plan
Figure 4.2

EMM
creating opportunities

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4.3.2 Construction Phase

Table 4.2 Avoidance, mitigation and management measures during construction

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
Avoidance						
1.	Avoid and minimise Koala injuries and mortality during construction phase.	Install and maintain Koala exclusion fencing	Koala exclusion fencing is to be installed in key locations to keep individuals outside of active mine areas, avoid and minimise Koala injuries including from vehicles, and maintain their connectivity along Isaac River and to habitats in south. Koala exclusion fencing has been identified for Stage 1 and 2 as shown in Figure 4.3. . Koala exclusion fencing specification is provided in Section 5.2.9 .	Stage 1 koala exclusion fencing is shown in Figure 4.3.	Post vegetation clearing occurring in the area. Koala exclusion fencing will be installed progressively over Stage 1 and 2. Prior to main construction activities and threats occurring.	Pembroke Site Manager Overseen by Pembroke Environmental Manager
2.	Maintain Greater Glider connectivity.	Install and maintain rope ladder crossings	Installation of rope ladder crossings will occur at permitted cleared corridors in riparian zones of Isaac River. Two rope crossings will be installed as part of Stage 1. The purpose is to maintain Greater Glider habitat connectivity at these locations. Further detail regarding Greater Glider rope crossings is provided in Section 5.2.10.	The indicative locations for rope ladder crossings for Stage 1 are shown in Figure 4.4.	Post vegetation clearing occurring in the area including clearing for the riparian corridor. Prior to main construction activities occurring.	Pembroke Environmental Manager Suitably qualified and experienced ecologists to install
3.	Maintain Koala connectivity.	Install bridge crossing that includes Koala furniture	The bridge crossing over Isaac River in Stage 1 will allow Koala movement under the bridge along riparian banks. Bridge design is further described in Section 5.2.12. Exclusion fencing up to the bridge crossing will be installed to ensure Koalas cannot go onto the bridge or access road. Install Koala furniture under the bridge to help facilitate movement if there has been rainfall and water in river.	Approved river crossing for Stage 1 and bridge location is illustrated in Figure 4.4..	During construction	Pembroke Site Manager Overseen by Pembroke Environmental Manager

Table 4.2 Avoidance, mitigation and management measures during construction

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
4.	Prevent dog attacks to native fauna.	No domestic dogs on site Wild dogs will be controlled	Site personnel will not be permitted to bring domestic dogs into the Project area. Wild dog control measures will be implemented in the Stage 1 and 2 area and surrounding land owned by Pembroke to reduce population numbers. Further information on pest animal control is detailed in Section 5.2.2.	Stage 1 and 2 areas and surrounding lands in ML700036, ML700032 and ML700035.	During construction	Pembroke Site Manager
Mitigation						
5.	Reduce potential impacts to fauna as a result of open trenches.	Monitor open trenches Minimise time trenches are open	Trenches will be inspected and monitored. This includes checking within two hours of sunrise and trapped fauna released. Additional monitoring will be undertaken following rainfall events. Fauna exit points including fauna ramps will be incorporated when construction is within 1 km of native vegetation, using appropriate material. Fauna refuges, such as sawdust-filled bags, will be provided regularly. The time a trench is left open will be minimised. As soon as practical following construction, the trench will be backfilled with excavated material, compacted and topsoil replaced and erosion controls implemented.	Where trenches go through mapped MNES habitats or are within 1km of mapped MNES habitats.	During construction	Pembroke Site Manager
6.	Prevent vehicle strike on MNES.	Reduce and enforce speed limits Install wildlife signage	Refer Criterion 14 in Table 4.1.	All Project internal roads to have reduced speed limits.	Signage to be installed prior to clearing commencing.	Pembroke Environmental Manager

Table 4.2 Avoidance, mitigation and management measures during construction

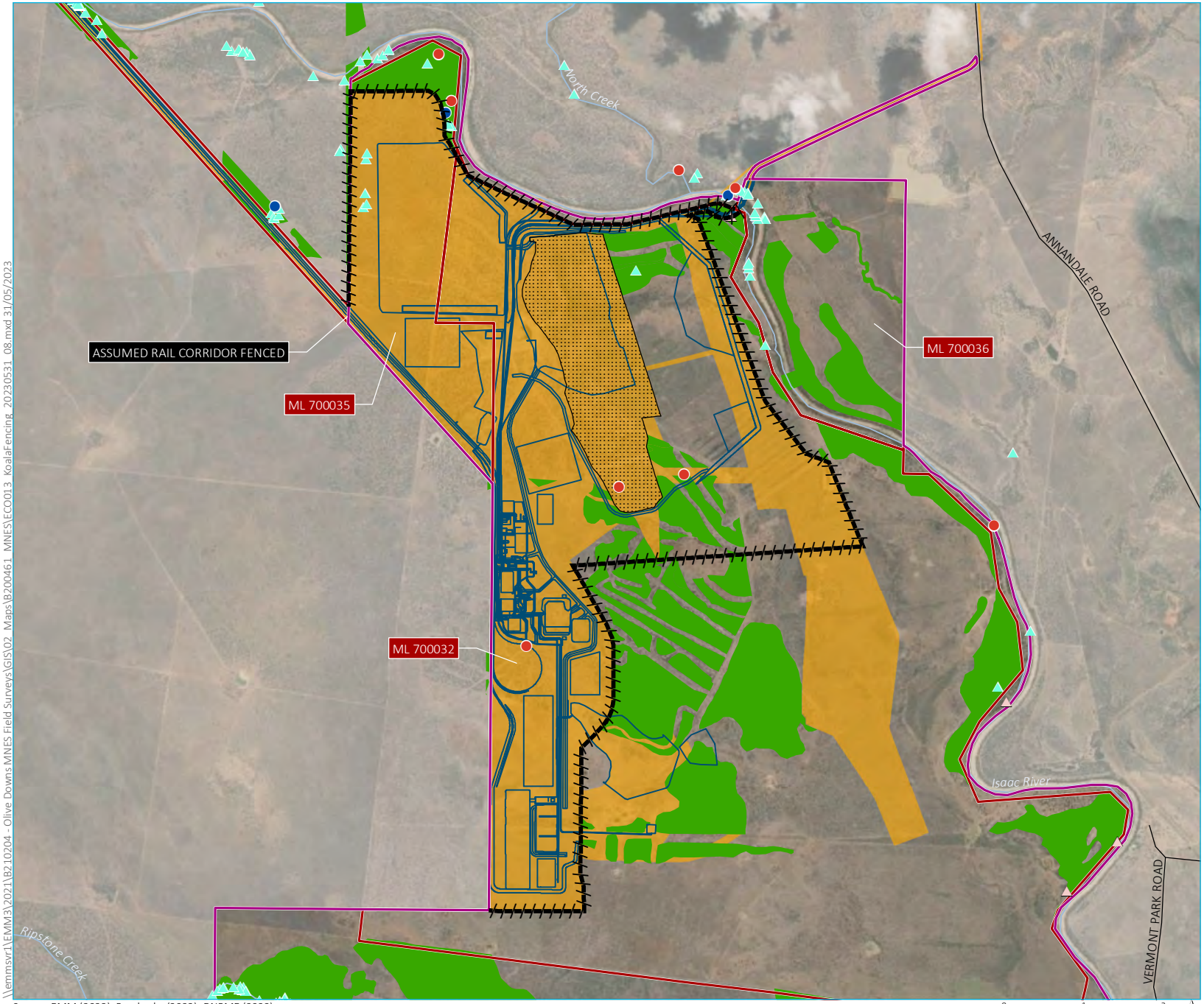
Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
7.	Removal and exclusion of grazing from riparian zones	Grazing is excluded from riparian zones on land associated with Stage 1 and 2 (outside of construction areas). Wildlife friendly fencing is used	Refer to Criterion 15. in Table 4.1.	Refer Criterion 15. In Table 4.1.	Fencing to exclude livestock from riparian zones (outside of construction areas) will be installed during the first 24 months of the Project.	Pembroke Site Manager
8.	Prevent the introduction and/or spread of weeds and/or disease within the Project area.	Hygiene protocols	Refer to Criterion 16. in Table 4.1.	Refer to Criterion 16. In Table 4.1.	To be implemented in all Project phases.	Pembroke Site Manager Pembroke Environmental Manager
9.	Prevent soil runoff into watercourses.	Erosion and sediment control measures are implemented.	Refer to Criterion 17 in Table 4.1	In areas where construction is occurring and soil is exposed. Particular focus in areas adjacent to watercourses and wetlands..	Install sediment and erosion control measures prior to, and during the clearing phase.	Pembroke Environmental Manager
10.	Reduce light spill into adjacent habitat.	Direct lighting away from MNES habitats	Lighting in areas directly adjacent to retained MNES habitats will be reduced where practicable. Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and lighting will be directed towards the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat. Lighting at night will be minimised during construction. The use of low wattage lighting with list spill guards	In areas where project infrastructure requires lighting, particularly around buildings.	During construction phase	Pembroke Site Manager

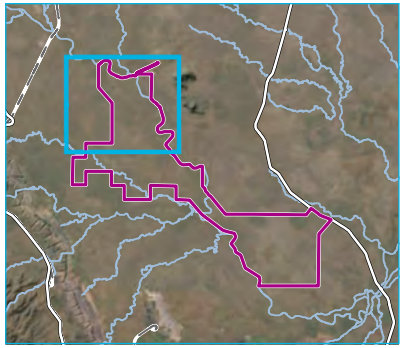
Table 4.2 Avoidance, mitigation and management measures during construction

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
11.	Ensure all site personnel are trained and aware of MNES.	Delivery of the Olive Downs induction program	Refer Criterion 10. in Table 4.1	Training will occur in the office and on-site during toolbox talks.	Inductions will be required to be completed prior to works commencing on site. Training and education should occur on a regular basis during construction phase.	Pembroke Site Manager
12.	Ensure safe handling of MNES.	Fauna handling to be undertaken in accordance with Appendix B	If Koala, Greater Glider or Ornamental Snake are encountered within the construction area, workers can refer to the Fauna Handling and Rescue Strategy to minimise the risk of harming the fauna. Refer Appendix B.	Applicable to all Project areas	During construction, operation and decommissioning phases.	Pembroke Environmental Manager Suitably qualified and experienced contractors will be used to assist
Management						
13.	Ensure no reduction in habitat quality within adjacent areas will occur as a result of the project.	Habitat quality is maintained in MNES habitats outside of approved clearing areas for Stage 1 and 2	Refer to Criterion 19 in Table 4.1.	MNES habitats to be retained (outside of approved disturbance limit for Stage 1 and 2) are shown in Figure 2.3 to Figure 2.8. Management actions are limited to land owned by Pembroke.	Management activities will commence in Year 2 of the Project and apply during all Project phases.	Pembroke Environmental Manager Suitably qualified and experienced personnel or contractors will be used to assist in management activities.

Table 4.2 Avoidance, mitigation and management measures during construction

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
14.	Prevent uncontrolled fire events.	Maintain access tracks and fire breaks Maintain and use fire fighting equipment Manage fuel loads	• Refer to Criterion 20 in Table 4.1	Access tracks and fire breaks will be established within approved disturbance areas. Areas outside of approved disturbance areas existing access tracks and fence boundaries will be maintained on land owned by Pembroke	Access tracks and fire breaks to be installed during vegetation clearing phase. Access tracks and fire breaks to be maintained during all phases.	Pembroke Site Manager





KEY

- Proposed Koala exclusion fencing
- Project area
- Mining lease boundary (containing stage 1)
- Project stage 1
- Mine pit 1
- Mine site layout
- Rail line
- Major road
- Minor road
- Named watercourse
- Koala habitat (outside stage 1)

Koala records (EMM)

- Observed
- Indirect evidence

Koala records (ALA/BMA/DMP Enviroscience)

- Observed
- Indirect evidence

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 1 2 km

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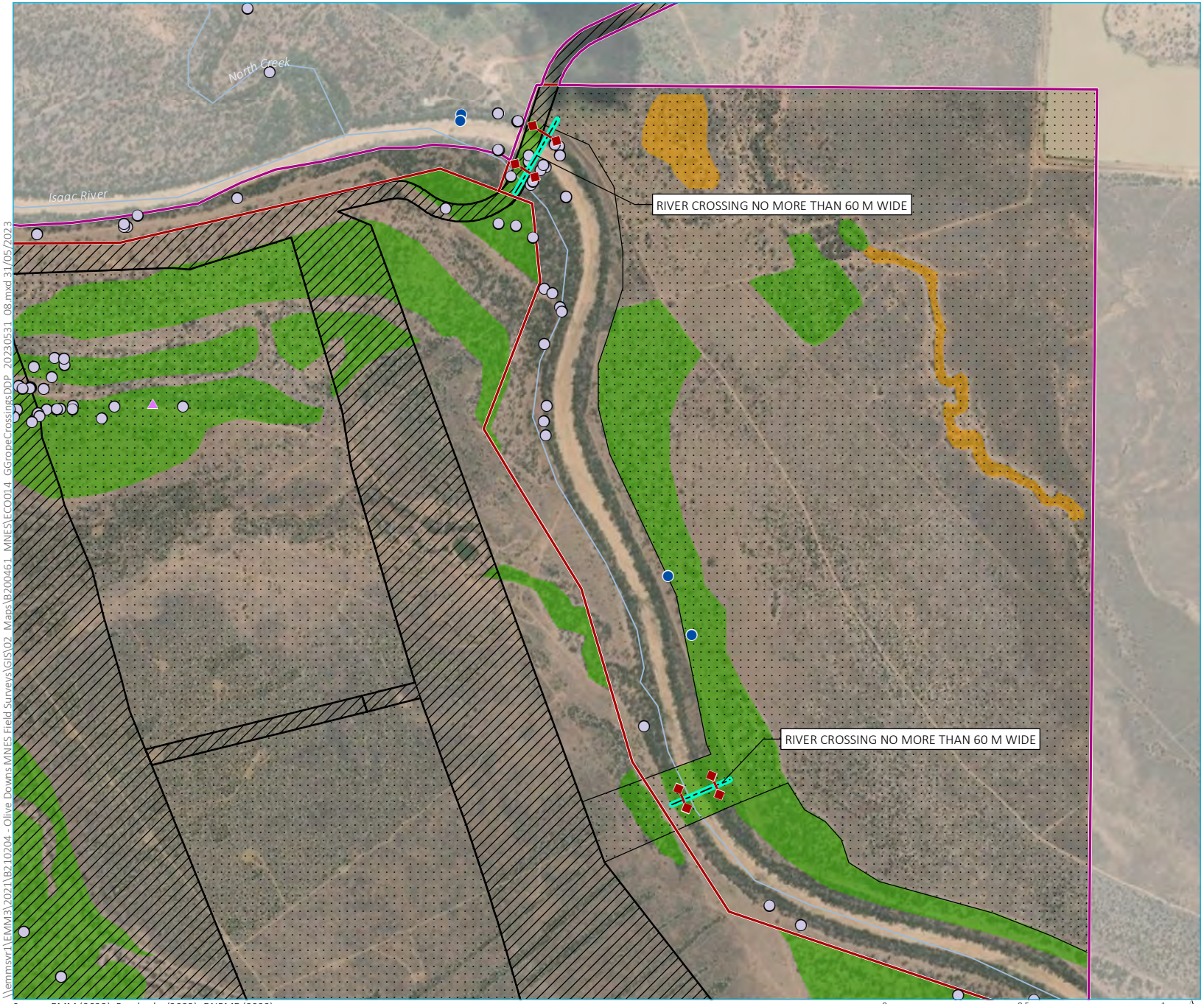
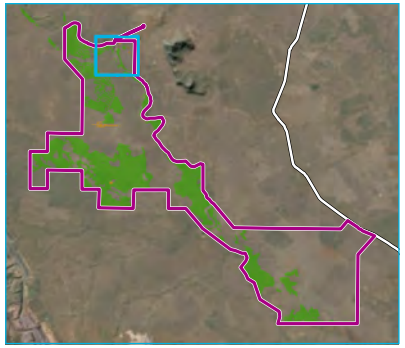
Proposed Koala exclusion fencing

Olive Downs
MNES Management Plan
Figure 4.3

EMM
creating opportunities





KEY

- Proposed rope ladder crossing location
- Indicative Isaac River access road crossing
- Project area
- Mining lease boundary (containing stage 1)
- Stage 1 impact footprint
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Greater Glider records (ALA/BMA/DMP Envirosciences)

- Observed
- Indirect evidence

Greater Glider records (EMM)

- Observed

Greater Glider habitat

- Remnant
- Regrowth

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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Proposed Greater Glider rope ladder crossings map 1 of 2

Olive Downs
MNES Management Plan
Figure 4.4

EMM creating opportunities

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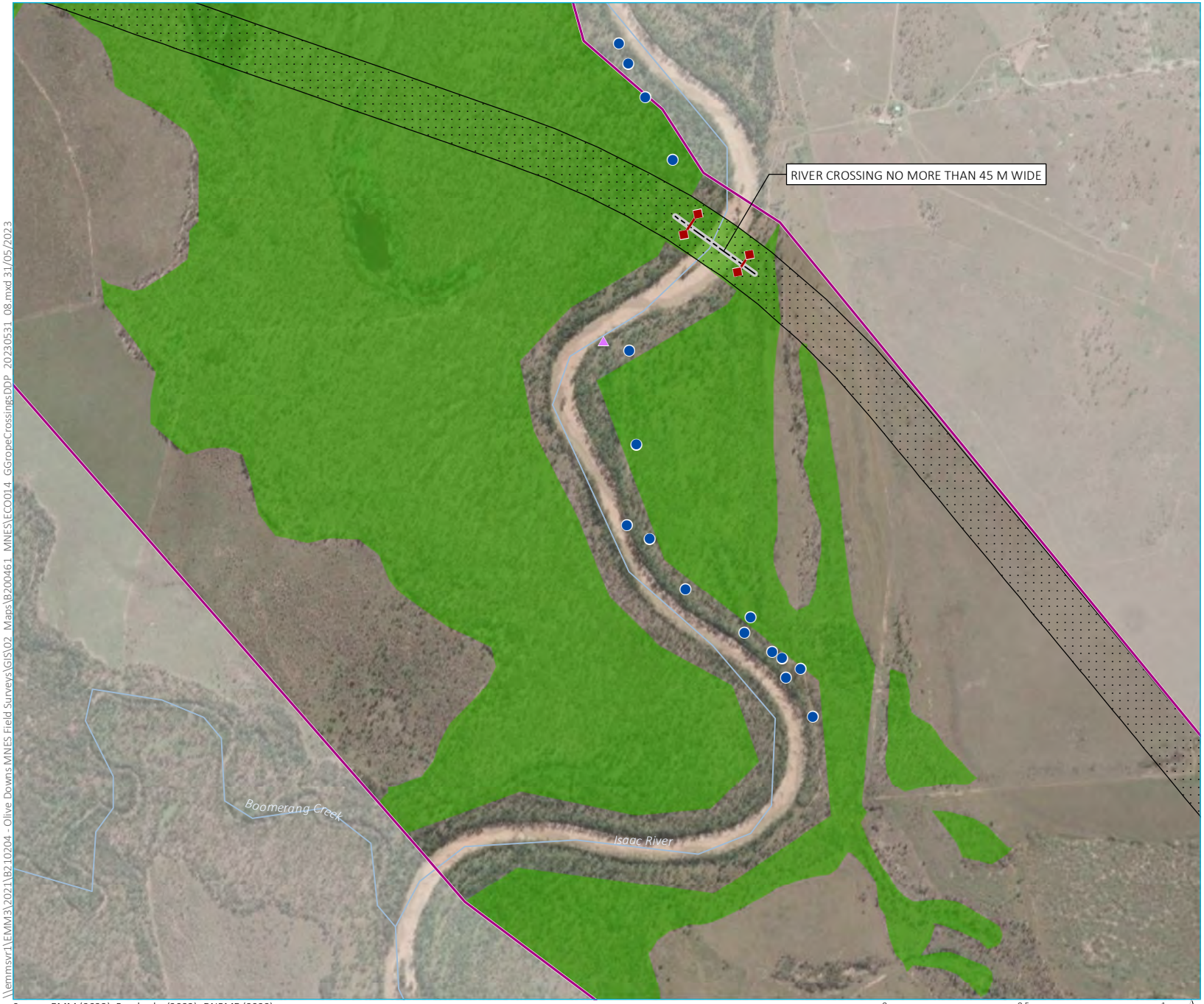

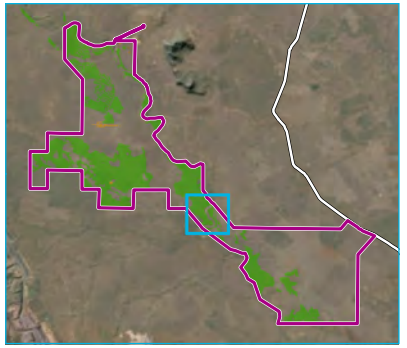

KEY

- Proposed rope ladder crossing location
- Indicative Isaac River crossing for conveyor belt
- Project area
- Remaining impact footprint
- Rail line
- Major road
- Minor road
- Named watercourse

Greater Glider records (ALA/BMA/DMP Enviroscienses)

- Observed
- Indirect evidence

Greater Glider records (EMM)

- Observed

Greater Glider habitat

- Remnant
- Regrowth

Source: EMM (2023); Pembroke (2023); DNRME (2022)

0 0.5 1 km

GDA 1994 MGA Zone 55

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Proposed Greater Glider rope ladder crossings map 2 of 2

Olive Downs
MNES Management Plan
Figure 4.4

EMM creating opportunities

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4.3.3 Operational and Decommissioning Phases

Table 4.3 Avoidance, mitigation and management measures during operations and decommissioning

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
Mitigation						
1.	Maintain Koala and Greater Glider connectivity.	Maintain Koala exclusion fencing and escape poles Maintain glider rope crossings	Koala exclusion fencing, escape poles and furniture will be maintained. Greater Glider rope crossings will be maintained. Further detail regarding maintenance is provided in Section 6.1 and 6.2.	Locations for Koala exclusion fencing and indicative rope crossings for Stage 1 and 2 are illustrated in Figure 4.3 and Figure 4.4.	Maintenance checks twice per year.	Pembroke Environmental Manager
2.	Prevent dog attacks to native fauna.	No domestic dogs on site Wild dogs will be controlled	Refer to Criterion 4 in Table 4.2.	Stage 1 and 2 areas and surrounding lands in ML700036, ML700032 and ML700035.	During construction and operation	Pembroke Site Manager
3.	Prevent vehicle strike on MNES.	Reduce and enforce speed limits Install wildlife signage	Refer Criterion 14 in Table 4.1.	All Project internal roads to have reduced speed limits.	Signage to be maintained. Refer Section 6.1	Pembroke Environmental Manager
4.	Removal and exclusion of grazing from riparian zones	Grazing is excluded from riparian zones on land associated with Stage 1 and 2 (outside of construction areas). Wildlife friendly fencing is used	Refer to Criterion 15. in Table 4.1.	Refer Criterion 15. In Table 4.1.	Fencing to be maintained. Refer Section 6.1.	Pembroke Site Manager
5.	Prevent the introduction and/or spread of weeds and/or disease within the Project area.	Hygiene protocols	Refer to Criterion 16. in Table 4.1.	Refer to Criterion 16 in Table 4.1.	To be implemented in all Project phases.	Pembroke Site Manager Pembroke Environmental Manager

Table 4.3 Avoidance, mitigation and management measures during operations and decommissioning

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
6.	Prevent soil runoff into watercourses.	Erosion and sediment control measures are implemented.	Refer to Criterion 17 in Table 4.1	In areas where works are occurring and soil is exposed. Particular focus in areas adjacent to watercourses and wetlands.	Implement measures during operation and decomissioning as required	Pembroke Environmental Manager
7.	Reduce light spill into adjacent habitat.	Direct lighting away from MNES habitats	Lighting in areas directly adjacent to retained MNES habitats will be reduced where practicable. Lighting will be designed in a manner that limits disruption on landscape character, views and visual amenity and lighting will be directed towards the infrastructure siting rather than dispersed into native vegetation when sites are adjacent to intact habitat. Lighting at night will be minimised during construction. The use of low wattage lighting with list spill guards	In areas where project infrastructure requires lighting, particularly around buildings.	During operational phase	Pembroke Site Manager
8.	Ensure all site personnel are trained and aware of MNES.	Delivery of the Olive Downs induction program	Refer Criterion 10 in Table 4.1	Training will occur in the office and on-site during toolbox talks.	Inductions will be required to be completed prior to works commencing on site. Training and education should occur on a regular basis during operation and decomissioning phase.	Pembroke Site Manager
9.	Ensure safe handling of MNES.	Fauna handling to be undertaken in accordance with Appendix B	If Koala, Greater Glider or Ornamental Snake are encountered within the construction area, workers can refer to the Fauna Handling and Rescue Strategy to minimise the risk of harming the fauna. Refer Appendix B.	Applicable to all Project areas	During construction, operation and decommissioning phases.	Pembroke Environmental Manager Suitably qualified and experienced contractors will be used to assist.
Management						
10.	Ensure no reduction in habitat quality within	Habitat quality is maintained in MNES	Refer to Criterion 19 in Table 4.1.	MNES habitats to be retained (outside of approved	Management activities will commence in Year 2	Pembroke Environmental Manager

Table 4.3 Avoidance, mitigation and management measures during operations and decommissioning

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
	adjacent areas will occur as a result of the project.	habitats outside of approved clearing areas for Stage 1 and 2		disturbance limit for Stage 1 and 2) are shown in Figure 2.3 to Figure 2.8. Management actions are limited to land owned by Pembroke.	of the Project and apply during all Project phases.	Suitably qualified and experienced contractors will be used to assist in management activities.
11.	Minimise residual impacts to MNES through progressive rehabilitation post mining.	Progressive rehabilitation	Rehabilitation will be implemented as soon as practicable following construction and decommissioning activities. Rehabilitation activities will include: • Waste rock emplacement final landforms are geotechnically stable and safe • Self-sustaining vegetative cover is established outside of voids • Establish self-sustaining areas of woodland • Establish grazing land where area is safe for cattle access and pasture cover occurs to stabilise soil Rehabilitation for post-mining land use will consist of areas with native vegetation (woodlands), areas of grazing land and final voids that will provide fauna habitat values. The agriculture (low intensity cattle grazing) post-mining land use areas would comprise a combination of native and improved pasture species. Remnant native vegetation in the Project area largely comprises woodland ecosystems adapted to alluvial and sand plains. Regional Ecosystems (RE) 11.5.3 (Poplar Box [Eucalyptus populnea] +/- Silverleaved Ironbark [E. melanophloia] +/- Clarkson's Bloodwood [Corymbia clarksoniana] woodland on Cainozoic sand plains and / or remnant surfaces) and RE 11.3.2 (Poplar box [Eucalyptus populnea] woodland on alluvial plains). Changes in the landform and substrate characteristics post-mining mean that RE 11.5.3 and RE 11.3.2 are not	In areas where open cut mining has been completed, or infrastructure is no longer required.	Rehabilitation timeframes will be compliant with applicable Environmental Authority and approved Project Rehabilitation Management Plan. Rehabilitation will occur progressively from the operational phase through to decommissioning phase.	Pembroke Site Manager

Table 4.3 Avoidance, mitigation and management measures during operations and decommissioning

Criteria No.	Performance criteria	Measure	Method	Where	Timing	Responsible party
			able to be recreated. However, framework species from these RE's (Poplar Box, Silver-leaved Ironbark and Clarkson's Bloodwood) and from RE's occurring on analogous elevated landforms in the region would be established in the woodland post-mining land use area. Residual voids will be isolated from the Isaac River. The final voids would comprise of low wall, highwall and a void water body landform components. Pembroke has investigated the likelihood that the final void would provide suitable native fauna habitat and is detailed in Table 4-2, Section 4 of Additional Information to the EIS (Pembroke 2019). The final voids would provide suitable habitat for a range of native fauna, including species recorded within the Project site by DPM Envirosciences (2018) such as the Strip-faced Dunnart (Sminthopsis macroura), Hoary Wattled Bat (Chalinolobus nigrogriseus) and Australian Grey Teal (Anas gracilis). Further detail on rehabilitation commitments are outlined in Section 4 Rehabilitation of the Olive Downs Coking Coal Project – Additional information to the EIS (Pembroke 2019) and Appendix D of the EIS. A Rehabilitation Plan is being finalised as part of the Project's Rehabilitation and Closure Plan (PCRP) for DES. The PCRP will be finalised prior to completion of Stage 1..			

5 MNES outcomes

Further detail on the environmental outcomes to be achieved through implementation of this MMP, and specific management measures are discussed in sections below. This information supports the avoidance, mitigation and management measures outlined in Section 4.

5.1 Environmental outcomes

The overarching environmental outcomes sought to be achieved through implementation of the MMP are:

- avoid and minimise injuries or mortality of MNES species during all Project phases, in particular the vegetation clearing phase;
- disturbance does not occur to MNES habitats and Brigalow TEC outside of approved Project stages;
- MNES habitat areas outside of approved Project stages will be managed to maintain habitat quality and utilisation by MNES on land as part of Stage 1 owned by Pembroke; and
- connectivity is maintained for Greater Glider and Koala. Connectivity structures are installed in proximity to habitats including along riparian corridors of Isaac River. Connectivity structures to be installed include:
    a. Greater Glider rope crossings;
    b. Koala exclusion fencing in combination with Koala poles; and
    c. Bridge crossing of Isaac River facilitating Koala movement underneath the bridge including use of Koala furniture.

Table 5.1 Specific MNES environmental outcomes

MNES	Outcomes
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)	Specific environmental outcomes for Koala are: • No more than 1,505.16 ha of Koala habitat will be cleared (for Stage 1 and 2); • Avoid and minimise injury and mortality to Koalas across the Project area through the use of best management practices; • Gain specific knowledge on Koala populations in Stage 1 area and effectiveness of clearing practices and protocols; • Maintain connectivity for Koalas through use of Koala exclusion fencing and Koala poles; • Maintain Koala habitats outside of disturbance footprints on land containing Stage 1 and 2 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas has occurred at end of Stage 1; • Ensure these Koala habitats outside approved clearing areas are available for the species to utilise during Stage 1 and Stage 2; and • Avoid and minimise hot bushfires occurring in retained Koala habitat.

Table 5.1 Specific MNES environmental outcomes

MNES	Outcomes
Greater Glider (*Petauroides volans*)	Specific outcomes for Greater Glider are: • No more than 1,285.35 ha of Greater Glider habitat will be cleared (for Stage 1 and 2); • Avoid and minimise injury and mortality to Greater Glider across the Project area through the use of best management practices; • Gain specific knowledge on Greater Glider populations in Stage 1 area and effectiveness of clearing practices and protocols; • Supplement Greater Glider denning habitat through installation of artificial tree hollows; • Gain specific knowledge on Greater Glider use of nest boxes and natural tree hollows that have been installed; • Maintain connectivity for Greater Glider through use of glider rope crossings; • Maintain Greater Glider habitats outside of disturbance footprints, on land containing Stage 1 and 2 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas as a result of the Project • Ensure that these habitats are available for the species to utilise during Stage 1 and 2; and • Avoid and minimise hot bushfires occurring in retained Greater Glider habitat.
Squatter Pigeon (Southern) (*Geophaps scripta scripta*)	Specific outcomes for Squatter pigeon are: • No more than 1,073.18 ha of Squatter Pigeon breeding habitat and 203.5 ha of Squatter Pigeon foraging habitat will be cleared (for Stage 1 and 2); • Avoid and minimise injury and mortality to Squatter Pigeon across the Project area through sequential clearing, reducing vehicle speed and reducing pest animal populations that are a direct threat to species; • Maintain Squatter Pigeon habitats outside of disturbance footprints, on land containing Stage 1 and 2 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas as a result of the Project and ensure that these habitats are available for the species to utilise; • Maintain local water supply/availability and water quality to ensure breeding habitat is not reduced; • Manage weed cover to maintain Squatter Pigeon habitat quality.
Ornamental Snake (*Denisonia maculata*)	Specific outcomes for Ornamental Snake are: • No more than 1,341.64 ha of Ornamental Snake habitat will be cleared (for Stage 1 and 2); • Avoid and minimise injury and mortality to Ornamental Snake across the Project area through pre-clearance surveys, sequential clearing, reducing vehicle speed and reducing pest animal populations that are a direct threat to species; • Maintain Ornamental Snake habitats outside of disturbance footprints, on land containing Stage 1 and 2 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas as a result of the Project and ensure these habitats are available for the species to utilise ; and • Exclude grazing from riparian zones and wetlands (outside of construction areas) and manage weed cover to maintain Ornamental Snake habitat quality.

Table 5.1 Specific MNES environmental outcomes

MNES	Outcomes
Australian Painted Snipe (*Rostratula australis*)	Specific outcomes for Australian Painted Snipe are: • No more than 19 ha of Australian Painted Snipe habitat will be cleared (for Stage 1 and 2); • Avoid and minimise injury and mortality to Australian Painted Snipe across the Project area through sequential clearing, reducing vehicle speed and reducing pest animal populations that are a direct threat to species; • Maintain Australian Painted Snipe habitats outside of disturbance footprints on land containing Stage 1 and 2 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas as a result of the Project and ensure, these habitats are available for the species to utilise during Stage 1; and • Exclude grazing from riparian zones and wetlands (outside of construction areas) and manage weed cover to maintain Australian Painted Snipe habitat quality. • Maintain water quality of wetlands and existing dams to ensure habitat is not reduced through erosion and sediment control measures.
Brigalow TEC	Specific outcomes for Brigalow TEC are: • No clearing of Brigalow TEC will occur (for Stage 1 and 2); • Maintain Brigalow TEC areas outside of disturbance footprints on land containing Stage 1 that is owned by Pembroke to ensure no decline in the condition or utilisation of these areas as a result of the Project and ensure no decline in the condition of these areas as a result of the Project; • Prevent the introduction and spread of weeds to reduce threats to the Brigalow TEC through hygiene protocols and weed management in Stage 1 and 2; • Avoid and minimise hot bushfires occurring in Project area with fire excluded from Brigalow TEC patches.

5.2 Mitigation and management measures

To support achieving the environmental outcomes listed in Section 5.1 a number of mitigation and management measures have been developed (as outlined in Table 4.1 - Table 4.3). Further detail on key measures are provided below. The implementation schedule for each of the mitigation and management measures is outlined in Appendix C.

5.2.1 Weed mitigation and management

Weed management will occur on land that is owned by Pembroke within the Project area as part of Stage 1 and 2. These areas of land owned by Pembroke are within ML700036, ML700035 and ML700032 as shown in Figure 1.2. Those areas of land within the Project area, not required to be developed for Stage 1 and 2, will be actively managed for weeds.

The aim of weed management is to minimise the introduction, establishment and spread of restricted and prohibited pest plants under the *Biosecurity Act 2014* (BS Act) (Qld) and other invasive species, not regulated under the BS Act, that present a threat to vegetation communities and species habitat in the Project area.

Weed management will focus on preventing introduction and spread of weeds to the Project area and reducing the extent of existing weed infestations (with a particular focus on MNES habitat areas being retained along Isaac River) (Figure 4.1). Weeds are a recognised threat to MNES species including Squatter Pigeon (TSSC 2015), Australian Painted Snipe (TSSC 2013a) and Brigalow TEC (TSSC 2013b).

Weed management will include:

- all vehicles and machinery to be washed down prior to entering the site. Wheel wash and rumble grids will be installed, and a designated wash bay will be established where vehicles and machinery can be cleaned on site before leaving site;
- regular audits to be conducted to ensure vehicles and machinery have been washed down and are weed free;
- personnel to be trained in how to wash down their vehicles and equipment to ensure weed seeds and bacteria are not spread;
- personnel are to ensure their clothing and boots do not carry weed seeds; and
- any soil or other materials brought into site are certified as weed free.

A baseline weed survey will be completed in the first year of Project commencement. This will be implemented in conjunction with habitat quality assessments for those MNES habitat areas being retained within the land associated with Stage 1. The survey will confirm weed species present, their distribution, and percentage cover across these MNES habitat areas. Large infestations will be mapped, and permanent photo monitoring points established.

Accordingly, a strategic grazing regime will be implemented to reduce the presence and biomass of exotic pasture grasses in the Project area (outside of riparian zones and wetlands where grazing is excluded) and assist to manage weeds (refer to Section 5.2.3). Increased biomass can increase likelihood of hot bushfires occurring which is a recognised threat to Greater Glider and Brigalow TEC.

Weeds will be managed at least annually, using chemical and/or mechanical control in accordance with the control measures and timing consistent with Biosecurity Queensland Fact Sheets (DAF 2020), for the relevant weed species. Further detail on weed control methods is provided in Appendix D. Weed biomass may also be a reduced through a combination of crash grazing, slashing and/or hazard reduction burns and cool burns where relevant as grazing isn't permitted in riparian zones. Post the baseline weed survey being completed Pembroke will prepare a Weed Action Plan for each year that sets out the specific weeds, control methods and effort to be applied. Weed control will be implemented by suitably experienced and licenced contractors or suitably qualified and licenced site manager.

5.2.2 Feral animal mitigation and management

Feral animal management will aim to reduce feral animal populations within the Project area and the habitat degradation they cause to MNES habitats. Invasive species have numerous negative impacts on native flora and fauna and the environment including habitat destruction, predation of small animals and potential disease transmission. Feral animals are a recognised threat to MNES species such as feral pigs for Ornamental Snake (DoE 2014b), foxes and cats on Squatter Pigeon (DEWHA 2008, DoE 2015) and wild dogs for Koalas (DoE 2014a).

Feral animal management will occur on land that is owned by Pembroke within the Project area as part of Stage 1 and 2. These areas of land owned by Pembroke are within ML700036, ML700035 and ML700032 as shown in Figure 1.2. Those areas of land within the Project area, not required to be developed for Stage 1 and 2, will be actively managed for pest animals. Feral animal management will be undertaken by suitably experienced and licenced contractors or suitably qualified and licenced site manager.

Table 5.2 provides examples of approved species-specific feral animal control measures recommended by the Queensland and Commonwealth governments that will be implemented. Control of feral fauna will be undertaken via several methods that are:

- species specific (wherever possible);
- cause no or little damage to the natural environment;
- are undertaken by suitably qualified and experienced contractors;
- are humane; and
- meet relevant Work, Health, Safety and Environment regulatory requirements.

Results of feral animal assessments will be reviewed following each reporting event to inform the need for, location and timing of species-specific control measures in subsequent years.

Table 5.2 Species-specific control methods for feral animals

Species	Biosecurity Act 2014 status	Control method
Pig (*Sus scrofa*)	Category 3,4,6	Trapping – funnel entrance/tripped-gate entrance/pig-specific trigger Shooting – ground shooting or shooting from helicopter Poisoning – 1080 poison baits selectively positioned (DAF 2020a)
Wild dog (*Canis lupus familiaris*)	Category 3,4,6	Ground baiting – 1080 and PAPP poison baits selectively positioned Shooting - opportunistic method (DAF 2020b)
Fox (*Vulpes vulpes*)	Category 3,4,5,6	Ground baiting – 1080 and PAPP poison baits selectively positioned Shooting – highly selective and carried out at night (DAF 2020c)
Feral cat (*Felis catus*)	Category 3,4,6	Shooting - highly selective and carried out at night Poisoning – fresh meat baits containing 1080 poison baits Trapping – baited cage traps (DAF 2020d)
Rabbit (*Oryctolagus cuniculus*)	Category 3,4,5,6	Baiting – 1080 and pindone poison baits placed along bait trails Fumigation – before and during breeding season in burrows Trapping – cage trap/barrel trap Shooting – when rabbits are most active (DAF 2020e)

No domestic animals will be permitted on site (excluding service animals or animals involved in management actions (e.g working dogs). Any existing feral animals on site will not be fed. Waste material will be appropriately sealed and stored to discourage encroachment by feral species. Waste will be stored in covered bins/skips to prevent fauna access.

5.2.3 Grazing management

Livestock will be removed and excluded from riparian zones (which are outside of construction areas) on properties associated with Stage 1 and 2, as required by Condition 46(c) of EPBC approval (EPBC 2017/7867). Riparian zones include entire area within 100m from the defining bank of any watercourse and/or wetland and are illustrated in Figure 4.2.

Watercourses have been defined using the Department of Natural Resources and Mines (DNRM) watercourse and drainage feature spatial dataset (2020). The vegetation management watercourse and drainage feature map for Qld is defined by s20AB of the Vegetation Management Act 1999 and covers all local government areas except in South East Queensland.

Watercourse is defined under Water Act 2000 as “a river, creek or stream in which water flows permanently or intermittently –

a) in a natural channel, whether artificially or improved or not; or

b) in an artificial channel that has changed the course of the watercourse.

A watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water”.

Wetlands were mapped based on Department of Environment and Science (DES) wetland environmental value mapping. The map of Queensland wetland environmental values as defined in schedule 2 of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019. Wetlands are categorised of high or general ecological significance. Watercourses and wetlands for Stage 1 area are illustrated in Figure 4.2.

Fences will not have barbed wire and will be wildlife friendly (except for areas that may need to be fauna exclusion fencing due to adjacent mine development). For fences that are required in areas for future development temporary fencing will be installed. This may include electric fencing as it prevents livestock from entering the area, but also native wildlife can go underneath bottom strand.

Fencing specification for livestock exclusion is provided in Section 5.2.7.

In areas that are not part of an active mining area or riparian area, strategic grazing will be used to assist in managing fuel loads and weeds. Fuel load, or biomass, describes the fallen bark, leaf litter and small branches accumulating in the landscape (Geoscience Australia 2020). Increased biomass can increase likelihood of hot bushfires occurring which is a recognised threat to Greater Glider (TSSC 2016) and Brigalow TEC (TSSC 2013b). To minimise impacts on MNES habitats and any degradation of soils and water quality, strategic grazing will be excluded where rainfall causes inundated or waterlogged soils.

The following habitat types are considered sensitive to grazing and require different management strategies:

- riparian areas along major watercourses including existing remnant riparian vegetation and regenerating riparian vegetation;
- gilgai landforms including gilgai in cleared agricultural grasslands/shrublands as they provide habitat for Ornamental Snake;
- other remnant woodland areas; and
- regrowth woodland areas.

Table 5.3 outlines the biomass management strategies to be implemented for each habitat type and triggers for grazing.

Table 5.3 Biomass load management strategies

Grazing management area	Management strategy	Trigger for control
Riparian areas along watercourses and wetlands	*Grazing is excluded* To ensure creek banks are not degraded, existing riparian vegetation is retained and natural regeneration along riparian areas can occur, it is proposed grazing is excluded from these areas. Watercourses and adjacent riparian areas (at least 100 m from the defining bank of any water source) and 100m from wetlands will be fenced off. Off-stream watering points will be installed to ensure cattle have adequate access to water. Areas not permitted to be grazed are shown in Figure 4.2. As riparian environments are susceptible to erosion, control utilising fire would also be avoided. *Slashing* Where control of fuel load/biomass is required, slashing would be preferred over grazing. Slashing will need to ensure no native tree saplings are harmed.	For biomass control: • restricted to areas with biomass cover of exotic species of >50%; • slashing to be undertaken using manual brush cutters to a height of no less than 20 cm; and • slashing to occur immediately prior to flowering and seeding period of key weed species to reduce seed set.
Remnant woodland	*Grazing permitted to reduce biomass* Crash grazing will be used to maintain native vegetation and grassy open woodland ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass. Grazing will be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 5.2.4.	For biomass control: • Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%. • Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height. – Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. Fire may be used to manage biomass, in line with recommendations in Section 5.2.4.
Regrowth woodland	*Grazing excluded from young saplings/planted tubestock* Areas of existing naturally regenerating native vegetation (i.e. naturally occurring areas of saplings or 'suckers') should be fenced off and grazing excluded. Grazing may not occur in these areas until the saplings are of a size to withstand grazing and browsing from stock (approximately 2−3 years). After such time, crash grazing will be used to maintain native vegetation and grassy ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass.	Exclude all grazing in naturally regenerating areas until saplings are capable of withstanding impacts from livestock (approximately 2−3 years). For weed control: • Restricted to areas with weed cover of >50% or areas with high threat weed (WONS or Bio Act listed). • Grazing timed to occur immediately prior to flowering and seeding period of key weed species to reduce seed set. • Grazing undertaken for very short periods (time will be depending on paddock size, generally days). • Grazing removed once reduction in seed heads has occurred. For biomass control:

Table 5.3 Biomass load management strategies

Grazing management area	Management strategy	Trigger for control
	Grazing should be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 5.2.4.	• Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%. • Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height. – Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. Fire may be used to manage biomass, in line with recommendations in Section 5.2.4.
Cleared agricultural grasslands	*Grazing permitted to reduce biomass* Crash grazing will be used to maintain native vegetation and grassy ecosystems. Crash grazing will be undertaken at specific times of year for short periods to control weed cover or control excessive grass biomass in above average growth seasons. Grazing will be undertaken at a time of year immediately prior to flowering of key weed species to reduce seed set, or as required to control biomass. Grazing should be excluded from any areas with low levels of weed cover (<50%) or low biomass (<70%). Once evidence of natural regeneration is occurring, the grazing management strategy for regrowth woodlands outlined above should be applied. *Cool mosaic burns to reduce biomass* Fire will be implemented to control fuel load/biomass in line with recommendations in Section 5.2.4.	For biomass control: • Restricted to areas with biomass cover of >70%. • Grazing undertaken within a grazing window, avoiding key growth period for native species. • Groundcover maintained at a minimum of 70%. • Sward heights of dominant grasses maintained at following minimum sward height: – Short grasses (<0.6 m): maintained at 5 cm bulk sward height. – Medium grasses (0.6 m to 1.2 m): maintained at 10 cm bulk sward height. – Large grasses (>1.2 m): maintained at 20 cm bulk sward height. • Fire may be used to manage biomass, in line with recommendations in Section 5.2.4. Once regeneration is evident, exclude all grazing in naturally regenerating areas until saplings are capable of withstanding impacts from livestock (approximately 2-3 years).

5.2.4 Fire management

Access tracks and fencelines will be used as firebreaks within the Project area, and fire exclusion zones around infrastructure will be established.

The firebreaks will be maintained by:

- grading all existing/proposed fence lines;
- grading all existing access tracks bordering or traversing Project area; and
- strategic grazing will be used to control fuel loads, where appropriate/necessary (see Section 5.2.3).

Grazing will be permitted in sections of the Project area on a managed and limited basis to control weeds and reduce fuel loads. The suitability of conditions for undertaking a grazing event will be informed by biomass monitoring events (see Section 5.2.3).

When necessary, fuel management (eg cool mosaic hazard reduction burns prior to the dry season) will be undertaken in consultation with the Qld Rural Fire Service (RFS). Consultation with RFS will also be required for controlled burning at appropriate intervals to promote regeneration and germination of native vegetation communities and species. Fire will be excluded from the Brigalow TEC patches.

5.2.5 Nest box trial

Nest boxes will be used to provide supplementary breeding and sheltering habitat that have been removed through vegetation clearance within the impact area. The target species for nest box utilisation is the Greater Glider, and the nest box program will be trialled for Stage 1 of the project. These will be installed within adjacent suitable habitat that is not within any future disturbance areas being the Issac River corridor as shown in Figure 4.1. During the pre-clearance surveys exact locations for nest box installation will be finalised. Greater Glider are known to use a large number of hollows within their home range, using between 2-18 different hollows. Greater Gliders do not appear to build a nest as such, however, occasionally utilise a lining of leaves (Wildlife Preservation Society of Qld 2019).

During pre-clearance surveys all hollow-bearing trees to be removed during clearance will be marked on site and hollows suitable for Greater Glider spatially recorded. Tree hollows that meet the requirements for Greater Glider will be specifically identified and mapped (see Figure 4.1 for specific detail). As part of the stage 1 trial, nest boxes suitable for Greater Gliders will be installed at a ratio of 1:4, i.e. 1 nest box will be installed for every 4 suitable natural hollows (of Greater Glider dimensions that are cleared), as far as practicable with consideration to the following limitations:

- number and density of appropriate trees in the allocated Isaac River recipient area; and
- number and density of existing suitable hollows in the allocated Isaac River recipient area.

Suitable access to enable the nest box to be safely installed through use of an elevated work platform.The number and spacing of nest boxes within the recipient area will be determined by a suitable qualified ecologist with consideration to the above factors.

Following the Stage 1 trial, should remote camera and visual inspections (see section 6.2) demonstrate at least 1% of nest boxes are being utilised by Greater Glider and therefore that nest boxes have some level of success, nest boxes will be installed at an increased ratio for all future clearing activities.

The design and installation of Greater Glider nest boxes will include:

- inner width/height of 250x300 mm;
- depths of 400 mm;
- entrance diameter of 80-90 mm;
- height above ground above 8 m; and
- rear entranced to face the host tree trunk (Hollow Log Homes, 2015).

i Greater Glider nest box design

Three nest box types will be trialled, including:

1. Birch Plywood Boxes – installed the with 'Habisure System' (Franks & Franks 2006) to prevent inadvertent tree damage (Plate 5.1). These boxes have a lifespan of 10 - 15 years;
2. CYPLAS Boxes - Made from 100% Recycled HDPE (High density polyethylene) and Queensland Cypress installed with the 'Habisure System' (Franks & Franks 2006) to prevent tree damage. These boxes are Termite and rot proof and have a lifespan of at least 30years; and
3. Salvaged large tree hollows retrieved from the clearing area. Pembroke will trial salvage and installation of up to 10 naturally formed hollows.

ii Installation method

50% of nest boxes will be installed as far as practicable prior to the commencement of clearing for Stage 1.

500 nest boxes were installed by end May 2023 which was the total amount estimated to be required.

The intent of installing a number of nest boxes for Greater Glider prior to clearing occurring is that they will provide alternative habitat for individuals displaced during clearing activities.

Salvaged tree hollows will be installed during the clearing phase.

A suitably qualified ecologist will supervise the installation of nest boxes in accordance with this plan. The ecologist would decide on the precise host trees taking into account information within this plan as well as the following factors:

- selecting mainly larger trees (both in DBH and canopy cover) for host trees where possible;
- selecting trees within genera known to be utilised by the target species (e.g. *Eucalyptus*, *Corymbia*, *Angophora*);
- consideration of location of habitat connectivity structures (i.e. glider crossing structures), existing hollows and food resources in relation to nest box location;
- the fixing arrangements for nest boxes with rear facing entrance holes will allow spaces between the nest boxes and trees for fauna to access the nest box (RMS 2017);
- nest boxes should generally be orientated between northwest and east to avoid hot afternoon sun and the dominant direction of severe storms. Rear entranced Glider boxes will have limited aspect-related issues (RMS 2014); and

- nest boxes should be placed in areas with limited artificial light sources.

Nest boxes will be attached to trees using the Habisure System (Franks & Franks 2006) (Plate 5.1 and Plate 5.2). This attachment method is recommended as it allows for at least one metre of diameter growth of the host tree before adjustment is required. Bolting or screwing nest boxes to trees is not recommended due to increased damage to trees and a comparatively short lifespan.

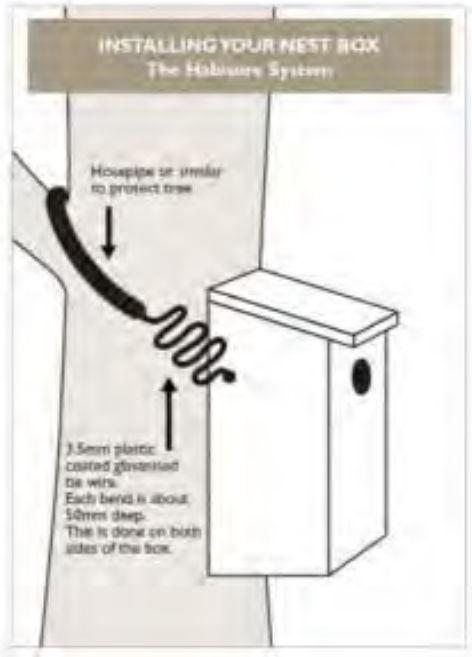

Plate 5.1 Habisure system of nest box attachment (Franks and Franks 2006)

Plate 5.2 Nest box installed with habisure method on Jinker Track, Moreton Bay Regional Council (EMM 2020)

iii Maintenance of nest boxes

Maintenance inspections will be undertaken in conjunction with monitoring events. Potential maintenance works would involve:

- repairing nest boxes;
- reattaching nest boxes to trees;
- removal of feral species (including possible retrofitting of nest boxes to exclude feral species);
- removal of excessive denning material (i.e. leaf litter);
- replacement of fallen, damaged or degraded nest boxes; and

- repositioning or relocation of dysfunctional nest boxes. If nest boxes need to be removed from the site for repair and shows signs of native fauna usage, alternative nest boxes will be installed in the same location upon removal of the damaged box (RMS 2017).

Monitoring of nest box use by Greater Gliders is outlined in Section 6.2.

iv Nest boxes best practice

Best practice has been shown in projects undertaken by Government departments such as Roads and Maritime (RMS) in NSW who have been installing artificial hollows (i.e nest boxes) for many years and have had success with gliders and other arboreal mammals using the nest boxes. Brisbane City Council is also undertaking work with the Queensland Glider Network (QGN) where they had installed nest boxes into Greater Glider habitat to the north of Brisbane and undertaking monthly monitoring. In March 2018 they successfully recorded a Greater Glider using a nest box. The QGN's nest box monitoring programs in Brisbane have highlighted how successful and important nest box programs can be, but there are challenges as not all nest boxes are utilised by target species and there is competition for use of the artificial hollows by Brush-tailed Possums, Common Myna etc. Local governments in South East Queensland are also regularly installing nest boxes as best practice near glider rope crossings as shown in Plate 5.2.

Nest boxes have been found to be occupied in greater numbers when placed in younger forests where there are fewer hollows (Lindenmayer et al. 2009). Lindenmayer et al. (2009) identify the importance of targeting the locations where nest boxes are placed. Additionally, a study by Goldingay et al. (2018) identified the main loss of functionality of nest boxes was a lack of maintenance over time. By placing next boxes in areas of lower hollow density retained habitat will be improved.

5.2.6 Installation of salvaged, natural tree hollows

The re-use of large hollows has been demonstrated to provide higher potential for uptake success by comparison to artificial nest boxes. Monitoring of a relocated hollow section and large nest boxes designed for owls placed at Wadalba, NSW showed that the hollow received regular activity and use over the winter period from Sulphur-crested Cockatoo (nesting), Barn Owl, Common Brushtail Possum, Australian King Parrot, Sugar Glider, Feather-tailed Glider, Galah and the Southern Boobook Owl (Central Coast Council 2016).

The process of installing a natural tree hollow will be done by EWP. The recipient tree is the tree that will receive the relocated hollow section. The suitability of the recipient tree will firstly be assessed including health of the tree, structural integrity and there is a clear flyway in the direction of suitable roosting habitat, away from noise, artificial lighting and disturbance. The recipient tree will also be assessed to determine the hollow can be placed at least 10 – 15m high.

Fixation methods to the recipient tree are required to prevent or minimise impact to the health and structural integrity of the recipient tree and ensure a safe and long-term outcome. The procedure involves:

- the placement of the hollow section into a selected recipient tree through the use of an appropriately sized crane to lift the section;
- tree climbers will guide the placement of the section onto the supporting branch on the EWP (Plate 5.3);
- screw galvanised builders strapping around both components including recipient tree and hollow;
- or use steel cable and turnbuckles; and
- timber blocks and particle board are used to protect the live tree (Central Coast Council 2016).

There are two methods for fixing the hollow section to the recipient tree depending on the weight and size of the section. All fasteners and hardware used to affix the section to the recipient tree are to be suitable for external use. (e.g. galvanised, stainless steel, brass).

Plate 5.3 EWP to attach a salvaged hollow to recipient tree

5.2.7 Fencing specification to exclude livestock from riparian areas

As mentioned in Section 5.2.3, grazing is to be excluded from riparian zones (Figure 4.2) that aren't in a construction area. Fencing is an integral part of land management by acting as a barrier for stock movements. However, fences can restrict the movement of native wildlife, and can cause serious injury and deaths. Barbed wire, in particular, is a major hazard for wildlife with more than 75 wildlife species identified in Australia as occasional or regular victims of barbed wire fences, especially nocturnal animals such as bats, gliders and owls. Barbed wire fences are identified as a threat to the Greater Glider (TSSC 2016).

For existing fences, the top strand of barbed wire will be replaced with plain or borderline (white plastic coated) wire as this can significantly reduce the risk of entanglement (Land for Wildlife Qld 2017). Reflectors will also be placed on the top wire to increase detectability at night by wildlife.

For new fencing design parameters will include:

- design a fence to allow for animals to pass underneath. Leave a minimum of 40 cm between the ground and the bottom wire;
- choose a plain, high-tensile fencing wire or borderline (white plastic coated) for top strand. If this is tensioned correctly, this fencing material can contain most stock. Put reflective material or aluminium plant tags on top strand so fauna can more easily see this at night. Tags need to be placed at 30cm intervals (Macedon Ranges Wildlife Network 2020); and
- electric fencing will be used in areas where temporary fencing is required. The bottom hot wire will be kept above 40 cm from the ground to allow for small animals to pass under with ease. As it is cheaper and quicker to construct, and effective for containing livestock, electric fencing will be used in areas required to be developed in future stages.

Fencing will:

- ensure creek banks are not degraded;
- retain existing riparian vegetation;
- allow for natural regeneration along riparian areas;
- protect aquatic habitat and water quality; and
- reduce stock loss from bogging and drowning.

5.2.8 Koala monitoring (Stage 1)

Despite their relatively large size and not utilising tree hollows, Koalas can often be difficult to spot during pre-clearance surveys and during actual vegetation clearing. This makes them particularly susceptible to being overlooked during the tree felling and when this occurs, severe injuries or mortality can occur. To significantly reduce the chances of this occurring it is essential to have an accurate understanding of the likely numbers to be utilising a proposed clearing area, and to be able to accurately determine the location of Koalas within the impact area just prior to clearing. This will be done through monitoring with telemetry devices (i.e. GPS/satellite and/or VHF tags or collars). With the overall performance objective to avoid and minimise any injuries or mortality occurring to Koalas during vegetation clearing phase.

Koala monitoring program will be implemented for Stage 1 as a trial. The monitoring will have added benefits in that it will provide additional information on the Koala population utilising the Project area (such as number of individuals, their health, breeding, age etc), their movements and effectiveness of mitigation measures being put in place. Translocation of Koalas is not proposed as it is a very intrusive way of moving Koalas from a clearing area and other studies have shown it is ineffective. It is preferred that other avoidance and mitigation measures are trialled, such as sequential clearing, use of fauna spotter catchers, and tracking Koalas through use of GPS collars to learn more about the Koala populations prior to clearing commencing, being able to identify their location during clearing to ensure impacts do not occur, and allow them to naturally disperse from the area of their own volition and monitor their dispersal. Therefore this is both an avoidance and mitigation measure, as well as a research undertaking for the species.

The Koala tracking program will allow information to be gathered on:

- individual's health (such as disease);
- age;
- sex;
- breeding;
- number or individuals; and
- dispersal.

Koala monitoring will commence during pre-clearance surveys at least 3-4 weeks prior to clearing commencing to allow sufficient data be recorded relating to regular activity areas and movement. This will be undertaken by suitably qualified ecologists appointed by Pembroke who have the appropriate Scientific Purposes Permit (SPP) and animal ethics approval in place. It is proposed two teams will implement the Koala monitoring as it will go over a four month period therefore teams can work on a rotation basis.

While monitoring during clearing is the most important component in order to fulfil the objective of not injuring or killing Koalas during the clearing process, monitoring is also essential to determine the fate of Koalas post clearing. Koalas will be monitored for at least 3 months post clearing to determine where they move to after clearing, survival rates and where they may settle. Previous studies have shown Koalas may take months to establish a new home range following impacts (i.e. clearing/translocation) and some individuals may travel long distances before settling.

A more detailed Koala Monitoring Implementation Program will be developed that will form the basis for the Scientific Purposes Permit (SPP) and Animal Ethics applications and approvals. These approvals are required from the Queensland Government before the monitoring can be undertaken. This will include specific methodologies, timing, personnel and costs.

i Koala monitoring best practice

Using telemetry to understand how Koalas use the Project area will significantly increase the likelihood that Koalas will not be injured during clearing and allow for adaptive management of the species during the clearing phase. For example, Goldingay and Dobner (2013) were able to use GPS tracking to identify common routes for Koalas through a fragmented urban area to see where future management should include strategic habitat tree planting. By understanding Koalas movements in the Project area and potentially adjacent areas will assist Pembroke to identify the best mitigation approaches including location for exclusion fencing.

Koala monitoring using GPS prior to, during vegetation clearing and post vegetation clearing, has been used successfully in the Qld Moreton Bay Rail Project and the Toowoomba Second Range Crossing. No Koalas were injured during the clearing of vegetation for these projects as they were tracked and monitored in detail using the telemetry method in combination with fauna spotter-catchers. These programs also helped understand Koala population numbers in the Project area, the health of that population, threats and their dispersal.

5.2.9 Koala connectivity structures: exclusion fencing and Koala escape poles

Koala exclusion fencing and escape poles will be installed in key locations to mitigate threats to resident and transient Koalas, posed by active mine sites and associated activities (DES 2019).

Specifically, Koala exclusion fences and escape poles will keep Koalas outside of active mine areas and avoid and minimise Koala injuries including from vehicles. Koala exclusion fencing locations for Stage 1 are shown in Figure 4.3.

Koala escape poles will be installed every 200m along the fenceline, these are to be a minimum of 125 mm in width or diameter, and the height will be at least 3.30 m so the Koala can get above the height of exclusion fence.The poles will be salvaged eucalypt trees from clearing areas that are of the specified width and have retained bark .

Installing fencing material that is unclimbable discourages Koalas from climbing the fence and entering the active mine area. Chain wire fencing with a smooth metal or perspex sheet on top of the fence in the direction that the Koala will attempt to climb is the preferred fencing material type (Plate 5.4). Fencing will be designed and installed in accordance with the following specifications:

- the top of the unclimbable section of fencing must be least 1.5 m from the ground to prevent koalas jumping and gripping the top of the fencing;
- fence bracing or supports are on the mining side of the fence, away from koala access;
- fencing should extend to ground level along uneven or undulating ground;
- escape poles should be placed on the mining/development side to allow koalas trapped in the mine to exit into habitat (Plate 5.4);
- escape poles will be installed at least every 200 m along the fenceline; and
- the requirement of 'Qld Style Koala Fencing' (Plate 5.4), which are:
    - galvanised chain-link fence with 2,100 x 50 x 3.15 mm mesh;
    - fence to be at least 1.5m in height;
    - metal sheeting to be attached to the top of the fence;
    - three strands of plain wire are to be placed at 60 mm and 1200 mm from the ground, with the remaining wire at the top of the posts;
    - ground mesh 600 x 50 x 2.5 mm to be placed 200 mm from the bottom turned and pegged to the ground for a min. 400 mm; and
    - posts to be spaced at max.3000 mm.

Smooth metal or perspex sheet can be placed at the base of the fenceline to stop the movement of small to medium sized reptiles (Plate 5.5) (DES 2019).

Koala exclusion fencing requires regular maintenance. Vegetation beside the fence should be regularly maintained to exclude trees and shrubs from within 3 m of the fence, to keep canopies of trees trimmed, to remove links to tree canopies on the other side of the fence, and to remove fallen branches and vine growing on the fence which Koalas may use to climb over the fence.

Plate 5.4 Koala exclusion fencing Jinker Track, Moreton Bay Regional Council (EMM 2020)

Plate 5.5 Koala escape pole (DES 2019)

i Koala connectivity structure best practice

Koala fencing is required to exclude the species from areas in which they could be harmed such as highways, active mine sites, areas with heavy machinery etc. Fencing is key in avoiding and mitigating animal access to roads in order to avoid vehicular strike. RMS highway upgrades in NSW have used Koala exclusion fencing successfully across multiple highway upgrades and the above method of fencing is approved by DES and standard in all Qld Road Projects. Queensland Department of Transport and Main Roads (TMR) outline this method in the *Fauna Sensitive Design Road Manual: Volume 1 - Past and Existing Practices* (DMR 2000).

Koala exclusion fencing is also now standard for South East Queensland local governments when upgrading roads to ensure impacts from vehicle strike are minimised to Koalas where their habitat occurs on one or both sides. Koala exclusion fencing combined with Koala poles are shown to be an effective measure to reduce Koala mortality.

5.2.10 Greater Glider connectivity structures: rope ladder crossings

Greater Glider rope ladder crossings will be installed at each of the five clearance corridors within the Isaac River and Ripstone Creek riparian zones as required by Condition 46. The objective is to support the movement of Greater Gliders across the cleared riparian corridors, where there is suitable habitat either side. Final crossing locations relevant to project Stage 1, and indicative locations for those relevant to project Stages 2 and 3, as applicable to the Isaac River clearance corridors are shown in Figure 4.4.

Final crossing locations will be confirmed in future revisions of the MMP. Crossing locations cannot be displayed for the Ripstone Creek clearance corridors, as the locations of corridors themselves are yet to be determined, however will be included in future revisions of the MMP. The following will be considered when determining the final locations of crossings:

- poles must be located at a safe distance from defining river banks;
- the locations of Greater Glider records and habitat trees in the adjacent retained areas;
- capacity to link the crossings to adjacent habitat for target species (habitat trees) eg via ropes or ladders tied off from the poles into surrounding trees. Nearby trees are essential to link the canopy bridge into the surrounding vegetation; and
- a minimum seven metre clearance above the ground must be achieved.

Rope ladder crossings have the potential to restore habitat connectivity disrupted by roads for some arboreal mammals, as confirmed by a 2012 study on the Pacific Highway monitoring the use of rope bridges by arboreal mammals. Several species of possum and glider were observed using the crossings (Goldingay 2012). Rope ladder crossings are generally attached to recycled electricity poles and have cables in the adjacent vegetation to provide tension and access (VicRoads 2012).

Rope ladder crossing design and materials will be based on the most up to date standards and design shown to be effective for gliders and crossing wide spans such as roads. There are presently two main rope ladder designs being:

1. Flat rope design - designed for the glider, squirrel and ringtail possums (Plate 5.7).
2. Boxed rope design - designed for the protection of the sugar glider, squirrel glider and possums (Plate 5.6).

These ladders range from 40 to 80 metres long and are made in 10 metre segments to allow easy installation. The boxed rope design will be used for Stage 1. Pembroke will trial the flat rope design in Stage 2.

Plate 5.6 **Box Rope ladder crossings (image left with cables to adjacent trees) (Left Photo: EMM 2020, Right photo: Fauna Crossings 2020)**

Plate 5.7 Flat rope ladder crossing design Jinker Track, Morton Bay Regional Council (EMM, 2020)

An advantage of rope ladder crossings is that they can be used by non-gliding arboreal fauna, such as the Brush-tailed Phascogale, Antechinus species, possums and small gliders (Sandpiper Ecological Surveys 2013). Rope bridges also provide greater flexibility as they can be designed to fit the forest gap, do not always rely on retention of tall trees close to the highway and avoid the need for median poles, except where there are larger gaps, thereby avoiding safety issues with such poles (Sandpiper Ecological Surveys 2013).

Rope bridges are generally attached to recycled electricity poles and have cables in the adjacent vegetation to provide tension and access.

A remote camera trap will be placed on either end of the rope ladder crossing during installation by suitably qualified personnel to maintain a record of fauna usage. The cameras will be powered by solar panels. Usage of the crossings will be included in monitoring (Section 6.2) and annual reporting (Section 7.1).

Plate 5.8 Camera to detect species using rope ladder crossing (Faunatech 2020)

i Greater Glider connectivity structure best practice

Rope crossings have been used as standard practice by RMS NSW for mitigating fragmentation impacts on arboreal species such as Greater Gliders on projects such as the Karuah Bypass. TMR and SEQ local governments have been adopting the use of rope crossings for Gliders and other arboreal animals, such as on the Bruce Highway Upgrade.

They have become common practice and monitoring is showing them to be effective in providing connectivity for the species across cleared areas of habitat.

5.2.11 Greater Glider monitoring (Stage 1)

The Stage 1 area is known to support Greater Glider habitat and individuals have been recorded to the north and east along the Isaac River (Figure 2.2). If Greater Gliders are found in tree hollows during pre-clearance surveys in the Stage 1 clearing area, that they are collared and radio-tracked to gather information including:

- their dispersal within the Project area and surrounding areas during and post clearing;
- determine if they are utilising nest boxes that have been installed prior to clearing along the Isaac River and adjacent habitats (Figure 4.1);
- the health of individual Greater Gliders; and
- population numbers.

While mitigation actions will be implemented to encourage natural dispersal of Greater Glider from the clearing area, it is likely many will remain in their preferred denning trees at the time of clearing. Therefore, prior to felling, each habitat tree (known or suspected to be used by Greater Glider) will be inspected using an EWP.

Suitably qualified ecologists/wildlife spotter-catchers will inspect each trees hollow for Greater Glider. If the species is present, they will be captured by hand if possible. Or in a situation where they are too deep within a hollow to be reached, the hollow entrance will be blocked with a rag or towel and the limb cut where solid below the den. This latter method is preferred as it will cause less stress on captured Greater Gliders as opposed to physically extracting them from hollows during daylight.

Once gliders are captured (either bagged or remaining in a hollow limb), they will be placed in a quiet, shady and cool location until release that night in the pre-determine release area/s. Those gliders within recovered hollows, will have the rag/towel removed from the hollow limb and will be left to emerge in their own time.

Prior to release, those Greater Gliders that are to be monitored post release will be fitted with a radio-collar.

The monitoring of Greater Gliders is proposed as a trial for Stage 1. It will provide important information on Greater Glider populations in the Project area and enable learnings in terms of where Greater Gliders are dispersing, are they utilising nest boxes and their survival rates post clearing of their original denning tree. Monitoring is will occur to occur during clearing and three months post clearing.

A more detailed Greater Glider Monitoring Implementation Program will be developed that will form the basis for the SPP and Animal Ethics applications and approvals. These approvals are required from the Queensland Government before the monitoring can be undertaken. This will include specific methodologies, timing, personnel and costs.

i Greater Glider monitoring best practice

Similar to tracking Koalas with telemetry, it will be important to understand the populations of Greater Glider within the Stage 1 area, effectiveness of sequential clearing methods, their dispersal and use of nest boxes.

Not a lot of studies have been undertaken specifically targeting Greater Glider use of nest boxes, including the most effective design, heights in trees etc therefore this is considered an important monitoring program to implement to gain more knowledge on effective mitigation strategies for the species. Key information can be gathered on where they are denning, how far they disperse, and are certain nest box designs and heights more preferred than others.

5.2.12 Access road crossing design

An access road in the north of the Project area is required to allow entry to the site from Annandale Road. Where the access road crosses the Isaac River a bridge will be installed. This river crossing and bridge will be constructed during Stage 1.

The bridge will be raised above the riverbed and design elements will be included to allow native wildlife including Koalas to access the riparian corridor and be able to move under the bridge north to south along the river. Under the bridge Koala fauna furniture will be installed to allow them to get off the ground in case of rainfall events where the water has come up higher on the bank, and to also evade predators. The Isaac River is dry most times of the year which allows fauna movement to occur below the bridge.

Exclusion fencing will also be installed on either side of the access road (on both sides of the river) to ensure wildlife including Koalas cannot get onto the access road and bridge along the riparian area. Where feasible and reasonable, the design is to avoid placing piers in permanent water channels and on stream banks, to minimise alteration to water flow and/or damage to stream bank vegetation.

The bridge will be designed to include:

- a natural substrate at the abutment, such as soil or vegetation, where feasible and reasonable. Scattered rocks could be included;
- allow unimpeded water flow, stream bank and riparian vegetation, preferably on both sides of the water course; and
- the height of bridge will allow sufficient light and moisture to encourage growth of vegetation under the structures.

5.2.13 Sequential clearing

Phase 1

Pre-clearance ecology surveys will have been conducted of an area before any clearing commences. If marked habitat trees containing tree hollows have been checked with the EWP then clearing of all vegetation can occur in the presence of a fauna spotter catcher. Clearing of habitat trees must only occur on the same day it has been checked.

If hollows have not been checked then only understorey vegetation and smaller juvenile trees will be cleared. Juvenile trees are under 4 m in height or trunk circumference of less than 31.5cm at 1.3m above the ground. Vegetation will be cleared gradually moving away from any higher risk areas (i.e major road, construction zones) towards adjacent fauna habitat. It will be ensured corridors of vegetation are retained to assist fauna move safely out of the area.

Phase 2

After 48hrs the second phase can commence which is to clear the remaining larger trees, including those with hollows. Trees with small hollows will be cleared using the "slow drop" technique. The tree will be brought down slowly by the machine and mulch put underneath to soften the fall. They will then be inspected by the fauna spotter catcher to ensure no wildlife remain in the hollow. Where possible fauna will be caught, and released into suitable recipient sites once clearing has stopped. Fauna handling procedures are documented in Appendix B.

If injured, fauna will be taken to a local vet/wildlife carer for treatment.

It is crucial that Greater Gliders, Koalas and other arboreal fauna are given the opportunity to disperse from the area once clearing has commenced under their own volition. To encourage this, no habitat trees, as identified and demarcated in pre-clearance surveys and/or through active Koala monitoring, will be isolated.

For those trees identified as containing Koala, surrounding trees with overlapping crowns or that may impact the Koala's tree during felling will not be cleared until the Koala has moved from the area under its own volition. In most situations this occurs overnight and will be confirmed for monitored Koalas by checking the individual's latest location. Once it has been confirmed the Koala has vacated the original tree, clearing can occur as usual following required checks for other fauna.

For those trees identified as habitat trees for Greater Glider, dispersal corridors will be left in place that link vegetation with clearing areas to adjacent areas of retained habitat, and are to be maintained for a further 24 hours, to facilitate overnight dispersal. Such corridors could consist of a single row of trees no more than 30-40m apart that will act as 'stepping stones' to allow Greater Gliders to glide from tree to tree.

While dispersal described above is encouraged to assist in reducing the number of Greater Gliders within a clearing area, it is likely many will remain in their preferred denning trees at the time of clearing. Therefore, prior to felling, each habitat tree will be inspected using a EWP.

Suitably qualified ecologists/wildlife spotter-catchers will inspect tree hollows for Greater Glider. If the species is present, they will be captured by hand if possible. Or in a situation where they are too deep within a hollow to be reached, the hollow entrance will be blocked with a rag or towel and the limb cut where solid below the den. This latter method is preferred as it will cause less stress on captured Greater Gliders as opposed to physically extracting them from hollows during daylight.

Once gliders are captured (either bagged or remaining in a hollow limb), they will be placed in a quiet, shady and cool location until release that night in the pre-determined release area/s. Those gliders within recovered hollows, will have the rag/towel removed from the hollow limb and will be left to emerge in their own time.

Prior to release, some Greater Gliders will be fitted with a radio-collar. Further detail on the radio-tracking of Greater Gliders is provided in Section 5.2.10.

If any fauna are injured in the clearing process they will be taken to a local vet/wildlife carer for treatment.

Some hollow limbs that are recovered during the EWP process will be salvaged and fixed to suitable trees in the pre-determined release area/s using EWPs to provide a denning resource for relocated Greater Gliders. Further detail on the method to install natural hollows is in Section 5.2.5.

Non-woody vegetation should be incorporated into the stripping of topsoil to retain any organic materials and nutrients. Topsoil is not to be mixed with subsoil and will be stockpiled separately for re-use.

5.2.14 Pre-clearance surveys

Pre-clearance surveys will be undertaken by a suitably qualified ecologist/s to identify the presence of MNES species in the proposed clearing area including; Koalas, Greater Glider and Ornamental Snake. The surveys will include targeted active searches such as spotlighting to increase detectability of these three species over a number of consecutive nights.

i Greater Gliders

As Greater Gliders are dependent on large, hollow bearing trees for a sheltering/denning resource, nocturnal and diurnal pre-clear surveys will be conducted to identify and locate all potential Greater Glider habitat trees.

Nocturnal pre-clear surveys will involve spotlighting/stag watching commencing at dusk to confirm Greater Gliders are present in the clearing area generality, and also to assist in determining which tree/s they are actively utilising.

Greater Gliders have been recorded emerging from their dens 35 minutes after dusk (Lindenmayer et al. 1999) with another study revealing emergence time after sunset ranged between 18-227 minutes (Smith et al. 2007). This highlights the importance of conducting spotlighting and stag watching surveys at this time to ensure active habitat trees can be identified.

Due to Greater Gliders utilising multiple tree hollow dens in different trees, replication of the nocturnal surveys will be conducted to provide the highest likelihood of identifying all greater glider habitat trees. A minimum of three consecutive nights will be surveyed. For example, Comport et al. (1996) found Greater Gliders in North Queensland utilised 4-6 different dens in any one month with one or two dens being occurred most frequently while Smith et al. (2007) found up to 20 different dens were used by individual animals within their home range.

Any observed individuals will be recorded including their GPS location. All identified and suitable hollow-bearing habitat trees located during pre-clearance surveys will be recorded with a GPS and clearly identified with pink fluorescent flagging tape. This information will inform salvage efforts by fauna spotter-catcher and provide an understanding of the number of hollows present.

Suitable hollow-bearing trees will be identified using the following key attributes:

- alive/dead myrtaceous trees or dead non-myrtaceous trees over 30 cm diameter at breast height (DBH) (Smith et al. 2007); possessing
- hollows with a diameter greater than 8 cm (Gibbons & Lindenmayer 2002) and at least 8 metres from the ground (Maloney 2007).

ii Koalas

For Stage 1, Koalas will be surveyed prior to clearing and a tracking program will be implemented using radio-tracking collars. Koala pre-clearance surveys can include the use of a drone to improve their detection in an area.

The purpose is to identify the number of Koalas that may be utilising the Stage 1 clearing area, their health, identify where they are during clearing to avoid impacts on them, and gain other useful information about Koalas in the Project area and their movement post clearing as to where they establish new home ranges.

Further detail is provided in Section 5.2.8.

iii Ornamental Snake

Spotlighting will occur in mapped areas of Ornamental Snake habitat (Figure 2.5). Spotlighting will occur over three consecutive nights to determine if the species are present. Prior to clearing commencing a fauna spotter catcher will survey the area the night prior and attempt to capture Ornamental Snake that may be out foraging. They will then be released that night to adjacent suitable habitats which are being retained outside of the Project stages.

iv Pre-clearance ecology survey methods

Diurnal pre-clear surveys will be conducted in conjunction with the nocturnal surveys and will use the following sequence:

- clearing area clearly demarcated both on ground and in map form. Demarcation on the ground will be either temporary fencing, signage, flagging tape or pegs. Ecologists undertaking pre-clearance surveys have the impact areas on their tablet or phone in spatial format also;
- pre-clearance breeding place surveys will be conducted by suitably qualified ecologists/wildlife spotter-catchers. All trees within the clearing area will be thoroughly searched and all trees that contain hollows or suspected hollows will be marked (as per Appendix E). Those hollows with an entrance diameter equal to or greater than 5-10cm large, will be recorded with a GPS as they are potential Greater Glider hollows, and clearly identified as per the tree marking procedure in Appendix E. ;
- while some tree hollows may be obvious from the ground, not all may be clearly observed due to constraints such as the tree height and dense foliage obstruction the view. In such instances, if hollows cannot be clearly seen but are suspected of occurring in potential habitat trees for Greater Gliders, these trees will also be recorded as above;
- animal breeding places will be identified and recorded in GPS and habitat trees marked as per Appendix E;
- recorded GPS and breeding place data will be mapped and distributed to all relevant personnel involved in clearing operations. This data can then be used to assist in co-ordinating clearing operations;
- identify micro-habitats for salvage (ie naturally formed hollows, large fallen logs, trees for use as millable timber and koala poles).

v Recipient sites

Identify suitable areas for fauna relocation in adjacent areas providing suitable habitat for the species. Suitable recipient sites for Greater Gliders and Ornamental Snake will be identified and GPS recorded. These will be areas that are close to the Project, that provide suitable habitat and will not be cleared in the future for the Project. They will also be areas in which nest boxes (suitable for Greater Glider) are to be installed prior to clearing. Further detail on nest boxes is provided in Section 5.2.5.

6 Monitoring

Pembroke commits to implementing a comprehensive monitoring program to ensure the MMP meets the environmental outcomes and performance criteria that have been established. A monitoring program has been developed and is detailed in following sections and summarised in Table 6.1.

The results of the monitoring program will be used to ensure identified avoidance, mitigation and management measures are being implemented effectively, to inform operational management decisions and adaptive management of this MMP. Monitoring will detect the attainment/maintenance of interim performance targets and environmental outcomes, and determine if corrective actions are required.

The monitoring methods are:

- specific to the MNES and performance criteria being assessed;
- designed to enable a determination if a criteria has been achieved or whether corrective actions are needed; and
- quantitative and repeatable such changes over time can be observed through the comparison of monitoring events.

The frequency and timing of monitoring is sufficient to track progress towards each set of milestones and to determine whether milestones have been or are likely to be achieved in a timely manner, to allow for the implement all necessary corrective action.

6.1 Project area inspections

The aim of general Project area inspections is to identify any potential issues that may require remedial action. These general inspections will be conducted by a Pembroke environmental representative who is suitably qualified and experienced to assess both land management activities and threatened species and ecosystems twice per year for the duration of the Project to assess the following:

1. Compliance with restrictions for vegetation clearing
2. Maintenance of access tracks and firebreaks
3. Efficacy and integrity of erosion and sediment controls
4. Efficacy and integrity of Fauna crossing structures, fencing, gates and vehicle speed signs
5. Compliance with hygiene protocols
6. Efficacy and integrity of livestock exclusion fencing both permanent and temporary

These events will also be used to detect occurrences of land degradation, erosion and weed infestation as well as project activities, including access, outside approved areas.

This will be achieved by the nominated environmental representative auditing the Project site through visual inspections to confirm actions have been completed, inspecting infrastructure and interviewing on site managers including Pembroke Site Manager and Environment Manager to demonstrate actions have been implemented. A report will be produced post each general Project area inspection summarising findings and identifying any

corrective actions that are needed. The report will be issued to the Pembroke Site Manager for information and any actions needed.

6.2 Greater Glider crossings and nest box monitoring

i Rope crossings

A remote camera trap will be placed on either end of the rope ladder crossing to maintain a record of fauna usage. Camera footage will be reviewed quarterly for usage by Greater Gliders. Rope crossings will be visually inspected every six months to monitor the condition of the ropes. Any damaged rope crossings will be taken down and replaced immediately.

ii Nest boxes

Five remote cameras will be installed during the Stage 1 trial, including one on a salvaged natural hollow to maintain a record of fauna usage. Camera footage will be reviewed quarterly for the first two years and then every six months until first MMP review. Results will be reviewed to assess if the nest boxes have been successful.

Remote cameras will be installed on or around nest boxes, in location sufficient to monitor entrance and egress, to maintain a record of fauna usage. All nest boxes will be visually inspected 6 months after their installation, and twice a year thereafter until construction is completed for Stage 1. Twice-yearly inspections will coincide with breeding cycles. The frequency of visual inspections will be increased and additional monitoring may be considered if, through visual inspection and/or camera footage review, should nest boxes show evidence of utilisation or possible utilisation by Greater Glider to the satisfaction of the suitably qualified ecologist. Any increased or additional monitoring will be prepared in consultation with the suitably qualified ecologist. Following the construction phase and during the operations phase, inspections will occur annually for at least 3 years.

Visual inspection and camera footage reviews will be conducted by a suitably qualified ecologist as relevant to Greater Glider.During monitoring, nest boxes will be checked for wear and tear and may require maintenance. Any damaged nest boxes or nest boxes containing pest species will be taken down and replaced immediately.

6.3 Habitat quality monitoring

Weed, feral animal, grazing and fire management will be undertaken in all areas of retained MNES habitats (outside of disturbance footprints) to maintain habitat quality.

Habitat quality monitoring of retained MNES habitats will be undertaken to ensure habitat quality is successfully maintained throughout the project life. For the first five years this will be within areas associated with Stage 1 and owned by Pembroke within ML700032, ML700035 and ML700036 as shown in Figure 1.2

Habitat quality monitoring will be undertaken in accordance with the *Guide to Determining Terrestrial Habitat Quality* (DES 2020) and converted to scores out of 10. Ten survey sites will be established in representative patches of vegetation communities and MNES habitats as mapped in Figure 2.3 to Figure 2.8 (where the habitat occurs outside the approved disturbance areas). The 10 habitat quality sites are illustrated in Figure 6.1. Habitat quality assessments will be undertaken by suitably qualified ecologists.

The habitat quality baseline surveys will be undertaken in March/April of 2022 and will provide benchmark scores for a number of key attributes including:

- recruitment;
- tree, shrub and grass species richness;

- canopy cover;
- canopy height;
- native grass cover;
- weed cover;
- connectivity;
- threats;
- quality of foraging;
- quality of shelter; and
- mobility.

Habitat quality surveys, applying the *Guide to Determining Terrestrial Habitat Quality* (DES 2020), will then be completed between March and April annually for the first five years. The habitat quality sites will be expanded into further areas as part of the next iteration of the MMP for Stage 2 and will be approved by the Minister. Habitat quality monitoring for Stage 1 will be completed on an annual basis for the first five years, every second year for next five years provided habitat quality is maintained or improved. Monitoring will then be conducted every 5 years until completion of the Project. This is due to the main habitat quality changes and improvements will occur in the first 10 years, and then should be maintained post that.

Results from each monitoring event will be compared to establish that habitat quality has not decreased overall, and any particular individual criteria have not worsened (i.e weed cover, canopy cover, recruitment etc).

Each survey site's data is scored individually against a BioCondition benchmark relevant to the regional ecosystem (RE) represented at that site and compared against a set of maximum scores defined in the *Guide to Determining Terrestrial Habitat Quality* (DES 2020). The habitat quality assessments will also include permanent photo monitoring points to assist in assessing any changes over time, and the success of management measures.

The same sites and methodology will be repeated at each monitoring event so scores can be compared for each attribute.

6.3.1 Photo monitoring

In areas where active management is being undertaken, photo monitoring offers a simple and effective visual means by which to capture the response of the vegetation to management actions. Photo monitoring will be conducted at all fixed habitat quality assessment monitoring sites. Photos at each photo monitoring point will be taken in a north, east, south and westerly direction. A permanent feature will be included within the photo frame to provide a fixed reference point. A record of the photographs will be maintained, including GPS co-ordinates, date, time, direction and the height above the ground the photograph was taken. Data from habitat quality assessments and photo monitoring will be recorded on survey sheets and these will be attached to the monitoring reports that will be included in the annual reports.

6.3.2 Habitat utilisation monitoring

Habitat utilisation monitoring of retained MNES habitats will be undertaken to ensure habitat utilisation by the target MNES fauna species is successfully maintained throughout the project life. For the first five years this will be within areas associated with Stage 1 land owned by Pembroke.

To enable monitoring of MNES fauna species utilisation, and detect any changes in utilisation over time, as part of the habitat quality assessment surveys targeted fauna species monitoring will be completed. These targeted MNES surveys will commence in Year 2 (being 2023) and be undertaken annually during Years 3 to 5. Timing will then go to every five years for remainder of Project.

The habitat utilisation monitoring will entail:

- 10 permanent 1km transects will be established in suitable Koala habitat and these will be droned using a thermal imagery camera to identify the presence of Koalas. These drones have proven to be very effective in detecting Koalas during pre-clear ecology surveys to date. Koala utilisation of the project area and population information will also be supplemented by the Koala tracking program for Stage 1;

- spotlighting will be completed along the full length of the track which goes along the Isaac River corridor. Greater Gliders have been confirmed through this area. Spotlighting will be to detect the presence of Greater Glider and/or Koalas in suitable habitats. Drone surveys will also be used as a supplementary method to detect Greater Gliders. Greater Glider utilisation of the project area and population information will also be supplemented by the Greater Glider tracking program for Stage 1;

- five camera traps to be placed near permanent water sources over three consecutive nights, and diurnal bird surveys at each habitat quality monitoring site to identify presence of Squatter pigeon; and

- spotlighting over three consecutive nights in mapped suitable habitat for Ornamental Snake to identify presence of species.

These survey methods are consistent with applicable EPBC survey guidelines for the species, and regarded as suitable methods to survey for utilisation of habitats by these target MNES species. Use of thermal imaging drones has proven to be successful in detecting Koalas on site. By repeating these surveys consistently, results can be compared to ascertain if there appears to be any change in species habitat utilisation. Weather conditions and any other limiting factors (such as drought or fire) will also be noted at the end of each MNES survey period.

6.4 Weed monitoring

Weed monitoring sites will be randomly stratified during each monitoring event, as well as having fixed monitoring sites including at each of the 10 MNES habitat quality transects for Stage 1. The weed monitoring sites will incorporate different vegetation communities (e.g. open woodland, riparian, wetlands). Other fixed monitoring sites will be set at strategic trafficable areas (e.g. entry gates, creek crossings, stock watering points) to monitor potential introduction and/or irruptions of prohibited and restricted weed species.

Weed monitoring sites will be established in the first operational year of the Project as part of the weed baseline survey (discussed further in Section 5.2.1).

The Project area will be monitored for weeds every year (post wet season) for the first three years of each project stage, followed by every two years for the remainder of the Project. Weed monitoring will determine the species richness and abundance, for the duration of the management period. The results of this monitoring will inform the methods for weed treatment and control (see Section 5.2.1).

Assessing the presence and abundance of weed cover will be done in accordance with the methodology outlined in the *Guide for determining terrestrial habitat quality* (DES 2020). Briefly, this method involves establishing a 50 m x 10m plot and dividing this plot into 20 smaller 5 m x 5 m sub-plots. Percent weed cover will be assessed in each of the 20 sub-plots and the total percent weed cover determined by taking the average from the 20 plots. Photo monitoring will also be undertaken within each plot.

In addition to the weed monitoring sites, incidental observations of weeds will be recorded from the Project area during the six monthly general inspections of access roads, fencelines etc. This will provide instances of weed infestations that occur away from the permanent weed monitoring sites. If trigger levels for weeds are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until the presence and distribution of weeds reduces to baseline levels or below. Further detail on corrective actions are set out in Table 6.1.

6.5 Pest animal monitoring

An initial assessment of the presence and distribution of pest animals was undertaken during the baseline ecological surveys (DPM Environmental 2018) undertaken between 1-14 November 2016. A follow-up comprehensive fauna survey was undertaken within the mine site in autumn from 23 April to 4 May 2017. Results found a number of pest animals were utilising the site including feral pigs, foxes, hares and wild dogs.

Pest animal surveys will be undertaken annually for the first three years of each project stage, followed by every two years for the remainder of the Project in conjunction with and at the same survey locations as, the MNES habitat quality assessment surveys. Monitoring will consist of standardised timed visual observations as well as infrared camera trap monitoring. Relative abundance will be assessed using the most appropriate method as determined by the suitably qualified ecologist conducting the monitoring, and may include amongst other methods, number of animals encountered over a standard time frame, or a standard transect length. Evidence of faecal samples and damage cause by feral animals (such as evidence of feral pigs in gilgai and wetlands) will be recorded by GPS and documented as part of pest animal monitoring reports.

Feral animals will also be opportunistically surveyed throughout the year outside of monitoring times during project area inspections (refer Section 6.1). Any evidence of mortality or injury to MNES as a result of feral animals will also be recorded during the pest animal surveys. If trigger levels for any feral animal species are met or exceeded, additional monitoring will be undertaken and will occur in conjunction with appropriate management measures until feral animal presence reduces to baseline levels or below. Corrective actions are set out in Table 6.1.

6.6 Dust monitoring

Pembroke will implement proactive and reactive dust control measures. These measures will include the use of weather forecasting and real-time measurement of dust levels and meteorological conditions to modify mining operations as required in order to achieve compliance with applicable air quality objectives at the nearest privately-owned receivers.

Meteorological data and TSP, PM10 and PM2.5 levels would continue to be monitored on an ongoing basis at the existing monitoring site at the Project for the implementation of operational dust controls. A network of dust deposition gauges would also be installed. If monitoring indicates any unexpected exceedances of air quality objectives, an investigation would be conducted by Pembroke, including additional dust monitoring if required.

Specific dust monitoring sites will be documented in an Olive Downs Air Quality Management Plan to be approved by DES prior to Project commencement.

6.7 Noise and vibration monitoring

Pembroke will implement proactive and reactive noise control measures. These measures will include the use of weather forecasting and real-time measurement of meteorological conditions and noise levels to modify mining operations as required in order to achieve compliance with applicable noise limits at the nearest sensitive receptors.

To reduce noise emissions at the nearest sensitive receptors throughout the life of the Project, Pembroke would enclose a portion of the overland conveyor and utilise low noise idlers.

Noise levels will be required to meet the thresholds specified in Project's Environmental Authority (EA) and specific monitoring locations will be documented in the Olive Downs Noise Management Plan to be approved by DES prior to Project commencement.

6.8 Erosion and sediment control

Six monthly general inspections of the Project area will identify any areas of erosion that may require addressing.

During vegetation clearing and construction phases erosion and sediment control measures will be inspected by a suitably qualified person on a monthly basis and post any significant rainfall event.

6.9 Fire and fuel load monitoring

Fire management within the Project area will be undertaken in accordance with the requirements of the Coal Mining Safety and Health Act 1999 (CMSHA), Coal Mining Safety and Health Regulation 2017 (CMSHR) and the Safety and Health Management Systems (SHMS) to mitigate fires from mining activities that have the potential to spread to MNES habitat. The CMSHR includes monitoring and review requirements for the SHMS.

Thresholds for biomass and fuel load are outlined in the grazing management Section 5.2.3 and Table 5.3. Monitoring of these measures being: weed cover, biomass cover and height of dominant grasses will occur every month while grazing is occurring. This monitoring will be undertaken on an ongoing basis for the life of the Project by the site manager who is responsible for managing livestock and meeting requirements under this MMP.

Habitat quality monitoring as outlined in Section 6.1 will also measure ground cover and support monitoring of biomass and potential fire risk.

Triggers and corrective actions associated with fire are provided in Table 6.1.

6.10 Summary of MNES Monitoring Program

Monitoring that will be undertaken to determine if environmental outcomes and performance criteria are being achieved are summarised below in Table 6.1. Monitoring methods are described, and if monitoring has identified the required outcomes are not being achieved, corrective actions are identified.

Table 6.1 Monitoring Program

Performance criteria	Monitoring	Trigger for corrective action	Corrective actions	Timing of corrective action	5-yearly Interim milestones
Avoid and minimise injuries and mortality of MNES species during all Project phases.	• Undertake pre-clearance surveys at least 3 weeks prior to clearing commencing • Prior to clearing activities commencing, review pre-clearance survey results to identify all avoidance and mitigation measures required.. • Site personnel to report any vehicle strikes on fauna within the Project area within 24hrs of incident occurring to Pembroke Environment Manager. • One certified fauna spotter-catcher is present during clearing activities per vegetation clearing machine. • Incidental observation of MNES species to be reported to Pembroke Environment Manager through use of MNES sighting forms. • Every 6 months monitoring of Koala exclusion fences and Glider crossings will occur.	• MNES species mortality or injury detected during any phase of the Project.	• Investigate and review incidence of an injury to, or the mortality of an MNES species to determine appropriate action. Actions will include but are not limited to: - increased monitoring - installation of additional avoidance/mitigation structures (e.g. fencing) - increased number of fauna spotter catchers. <u>During clearing</u> • If injury or mortality occurs during clearing stop clearing until corrective active have been implemented. <u>Vehicle Strikes</u> • Slow vehicle speed further. • Install speed bumps or similar speed reduction measures at strategic locations and high risk areas (adjacent to MNES habitat, riparian corridors) to ensure the reduction of vehicle speed. • Install additional fauna exclusion fences adjacent to access roads.	• Review of MNES injury or mortality incidence to be undertaken within 5 business days of notification. Refer Section 7.5 for incident reporting. • If relates to vegetation clearing, implement corrective action prior to the recommencement of any clearing activities. • If additional exclusion fencing is required this will be installed within one month of injury or fatality occurring.	• Injuries or mortality to MNES species have been avoided and/or minimised.
Ensure the project does not result in loss of MNES species habitats and Brigalow TEC outside of approved disturbance limits (as described in Table 1.1).	• Pembroke Site Manager to check delineation of boundaries and sign off prior to clearing commencing. • Six monthly general inspections of Project area to check clearing and construction areas have not exceeded approved areas for disturbance. Also check vehicles and machinery are not going off designated tracks. Refer 6.1.	• Clearing of MNES species habitat exceeds the approved disturbance limits provided in Table 1.1. • Evidence of disturbance to areas outside of approved limits (such as temporary work area or laydown placed outside of permitted area, vehicles going off tracks etc).	• Clearing works are to cease immediately and DAWE notified of the incident within five business days. The incident will be recorded in the Project's environmental and incident reporting system register. • Rehabilitation of the additional area that was cleared or disturbed. • Provide an offset for the cleared area if determined to be a significant impact to MNES.	• Suitable corrective action to be agreed with DAWE post notification. • If rehabilitation/revegetation is required this will commence within two months of DAWE agreed action/s. • If an additional offset is required timing will be agreed with DAWE.	• Greater Glider – no more than 978.5 ha of Greater Glider habitat cleared by the end of Stage 1 and 469.10 for Stage 2 • Squatter Pigeon – no more than 855 ha of Squatter Pigeon breeding habitat and 135.5 ha of foraging habitat for Stage 1. No more than 359.97 ha of Squatter Pigeon breeding habitat and 108.9 ha of foraging habitat cleared by the end of Stage 2 • Ornamental Snake – no more than 1,032 ha of Ornamental Snake habitat cleared by the end of Stage 1. No more than 550.71 ha cleared by the end of Stage 2. • Koala – no more than 1,110.5 ha of Koala habitat cleared by the end of Stage 1. No more than 533.37 ha of Koala habitat cleared by end of Stage 2 • Australian Painted Snipe – no more than 16 ha of Australian Painted Snipe habitat cleared by the end of Stage 1. No Painted Snipe habitat to be cleared in Stage 2. • Brigalow TEC – no clearance of Brigalow TEC by the end of Stage 1 or Stage 2. • 5 yearly interim reports issued to DCCEEW summarise the clearing areas and any areas of MNES retained, confirming MNES impacts are within approved limits. • GIS shapefiles provided to DCCEEW of cleared areas at 5 yearly interim reviews.

Table 6.1 Monitoring Program

Performance criteria	Monitoring	Trigger for corrective action	Corrective actions	Timing of corrective action	5-yearly Interim milestones
All MNES species habitat and Brigalow TEC outside of the Project stages are retained and managed to maintain habitat quality and utilisation by MNES.	• Habitat quality assessments in retained MNES habitat will be undertaken annually for the first five years in Stage 1. It will then go to every second year for Years 5-10. Then every 5 years for remainder of the Project.(Section 6.3). • Targeted MNES surveys in retained MNES habitat described in Section 6.3.2 will commence in Year 2. • Monitoring will be undertaken in accordance with the State guidelines for determining terrestrial habitat quality. These methods are outlined in the *Guide to determining terrestrial habitat quality* (DES 2020). • Pest animal monitoring as per Section 6.5. • Weed monitoring as per Section 6.4. • Six monthly general inspections of Project area to check koala exclusion fencing and poles are in good condition. Refer 6.1.	• Monitoring shows habitat quality scores have decreased from baseline score in >20% of monitoring sites. • Permanent weed monitoring transects show a 20% increase in weed abundance and cover. Pest animal monitoring shows habitat disturbance is occurring to MNES species habitats such as feral pigs in wetland areas.	• Larger scale habitat quality assessment will be completed across the whole area being retained. • Increased habitat quality assessment frequency • Should a decline in habitat quality scores be observed, the cause will be investigated and detailed in the annual report (Section 7.1). • Should a decline in habitat utilisation by MNES species be observed, the cause will be investigated and detailed in the annual report (Section 7.1). • Investigation of additional impact mitigate measures. • Should a habitat quality decline and/or decline in habitat utlisation be determined to be Project attributable, corrective actions will include but not be limited to: – an increase in frequency of weed management; – changing weed control methods; – increase in feral animal control; – increasing the frequency of dust suppression techniques; and – repair fences if damaged, or installation of new fencing; and – environmental offsets to be approved by the Minister. An environmental offset proposal will be submitted for approval in the event corrective actions have not resulted in MNES habitat usage.	• Corrective actions will be developed by a suitably qualified ecologist within 15 business days of the decline being detected. • Identified corrective actions will be implemented within one month of corrective actions being agreed.	• Monitoring demonstrates habitat quality for MNES habitats (outside of approved stages) has not declined from the baseline. • Connectivity for Koalas through the use of exclusion fencing and poles is maintained. • Water quality in retained dams and wetlands is maintained to ensure quality of habitat for Squatter Pigeon and Australian Painted Snipe is not reduced. • MNES species utilisation of habitat areas outside of approved disturbance limits is maintained. No project attributable decline in numbers occurs. • 5 yearly interim reviews will summarise the results of habitat quality monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.
Prevent the introduction and/or spread of weeds and/or disease within the Project area.	• Six monthly general inspections of Project area will identify any new weed outbreaks that may occur outside of designated weed monitoring sites. Refer 6.1 • Permanent weed monitoring transects to be undertaken as per Section 6.4 • Weed monitoring will also occur as part of the habitat quality assessments in MNES habitats being retained. Refer Section 6.3 for habitat quality assessments methods.	• New areas of weed outbreaks. • Permanent weed monitoring transects show a 20% increase in weed abundance and cover.	• Should an increase in weed cover or presence of new weed outbreaks be observed, an investigation will be undertaken to determine the cause. This will involve reviewing adherence to the Weed and Pest Management Plan and an assessment of the distribution of weeds within the Project area to determine the cause of the incursions. • Appropriate corrective actions will include but not be limited to: – an increase in frequency of weed management; – changing weed control methods; – increasing weed hygiene practices ; – changes to grazing regime; and – increase in feral animal control.	• From the investigation, corrective actions will be developed by a suitably qualified person within 15 business days of the trigger being detected. • Identified corrective actions will be implemented within one month of corrective actions being agreed.	• Monitoring demonstrates weed abundance has been maintained or decreased across Project area. • 5 yearly interim reviews will summarise the results of weed monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.

Table 6.1 Monitoring Program

Performance criteria	Monitoring	Trigger for corrective action	Corrective actions	Timing of corrective action	5-yearly Interim milestones
Prevent MNES species habitat degradation as a result of pest animals.	• Monitoring of pest animals will be undertaken in conjunction with habitat quality assessments as outlined in Section 6.5. • Habitat quality monitoring will be undertaken annually for the first five years, then every second year from years 5-10, then every five years for remainder of Project. • Six monthly general inspections of the Project area will be utilised to detect evidence of feral animal activity.	• Observed increase in incidental sightings of feral animals. • Observation of any MNES species mortality from pest animals such as dog attack on Koala. • Evidence of pest animal degradation on MNES species habitats.	• Should an increase in pest animal presence, or evidence of damage to MNES habitats occur, an investigation will be undertaken to determine the cause. This will involve reviewing adherence to the Weed and Pest Management Plan. • Consultation with DAF will occur on alternative pest animal control measures. • Appropriate corrective actions will include but not be limited to: – an increase in frequency and/or duration of pest animal management events; – changing pest animal control methods; – involving neighbouring properties if pest animals are coming from adjacent areas; and – additional exclusion fencing.	• From the investigation, corrective actions will be developed by a suitably qualified person within 15 business days of the trigger being detected. • Identified corrective actions will be implemented within one month of corrective actions being agreed.	• Monitoring demonstrates habitat degradation from pest animals has reduced from baseline. • no reports of MNES fauna mortality from pest animals. • 5 yearly interim reviews will summarise the results of pest animal monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.
Minimise impacts of dust deposition on MNES habitat.	• Monitoring of dust deposition will be undertaken in accordance with the Project's Air Quality Management Plan. Refer Section 6.6.	• Dust deposition levels exceed limits outlined in the Air Quality management Plan. • Visual inspections of vegetation adjacent to the disturbance areas show visible signs of dust deposition.	• Pembroke to investigate whether the exceedance is a result of Project activities and notify the administering authority within seven days of the exceedance occurring. • Pembroke will implement additional dust abatement measures such as watering down of dirt access roads.	• Corrective actions will be implemented within 10 business days of the trigger being detected.	• Dust has been appropriately managed and has not resulted in impacts on MNES habitats. • 5 yearly interim reviews will summarise the results of dust monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.
Prevent uncontrolled fire events.	• Monitoring of biomass (groundcover including organic litter), weed cover and grass height on a monthly basis as part of grazing regime (Section 5.2.3 and Section 6.9) • During the habitat quality assessments groundcover, weed cover and woody debris will be monitored annually for the first three years then every two years thereafter (refer to Section 6.9). • Six monthly general inspections will be undertaken to ensure mining operations are implementing required fire safety procedures and fire breaks are being appropriately maintained.	• An uncontrolled fire occurs within the Project area that is due to mining activities. • Fuel loads exceed specified thresholds. • An unplanned bushfire occurs.	• Should an uncontrolled fire occur within the Project area, the Project's Emergency Response Plan will be enacted. Should any corrective actions and changes to fire management be required, they will be done in accordance with the CMSHA and CMSHR. • Changes to grazing regime may be required in response to climatic conditions. For example after high rainfall event fuel load may increase significantly. Therefore grazing intensity may need to be increased for a period of time. • Additional cool mosaic burns may be required to manage fuel loads where grazing isn't permitted. • Weed control intensity and frequency may need to be increased if weeds were a contributing factor to increase in fire risk.	• From the investigation, corrective actions will be developed by a suitably qualified person within 15 business days of the trigger being detected. • Any corrective actions identified will be implemented within 10 business days of the trigger being detected.	• Fire and fuel loads have been appropriately managed, and an unplanned bushfire has not occurred. • 'Hot' bushfires have not occurred in retained MNES habitats. • Fire has been excluded from mapped Brigalow TEC areas. • 5 yearly interim reviews will summarise the results of fire monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.

Table 6.1 Monitoring Program

Performance criteria	Monitoring	Trigger for corrective action	Corrective actions	Timing of corrective action	5-yearly Interim milestones
Maintain Greater Glider connectivity along Isaac River and provide supplementary breeding and sheltering habitat for Greater Glider.	• Monitor use of rope crossings through installation of cameras. Assess remote camera footage to identify if Greater Gliders are utilising the rope crossings. Refer Section 6.2. • Monitor Greater Gliders during Stage 1 clearing phase through radio-tracking collars. Identify if Greater Gliders are utilising installed nest boxes. Refer Section 6.2. • Undertake Greater Glider surveys to determine if they are using nest boxes such as spotlighting after dusk. • Monitor the condition of nest boxes and rope crossings.	• Greater Gliders are found not to be utilising the nest boxes after 6 months of monitoring. • Greater Gliders are not utilising the rope crossings after 12 months of monitoring. • Damage of the rope crossings and nest boxes, including pest animal occupancy in nest boxes.	• A suitably qualified ecologist will evaluate the potential reasons that nest boxes and /or rope crossings are not being utilised. • Corrective action will include but not be limited to: - relocation of nest boxes and/or adjustment of nest box height. - Change of nest box design/type installed.. - Increased monitoring frequency and duration (other programs have shown it can take many months for observations to be found). - Greater Glider surveys to determine their presence in the area. - If rope crossings are not being utilised, assess potential to change the design of rope crossings. - Relocating rope crossings. - Should any nest boxes be occupied by pest fauna species, investigate measures to reduce these species from using them.	• From the investigation, corrective actions will be developed by a suitably qualified ecologist within 20 business days of the trigger being detected. • Corrective actions will be implemented within 3 months following the corrective actions being agreed. • Should any rope crossings and nest boxes be damaged, they will be repaired within 20 business days after the damage has been identified.	• Greater Glider have been utilising rope crossings and artificial tree hollows/nest boxes. • 5 yearly interim reviews will summarise the results of monitoring and any corrective actions that have been implemented. The report will review effectiveness of those corrective actions.

7 Reporting and administration

7.1 Reporting

An 'annual report' will be prepared at the end of each calendar year. The annual report will summarise:

- all management actions that have been completed in that 12 month period;
- all monitoring that has been completed and monitoring results;
- assessment of monitoring results against performance criteria and five-year interim milestones to determine if they are being and or likely to be met; and
- identification of any issues that arose which required intervention or corrective actions to be implemented.

The annual report will feed into the annual compliance report which Pembroke is required to submit to DES. The annual report is also an opportunity to summarise findings to feed into the 5-year interim report.

The 5-year interim report will be prepared to track the past five years of monitoring and management actions. It will include a more detailed assessment against the performance criteria and five-year interim milestones for that particular project stage, any corrective actions implemented, and any adaptive management learnings will also be discussed. The MMP will be revised post these 5 yearly interim reviews if required.

7.2 Review of MMP

This MMP will undergo formal review at the completion of each project stage to evaluate the effectiveness of the MMP at managing project impacts on MNES and achieving the project's performance criteria interim milestones and environmental outcomes. As Stage 1 has only been underway for nearly 12 months, and early on set of Stage 2 a formal review prior to Stage 2 isn't proposed. The next formal review will be completed by the end of Year 6 of the Project which is prior to commencement of Stage 3.

Following each review, a revised version of the MMP will be prepared. This will allow for greater specificity and detail regarding the implementation of management measures and Project design elements for each stage of the Project (e.g project layout, fauna exclusion fencing, livestock fencing, crossings for Greater Glider), to be incorporated. Revising the MMP will also allow for avoidance, mitigation and management measures, as well as monitoring to be updated to reflect previous learnings and best practice methods at the time. Each revised version of the MMP is to be prepared by a suitably qualified person and submitted to the Commonwealth Department of Environment (presently DAWE) for the Minister's approval in accordance with the requirements of condition 78 of EPBC Approval 2017/7867.

Each project stage will not be commenced, until the associated revised MMP has been approved by the Minister. i.e. Stage 3 is not to commence until the MMP has been revised to include the necessary information as set out in condition 46 of EPBC Approval 2017/7867 for the purpose of Stage 3, and the revised MMP has been approved by the Commonwealth Minister for the Environment.

7.3 Responsibilities

All personnel undertaking Project activities are responsible for adhering to the management strategies outlined within this plan, however, the following are accountable for its implementation:

1. Project Director for initiating formal reviews of MMP.

2. Project Environmental Manager for ensuring implementation of prescribed avoidance, mitigation and management strategies for each phase within this plan.

3. Project Site Manager for ensuring this MMP is implemented during Project clearing, construction, operation and decommissioning phases.

4. Project Environment Manager to review results of the review and ensure corrective actions are implemented in a timely and effective manner.

5. Project Environment Manager for record keeping including extents of disturbance for each Phase.

7.4 Data management

The Pembroke Environment Manager will be responsible for overseeing and managing all monitoring activities and programs required as part of this MMP. This will include maintaining data records to informing how mitigation and monitoring efforts are tracking towards interim milestones as per the requirements of Condition 46(g) of the EPBC Act approval which states that frequency of monitoring must be sufficient to track progress towards each set of milestones, and sufficient to determine whether the milestones are likely to be achieved.

Data will include field survey data forms, reports, spatial data, camera footage and photos. If required, this data will be made available to DAWE upon request.

7.5 Incident reporting

Should an incident occur to a MNES such as vehicle strike, or injury or death during vegetation clearing on a threatened MNES species, the Pembroke Environment Manager will be notified within 24hrs. An internal review of the incident will be undertaken and an incident report prepared within 5 business days of Environment Manager receiving the notification.

The incident report will include recommendations as to any corrective actions that may be required to prevent the incident reoccurring.

Incident reports will be included in the annual reports which will be provided to DAWE.

8 Risk assessment

A risk assessment was undertaken using the risk assessment process provided by the DoEE to assess risks associated with failing to achieve the management objectives outlined in this MMP for mitigating impacts to MNES. For each identified risk, the potential consequence of the risk (Table 8.1) was assessed against the likelihood of that risk occurring (Table 8.2) to determine an overall risk rating using the matrix in Table 8.3.

The consequence and likelihood of each risk occurring was assessed following the implementation of the management and mitigation measures (i.e. control measures) to provide a residual risk rating.

Table 8.1 Consequence classification

Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
Minor	Minor risk of failure to achieve the MMPs objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.
Moderate	Moderate risk of failure to achieve the MMPs objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.
High	High risk of failure to achieve the MMPs objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.
Major	The MMPs objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.
Critical	The MMPs objectives are unable to be achieved, with no evidenced mitigation strategies.

Table 8.2 Likelihood classification

Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management actions have been put in place/are being implemented)	
Highly likely	Is expected to occur in most circumstances.
Likely	Will probably occur during the life of the project.
Possible	Might occur during the life of the project.
Unlikely	Could occur but considered unlikely or doubtful.
Rare	May occur in exceptional circumstances

Table 8.3 Risk rating matrix

		Consequence				
		1.Minor	2.Moderate	3.High	4.Major	5.Critical
Likelihood	5.Highly likely	Medium	High	High	Severe	Severe
	4.Likely	Low	Medium	High	High	Severe
	3.Possible	Low	Medium	Medium	High	Severe
	2.Unlikely	Low	Low	Medium	High	High
	1.Rare	Low	Low	Low	Medium	High

For the purposes of this risk assessment, the risk levels are defined as follows:

- Severe: Unacceptable risk that must not proceed until suitable and comprehensive control measures have been adopted to reduce the level of risk.
- High: Moderate to critical consequences. Works should not proceed without considerations of additional actions to minimising the risk.
- Medium: Acceptable with formal review. Medium level risks require active monitoring due to the level of risk being acceptable.
- Low: Acceptable with active management not considered required.

Table 8.4 Risk assessment and management

Risk event	Description of risk	Likelihood of occurrence	Consequence	Initial risk rating	Relevant management actions/measures	Likelihood of occurrence	Consequence	Residual risk rating	Performance criteria	Management triggers	Corrective actions	Monitoring mechanism
Clearing occurs outside of approved disturbance areas and exceeds limits.	Additional impacts to MNES occur and breach of approval conditions.	Possible	Major	High	• Infrastructure will be sited in accordance with the State and Commonwealth approval conditions. • Areas requiring vegetation removal will be clearly delineated to ensure disturbance to areas being retained is avoided. Limits of clearing are to be delineated using barricading or temporary fencing and signage prior to works commencing. Exclusion areas are to be clearly shown and labelled on all operational and management drawings and plans. • GIS shapefiles of exclusion areas will be provided to clearing personnel and/or contractors prior to the commencement of clearing operations. • Prior to entry to the Project area, all site personnel including contractors shall be made aware via toolbox talks and site information sheets, of the sensitive environs they will be working in and around and be advised of specific limitations to construction works being undertaken in or adjacent to threatened fauna habitat. All staff and contractors will be required to report sightings of SMP relevant fauna in the activity area to the EO immediately. • The EO or delegate will routinely inspect the disturbance limit boundaries to ensure that no clearing or disturbance of vegetation or habitat beyond the approved limits has taken place. • Pre-clearance surveys will be undertaken by a suitably qualified ecologist using approved State and Commonwealth survey guidelines 3 weeks prior to clearing activities commencing. • A Fauna Spotter will be present for all clearing activities and will conduct a walk-through survey prior to commencement of clearing and prior to clearing works each day to check vegetation and other fauna habitats.	Rare	Major	Medium	• Clearing is within approved disturbance limits. • No evidence of clearing within exclusion areas. • No unauthorised access into the exclusion areas.	• Evidence of clearing within the exclusion areas. • Evidence of access into the exclusion zones e.g. vehicle tracks, damaged fences.	• Should clearing of habitat for MNES exceed the approved disturbance limits in Table 3.1 of this MMP and/or occurs outside of the Project footprint, clearing, works are to cease immediately. The incident will be recorded in the Project's environmental and incident reporting system register. • Assessment will occur to determine how the additional clearing occurred. • Illegal clearing will be reported to DCCEEW and DES. Rectification measures of additional clearing will be agreed such as revegetation of that area.	• The Pembroke Environment Manager will monitor and record the total area of MNES habitat cleared every quarter and assess against the disturbance limits outlined in Table 3.1 of this MMP and the Project footprint as outlined in EPBC Act approval. • Field monitoring to occur twice a year will report on any evidence of unauthorised access and clearing.

Table 8.4 Risk assessment and management

Risk event	Description of risk	Likelihood of occurrence	Consequence	Initial risk rating	Relevant management actions/measures	Likelihood of occurrence	Consequence	Residual risk rating	Performance criteria	Management triggers	Corrective actions	Monitoring mechanism
Introduction of invasive weed species and/or spread of existing invasive weed species	Weed species become established and broaden their distribution in the Project area which will reduce habitat quality for MNES.	Likely	Moderate	Medium	• All vehicles entering the Project area are required to have a weed declaration form confirming their vehicle has had a certified weed washdown. • A site induction will provide weed management information to staff, contractors and visitors. • Access to the retained habitat areas will be limited. • Chemical/grazing control methods of control.	Unlikely	Moderate	Low	• No new weed species in the Project area. • No increase in the density of existing weeds. • Decrease in exotic pasture cover. • Non-native cover less than 10%.	• New weed species detected. • Increase in density of existing weeds. • Failure of weed control attempts. • Weed cover is greater than 10%.	• An investigation will be undertaken to determine the cause of increased weed cover. This will involve reviewing adherence to the Weed and Pest Management Plan and an assessment of the distribution of weeds within the Project area in relation to baseline to determine the cause of the incursions. • Increase frequency and/or duration of weed control efforts. • Investigate and/or implement alternate weed management control actions. • Amend weed hygiene practices.	• The Weed and Pest Management Plan will document weed presence, weed control measures and relevant management options.
Increased populations of invasive animals	Populations of invasive fauna species increase or are incorrectly managed.	Likely	Moderate	Medium	• Use of baiting (1080/PAPP) in pre-selected areas where invasive animal populations are high. • No domestic dogs allowed on site. • A site induction will provide information about invasive animals to staff, contractors and visitors.	Unlikely	Moderate	Low	• No increase in invasive animal populations. • No new invasive animals detected.	• Increase in invasive animal populations. • New invasive animals detected.	• Develop species specific additional measures to manage invasive animals.	• The Weed and Pest Management Plan will document invasive animal presence, control measures and relevant management options.
Vehicle strikes to MNES and other fauna	Site vehicles striking MNES and other fauna resulting in injury or mortality.	Likely	High	High	• Vehicular traffic to be restricted to designated access tracks and an on-site speed limit would be applied. • Speed limit signs to be installed on each road and in a number of locations. • Wildlife signage to be installed at key fauna habitat areas such as the main access road into site to identify potential for wildlife to be present and crossing the road. • A site induction will provide fauna injury information, including carers contact details, to staff, contractors and visitors. • Fauna exclusion fencing to be installed to minimise fauna getting into high risk areas.	Possible	High	Medium	• Avoiding and minimising MNES or other fauna injury or death.	• Any injury or mortality to a MNES species.	• An investigation will be undertaken to determine the cause of the fauna injury/mortality. • Reduce vehicle speeds further. • Erect additional fauna exclusion fencing in identified ‘hot spots’ where fauna are more likely to be present or injury occurred.	• The EO will monitor and record the total number of vehicle strikes.

Table 8.4 Risk assessment and management

Risk event	Description of risk	Likelihood of occurrence	Consequence	Initial risk rating	Relevant management actions/measures	Likelihood of occurrence	Consequence	Residual risk rating	Performance criteria	Management triggers	Corrective actions	Monitoring mechanism
Uncontrolled or unplanned fires	An uncontrolled or unplanned fire occurs because of project activities.	Likely	Major	High	• Fire breaks maintained around the Project area including buffers around potential ignition sources such as plant and machinery, haul roads and mine infrastructure areas. • Strategic grazing will be used to control biomass (groundcover including organic litter) where appropriate/necessary. • When necessary, hazard reduction burns prior to the dry season will be undertaken in consultation with the Qld RFS. Consultation with RFS will also be required for controlled burning at appropriate intervals. • A site induction will provide fire safety information to staff, contractors and visitors.	Rare	Major	Medium	• No uncontrolled or unplanned fires occur. • Biomass at sustainable levels.	• Uncontrolled or unplanned fires occur. • Fire damage to the Project area. • Biomass increase.	• Should an uncontrolled fire occur within the Project area, the Project's Emergency Response Plan will be enacted. • Identify source of the fire and ensure encroachment pathway managed. • Monitoring of fuel loads for fire management will be undertaken during habitat quality assessments. • Increase the frequency of biomass control measures and monitoring.	• The EO will monitor and record any fires that occur. • Field monitoring will report on any cases of uncontrolled or unplanned fires.
MNES habitat degradation	Habitat degradation and a decline in habitat values within MNES habitat.	Likely	Moderate	Medium	• Areas of MNES habitat adjacent to the disturbance footprint and within the Project area (i.e. mine lease) not to be cleared, will be clearly delineated and shown and labelled on all operational and management drawings and plans. • Site access is only to occur along designated site access tracks. No unauthorised access is permitted. • Selected trees and/or logs will be salvaged and reused as fauna habitat to enhance retained vegetation habitat values (e.g. within Isaac River and Ripstone Creek). Trees and other habitat features to be salvaged will be identified and flagged by the Fauna Spotter/Catcher during the walk-through survey and/or clearance activities. • Feral animals and weeds will be managed in accordance with the Project's Weed and Pest Management Plan. • Light spill will be directed to the open cut pits to minimise light spill. • Fences will be erected along major riparian corridors to minimise damage from livestock.	Unlikely	Moderate	Low	• No evidence of clearing in exclusion areas. • Decreased abundance of feral animals and weeds. • No evidence of livestock, erosion, compaction or degraded water quality.	• Evidence of clearing within exclusion areas. • Increased presence of feral fauna and weeds. • Habitat quality scores decreasing over two consecutive monitoring periods. • Evidence of livestock, erosion, compaction or degraded water quality.	• Habitat quality assessments in MNES habitat will be undertaken. • Develop species specific management plans. • Rehabilitation of MNES habitat. • Increasing feral animal and weed control measures or revising the type of measures implemented. • Repair fences if damaged, or installation of new ones.	• Field monitoring will report on evidence of MNES habitat degradation.
Trapped MNES fauna	MNES fauna become trapped in the mining Project area.	Possible	Moderate	Medium	• Koala exclusion fencing and poles to be installed. • Glider rope crossings to be installed. • Fauna exit ramps to be installed in trenches. • Fauna bridge across Isaac River to be installed.	Unlikely	Moderate	Low	• No evidence of MNES fauna being trapped within the mining Project area.	• MNES fauna being trapped within the mining Project area.	• An investigation will be undertaken to determine the cause of MNES fauna being trapped in the mining Project area. • Amend fauna crossing methodologies and equipment. • Increase monitoring of fauna crossings by installing remote sensing cameras in relevant areas.	• Field monitoring will report on evidence of trapped MNES fauna.

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Appendix A

Curricula vitae

Berlinda Ezzy

Associate Director – Ecology
EMM Consulting Pty Limited

Professional Overview

Berlinda is an Associate Director and Ecology Team Lead for Queensland with over 20 years of professional experience. She has worked for local and state government, as well as the private sector, across a range of environmental disciplines. Berlinda's areas of expertise include environmental planning and approvals, threatened species management, coordinating delivery of field ecology surveys and reporting and biodiversity offsets.

Due to Berlinda's experience in both government and consulting she has an in-depth knowledge of environmental legislation and policy including EPBC Act. Berlinda has led the preparation of numerous EPBC Act referrals, undertaken significant impact assessments and successfully developed and delivered environmental offset packages.

Berlinda has highly developed communication skills and works closely with proponents to tailor solutions for their projects to ensure approvals are granted in a timely manner.

Qualifications and licences

Bachelor of Applied Science (Honours) Natural Systems and Wildlife Management, University of Queensland, 1998

Specialisation

Environmental planning and approvals

Threatened species management

Biodiversity offsets

Field ecology surveys (coordination and delivery)

Representative experience

Infrastructure

- Inland Rail Gowrie to Kagaru – led delivery of targeted threatened species surveys, vegetation community surveys, BioCondition assessments, habitat mapping and habitat scoring, Qld (ARTC)
- Inland Rail (Qld sections) – development of a biodiversity offset multi-criteria offset spatial analysis tool including identification of biodiversity offset sites and Offset Strategy that addressed all sections, Qld (ARTC)
- Inland Rail (Qld Geotech Program) preparation of EPBC Act referral, protected plant surveys, Protected Plant Reports, Clearing application under NC Act, Environmental Management Plan, Approvals Strategy and Species Management Program, Qld (ARTC)
- Moomba to Wilton Pipeline, ecology and cultural heritage surveys and due diligence assessments of proposed maintenance areas, Western Qld, NSW and South Australia (APA)

Oil and gas

- Spring Gully Gas Project -led EPBC Act referral, MNES significant impact assessments, environmental offset analysis and advice, Env Offset Strategy, Central Qld (Origin Energy)
- Bowen Gas Project & Surat Gas Project -led EPBC Act referral, identification of environmental offset properties, ecology surveys of offset properties, landholder engagement and preparation of offset management plans, Central Qld (Arrow Energy)
- Australia Pacific LNG- preparation of Threatened Species Management Plans, Central Qld (Origin Energy)

Mining

- Olive Downs Coal Mine – led preparation of EPBC Act MNES Management Plan, High Risk SMP, EPBC Act Environmental Offset Mgt Plan, baseline ecology surveys, engaging with government regulators (Pembroke)
- Olive Downs Coal Mine – providing strategic advice and baseline surveys for implementation of management plans including nest boxes, Greater Glider research, Koala tracking, feral animal surveys etc.
- Blackwater Coal Mine, coordination of baseline surveys including terrestrial and aquatic ecology, threatened species habitat mapping, groundwater and noise for proposed future expansion, central Qld (BMA)
- Blackwater Mine - ecology surveys including habitat mapping and significant impact assessments for proposed seismic investigations (BMA)
- Bauxite Hills Mine Project - coordination of seasonal terrestrial and aquatic surveys, significant impact assessments, EPBC Act referral, Cape York (Metro Mining)
- Bauxite Hills Mine Project- preparation of Environmental Offset Strategy (addressing State and Federal requirements), Cape York (Metro Mining)
- Kevin's Corner Coal Mine - coordination of terrestrial ecology surveys, impact assessments, preparation of environmental offset strategy, EPBC Act referral, Galilee Basin (Hancock Galilee)
- Mount Isa Mines - Biodiversity studies including vegetation community surveys, fauna surveys and condition assessments, Mount Isa (Mount Isa Mines)
- Moorlands Coal Project - environmental offset strategy, central Qld (Cuesta Coal)
- Walton Coal Mine - Environmental Offset Strategy, central Qld (Aquila Resources).

Auditing

- Audit of application of Koala state planning regulatory provisions and offsets, South East Qld (Moreton Bay Regional Council)
- Audit of solar farm approvals and requirement for EPBC Act referral, Gympie (AMP Power)

Renewable energy

- Specimen Hill Wind Farm – coordination of field ecology surveys including threatened species, vegetation communities, EPBC Act referral and MNES/MSES significant impact assessments, lodgement of s22A, vegetation management plan and fauna management plan.
- Specimen Hill Wind Farm – preparation of clearing applications for protected plants under NC Act including Cycas megacarpa
- Boulder Creek Wind Farm - coordination of field ecology surveys including threatened species, vegetation communities, EPBC Act referral and MNES/MSES significant impact assessments, lodgement of s22A, vegetation management plan and fauna management plan.
- Boulder Creek & Specimen Hill Wind Farms – preparation of Environmental Offset Strategies including completion of calculators and identification of offset sites.

Government

- Provision of strategic advice and analysis on review of current environmental offset framework in Queensland including specific advice regarding pros and cons of mitigation banking, Qld (Department of Environment and Science)

Statutory planning and development approvals

- Berlinda has worked for both state government and local government in Queensland for over 10 years undertaking development assessments and developing policy and legislation regarding environmental management and threatened species conservation. Berlinda has an in-depth understanding of biodiversity matters listed under EPBC Act, NC Act and impact assessment requirements and regulator expectations.

Andrew Jensen

Associate Ecologist | Team Leader - Ecology
EMM Consulting Pty Limited

Professional Overview

Andrew has 15 years' consulting experience across a range of environmental disciplines and industries including mining, renewables, and oil and gas.

Key aspects of his work have included ecological reporting and leading field surveys, preparation of environmental impact statements, preparation of management plans, environmental offset plans, management of subcontractors and health and safety processes. Andy has also led preparation of a number of EPBC Act referrals including recently for two large wind farms.

Andrew routinely reviews environmental technical studies and has developed environmental management plans and negotiated environmental approval conditions for clients. Andrew has also been responsible for conducting a number of species impact significance assessments at both Commonwealth and state level.

Qualifications and licences

Bachelor of Science (Hons), University of St Andrews, 2003

Specialisation

Ecological assessment and reporting

Representative experience

- Specimen Hill windfarm, Ecological Surveys and EPBC referral, Biloela (Epuron)
- Boulder Creek windfarm, EPBC referral and ecological surveys, Mount Morgan (Epuron)
- Cooloola Great Walk, Review of EPBC referral, Brisbane (Queensland Parks and Wildlife Service)
- Blackwater Tailings Project, Blackwater (BHP)
- ARTC Inland Rail Project, Supplementary Fauna Surveys, Brisbane and SEQ (ARTC)
- Olive Downs Coal Mine Project, MNES surveys and monitoring, Moranbah (Pembroke Resources)
- Townsville Energy and Chemicals Hub Project, EPBC referral, Townsville (QPM)
- Queensland Coal Assets, Secondment to BHP, Brisbane (BHP)
- ARTC Inland Rail Project, Preclearance surveys for Geotechnical Program, Brisbane and SEQ (ARTC)
- Blackwater Mine Seismic Surveys, MNES Significant Impact Assessments, Brisbane (BHP)
- Mole River Dam, Ecological Constraints Report and Scoping Report, Brisbane (Water NSW)
- Carmichael Coal Mine, Secondment to Adani Mining, Brisbane (Adani Mining)
- Queensland Oil Refinery, Ecological Surveys, Gladstone (Queensland Oil Refinery)
- Mount Fox Windfarm, Ecological Constraints Report, Brisbane (Windlab)
- Blackwater Mine, Ecological Surveys, Blackwater (BHP)
- McPhillamys Gold Mine, Ecological Surveys and Biodiversity Assessment Report, Blayney NSW (Regis Resources)
- Tipton West Dalby Pipeline, Ecological Surveys, Dalby (APA Group)
- Rugby Run Solar Farm, Secondment to Adani Renewables, Brisbane/Moranbah (Adani Renewables)
- Reedy Creek Wallumbilla Pipeline, Ecological Surveys, Reedy Creek (APA Group)
- Styx Coal Mine, Supplementary Ecological Surveys, Marlborough (Waratah Coal)
- Bauxite Hills Mine, Ecological Surveys, north of Weipa (Metro Mining)
- Williamtown Airport – expansions, Newcastle (Defence Australia)
- Elk Antelope gas field, Preparation of ESIA, Papua New Guinea (Total E&P PNG Limited)
- Cape River Substation, Vegetation clearing permit, Pentland (Windlab)
- Frieda River Project, Aquatic Ecology Impact Assessment, Papua New Guinea (PanAust)
- Kennedy Energy Park, Ecological assessment and EPBC referral, Hughenden (Windlab)
- Chifley Road upgrade, Review of Environmental Factors, Chifley NSW (Roads and Maritime
- Granville Platform Upgrade, Review of Environmental Factors, Granville NSW (Sydney Trains)
- Erskineville platform upgrade, Review of Environmental Factors, Erskinville NSW (Sydney Trains)
- Menangle Park gas pipeline, Review of Environmental Factors, Menangle Park NSW (Jemena)
- Riverwood Bridge upgrade, Review of Environmental Factors, Riverwood NSW (Sydney Trains)
- P'nyang Project appraisal well, Preparation of ESIA, Papua New Guinea (Oil Search)
- P'nyang Project, Preparation of EIS, Papua New Guinea (Esso PNG P'nyang Ltd)
- Former Mary Kathleen uranium mine, Environmental Condition and Rehabilitation Assessment, near Mount Isa (Queensland Government)
- Sarsfield Gold Mine Expansion Project Supplementary Report to the EIS, Ravenswood (Carpentaria Gold)
- PNG LNG Pipeline Project, Preconstruction Environmental Surveys, Papua New Guinea (Spiecapag)

- PNG LNG Project, Secondment to ExxonMobil, Papua New Guinea (ExxonMobil)
- Moura Pipeline, Ecological Assessment and EPBC Referral, Moura (Queensland Nitrates)
- Hillalong Project, Ecological Surveys for reassignment of vegetation mapping, Glenden (Shandong Energy)
- Surat Gas Project, Supplementary Report to the EIS, Brisbane/Surat Basin (Arrow Energy)
- Arrow LNG Plant, Supplementary Report to the EIS, Brisbane/Gladstone (Arrow Energy)
- Moranbah Gas Project, Threatened Species Management Plan, Brisbane (Arrow Energy)
- Arrow LNG Plant, Preparation of EIS, Brisbane/Gladstone (Arrow Energy)
- Pagham Harbour Coastal Defence Scheme, Preparation of EIS, Pagham UK (Environment Agency)
- QE2 Teesport Berth Development, Preparation of EIS, Teesport UK (PD Teesport)
- Round 3 Offshore Windfarms, Review of Ecological Constraints, Edinburgh UK (Airtricity)
- Onshore Windfarm bird survey methodology design, Edinburgh UK (Enertrag)
- Dover Harbour Terminal 2 Development, Preparation of EIS, Dover UK (Dover Harbour Board)
- Dudgeon Offshore Windfarm, Preparation of EIS, Edinburgh UK (Dudgeon Offshore Wind)
- Elgin Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)
- Seaham Harbour Redevelopment, Preparation of EIS, Seaham UK (Durham Council)
- Titchwell Managed Realignment, Preparation of EIS, Norfolk UK (Royal Society for the Protection of Birds)
- Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys and Preparation of EIS, Elgin UK (Moray Council)
- Helix Project Phase II, Ecological Surveys, Grangemouth UK (British Waterways)
- Forres (River Findhorn) Flood Alleviation Scheme, Ecological Surveys, Elgin UK (Moray Council)
- Proposed Firth of Forth Windfarm, Review of Constraints, Edinburgh UK (Airtricity)
- Seahouses seawall upgrade, Ecological Surveys, Seahouses UK (Northumbria Council)
- Thames Estuary Maintenance Dredging, Review of Ecological Data, London UK (Port of London Authority)
- BERR Offshore Energy Strategic Assessment, Review of Survey Method, Edinburgh UK (BERR)
- Bo'ness Harbour Development, Wintering Bird Management Plan, Bo'ness UK (ING Estate)
- Brent Decommissioning, Sensitivity Assessment and Environmental Risk, Edinburgh UK (Shell)
- Canvey Biodiesel Plant, Preparation of EIS Addendum, Canvey UK (Sure Green Fuels)
- Barrow Waterfront Harbour Revision Order, Preparation of EIS, Barrow UK (West Lakes Renaissance)
- Trow Quarry Remediation Project, Ecological Surveys and Preparation of EIS, Trow UK (South Tyneside Council)
- Isle of Grain Windfarm, Review of Ecological Data, Isle of Grain UK (British Petroleum)
- Newhaven Desalination Plant, Preparation of EIS, Newhaven UK (Clarity Ltd)
- Strangford Lough Marine Current Turbine, Preparation of EIS, Strangford UK (SeaGen Ltd)
- Thanet Offshore Windfarm, Preparation of EIS Addendum, Thanet UK (Warwick Energy)
- River Carron Forth Gateway Project, Ecological Surveys, Grangemouth UK (British Waterways)

Nathan Garvey

Associate Director – Ecology | Division Leader – Ecology, Heritage, Spatial Solutions, Transport, Acoustics, Air Quality
EMM Consulting Pty Limited

Professional Overview

Nathan is an experienced ecologist with over 20 years' practice in ecological assessment and approvals across eastern Australia. Nathan has delivered projects across a diverse range of sectors including mining, oil and gas, linear infrastructure, renewable energy and residential development. Nathan is practitioner of biodiversity assessment and approvals, including biodiversity assessment for major projects and EPBC Act referrals. He is one of NSW's leading experts in biodiversity approvals and offsetting and his services are actively sought by public and private sector clients.

Nathan provides an innovative, whole-of-project approach, delivering solutions for our clients and working with teams to ensure high quality outcomes.

Qualifications and licences

Bachelor of Science, University of NSW, 2001

Graduate Diploma (Biological Science), University of NSW, 2003

Certified Environmental Practitioner (CEnvP)

Biodiversity Assessment Method (BAM) Accredited Assessor

Environment Institute of Australia and New Zealand (EIANZ) – Member since 2007

Specialisation

Biodiversity assessment and approvals

Biodiversity offsetting

Representative experience

Biodiversity assessments

- Dungowan Dam biodiversity assessment (Water Infrastructure NSW)
- Mole River Dam, biodiversity assessment (Water Infrastructure NSW)
- Snowy 2.0, biodiversity assessment and EPBC referral, Kosciuszko National Park NSW (Snowy Hydro Ltd)
- Dunmore Quarry, biodiversity assessment, Dunmore (Boral)
- Upper Thredbo Valley Track, Review of Environmental Factors, Thredbo (NSW National Parks and Wildlife Service)
- McPhillamys Gold Project, biodiversity assessment, Blayney (Regis Resources)
- New England Solar Farm, biodiversity assessment, Uralla (UPC Renewables)
- Mugga Quarry, biodiversity assessment and EPBC referral, Symonston (Boral)
- Gulgong Solar Project, biodiversity assessment, Gulgong (Vena Energy)
- Wagga Wagga Solar Project, biodiversity assessment, Gulgong (Vena Energy)
- Orange Grove Solar Farm, biodiversity assessment, Orange Grove (Overland Sun Farming)
- Quorn Park solar project, biodiversity assessment, Parkes (Renewable Energy Consultancy)
- Blueys Estate Planning Proposal, biodiversity assessment, Blueys Beach (City Plan Services)
- Wee Waa Solar Farm, biodiversity assessment, Wee Waa (Overland Sun Farming)
- Junee Solar Farm Grid Connection Biodiversity Assessment, Junee (Geolyse and Terrain Solar)
- Coffs Harbour Bypass, biodiversity assessment and EPBC referral, NSW (Aurecon and NSW Roads and Maritime Services)
- Goonumbla Solar Farm, biodiversity assessment, Goonumbla (Geolyse and Renewable Energy Developments)
- Gunnedah, Limondale, Hay and Hillston Solar Farms, biodiversity assessments, NSW (Overland Sun Farming)
- Walgett Solar Farm, biodiversity assessment and biodiversity management plan, Walgett (Geolyse and Epuron)
- Amended Rocky Hill Coal Project, biodiversity assessment, targeted fauna surveys and EPBC referral, Gloucester (RW Corkery & Co and Gloucester Resources Limited)
- Yarraman Abattoir and Feedlot, biodiversity impact assessment, Yarraman (KMH Environmental)
- Brandy Hill Quarry Expansion, biodiversity impact assessment, Brandy Hill (Hanson Construction Materials)
- Underground Expansion Project, biodiversity assessment and EIS for the EPBC referral, Wollongong (Hansen Bailey and Wollongong Coal)
- Nyngan Inground Storage, biodiversity assessment, Nyngan (NSW Public Works)
- Crest Road Albion Park, flora and fauna assessment, Albion Park (MMJ Wollongong and Spinitu)
- Princes Highway Upgrade, Foxground and Berry Bypass, biodiversity assessment, Foxground (AECOM and Roads and Maritime Services)
- Princes Highway Upgrade, Berry Bypass, biodiversity assessment, Berry (AECOM and Roads and Maritime Services)
- AGL Camden North Gas Project, flora and fauna assessment, Camden (AGL Upstream Investments)
- Dundas Tablelands Wind Farm, detailed flora and fauna assessment, Casterton (Origin Energy)
- Underground Expansion Project, biodiversity offset strategy, Russell Vale (Wollongong Coal)

Biodiversity Offsets

- Darkinjung Local Aboriginal Land Council Conservation Land Strategy (Darkinjung LALC).
- NSW Biodiversity Offsets Scheme: Guidance on Partial Loss (Biodiversity Conservation Division)
- Cumberland Plain Conservation Plan Biodiversity Certification Review (Biodiversity Conservation Division)
- Strategic Advice on the Biodiversity Offsets Scheme (Landcom and Biraban Local Aboriginal Land Council)
- Snowy 2.0 Transmission Connection, biodiversity offset strategy (Snowy Hydro Ltd and TransGrid)
- NSW Biodiversity Offsets Scheme Strategic Reforms, advice to Reginal NSW (Department of Regional NSW)
- Issues paper on the NSW Biodiversity Offsets Scheme (Urban Development Institute of NSW)
- Environmental Offset Calculator (WaterNSW)
- Snowy 2.0 Exploratory Works, biodiversity offset framework and strategy (Snowy Hydro Ltd)
- Gunlake Quarry, BioBanking agreement, Marulan (Gunlake Quarries)
- 33 – 35 Warradale Road, Silverdale: credit sourcing and retirement, Silverdale (SitePlus and TRN Group)
- Western Sydney Priority Growth Areas, biodiversity advice (Office of Environment and Heritage)
- Wilton Gardens and Wilton East, biodiversity offset advice and strategy, Wilton (Country Garden Australia)
- Albion Park Rail Bypass project, offset site advice, Albion Park (Shellharbour City Council)
- BioBanking Assessor services, various location in NSW (NSW Office of Environment and Heritage)
- Redgum Ridge Western Precinct, biodiversity certification, Figtree (Clifford Developments)
- Redgum Ridge Western Precinct, BioBanking Agreement, Figtree (Clifford Developments)
- 89 Port Stephens Drive Taylors Beach, BioBanking Agreement and BioBanking Statement, Taylors Beach (Port Stephens Council)
- Lots 4 and 6 DP 243079 Wilton, BioBanking Agreement, Wilton (Weaving Family Trust)
- 33 – 35 Warradale Road, Silverdale, BioBanking Statement, Silverdale (SitePlus and TRN Group)
- 33 – 35 Warradale Road, Silverdale, BioBanking Agreement, Silverdale (SitePlus and TRN Group)
- NorthConnex, biodiversity offset strategy, Sydney NSW (Lend Lease Bouyeres Joint Venture)

Peer review and expert witness services

- UPG 72 Pty Ltd vs Blacktown City Council: Class 3 Hearing in the Land and Environment Court, Regent Street, Riverstone NSW (UPG 72 Pty Ltd)
- Mako Minerals Pty Ltd vs Liverpool City Council: Class 1 Hearing in the Land and Environment Court, 135 Kurrajong Rd, Prestons - Lot 103 (Liverpool City Council)
- Mako Minerals Pty Ltd vs Liverpool City Council: Class 1 Hearing in the Land and Environment Court, 125 Kurrajong Rd, Prestons - Lot 102 (Liverpool City Council)
- Austral Developers Pty Ltd vs Liverpool City Council: Class 1 Hearing in the Land and Environment Court, Ninth Avenue, Austral (Sparke Helmore Lawyers and Liverpool City Council)
- Snowy 2.0 Transmission Connection, biodiversity development assessment report review (Snowy Hydro Ltd and TransGrid)
- Cumberland Plain Conservation Plan Biodiversity Certification Review (Biodiversity Conservation Division)
- Hunter Valley Operations: proposed Striped Legless Lizard survey methods (Glencore)
- Albion Park Bypass: biodiversity stewardship site assessments for Croome Reserve and Dunmore Wetlands (Shellharbour City Council)
- Gunlake Quarry Pty Ltd vs The Minister for Planning: Class 1 Hearing in the Land and Environment Court, Modification to Consent for the Gunlake Quarry (Corrs Chambers Westgarth and Gunlake Quarry)
- IRT Culburra Beach Development Application: biodiversity assessment peer review, Culburra Beach (Illawarra Retirement Trust)
- Blueys Estate Biodiversity Assessment: peer review, Blueys Beach (City Plan Services)
- Expert review of the Addendum to NSW Biodiversity Offset Policy for Major Projects: Upland swamps impacted by longwall mining subsidence (NSW Minerals Council).
- Tarrone Gas-fired Power Station, expert witness statement, Tarrone (URS Corporation)
- Ballarat Koala Habitat Assessment, expert witness testimony to the Victorian Civil and Administrative Tribunal, Vic (VCAT)

Ecological monitoring and management plans

- Snowy 2.0 Main Works, biodiversity monitoring plan, Kosciuszko National Park (Snowy Hydro Limited)
- Snowy 2.0 Exploratory Works, biodiversity monitoring program, Kosciuszko National Park (Snowy Hydro Limited)
- Snowy 2.0 Exploratory Works, biodiversity monitoring plan, Kosciuszko National Park (Snowy Hydro Limited)
- Dunmore Hard Rock Quarry, flora and fauna management plan, Dunmore (Boral)
- Beryl Solar Farm, biodiversity management plan, Beryl (Geolyse and Downer)
- Mona Vale Road, biodiversity monitoring plan and implementation, Sydney NSW (Roads and Maritime Services)
- Walgett Solar Farm, biodiversity management plan, Walgett (Geolyse and Epuron)
- Balickera Tunnel, targeted microbat surveys, Balickera (GHD and Hunter Water)
- Additional Crossing of the Clarence River at Grafton, flora and fauna management plan, NSW (Fulton Hogan)
- Dendrobium Mine, biodiversity management plans and monitoring (Illawarra Coal)
- Longwall 6 and 7, biodiversity and upland swamp management plans, Russell Vale (Wollongong Coal)

- NRE No. 1 Colliery Dam 6 Green and Golden Bell Frog monitoring program, Russell Vale (Wollongong Coal)
- Appin Area 9, biodiversity management plan, Appin (Illawarra Coal)
- Shell Port Kembla, Green and Golden Bell Frog management plan, Port Kembla NSW (URS Australia)
- Penshurst Wind Farm, targeted surveys for the Brolga and Southern Bent-wing Bat, Penshurst (RES Australia)
- Holcim Colac Quarry, Coorangamite Water Skink translocation plan, Colac (Holcim Australia)
- Victorian Desalination Plant, targeted surveys for the Growling Grass Frog, Wonthagi (GHD)

Publications and presentations

- Creating value from natural capital: Biodiversity offsets and the double dividend. Presentation to the Jana Investors Annual Conference, November 2022.
- Disaster to recovery: A tail of the Smoky Mouse. Presentation to the EIANZ Annual Conference October 2020.
- BAM – where does fauna fit into the requirements of the new Biodiversity Conservation Act? Presentation to the Ecological Consultants Association of NSW annual conference, 2017.
- The Biodiversity Conservation Act 2016: a new framework for biodiversity assessment in NSW and how you can be prepared. Presentation to EMM breakfast seminar, Sydney, 2017.
- An assessment of changes in the extent and distribution of upland swamps in relation to longwall mining. Report to Wollongong Coal, 2015.
- The assessment and offsetting of indirect impacts. Presentation at the Biodiversity Offsetting for Mining, Infrastructure and Urban Development Conference, Sydney, 2015.
- Coastal upland swamps and longwall mining. Presentation to the Australian Institute of Mining and Metallurgy, Wollongong, 2014.
- Garvey, N, Ben-Ami, D, Ramp, D & Croft, D 2010, Survival behaviour of swamp wallabies during prescribed burning and wildfire, Wildlife Research 37(1), pp. 1–12.

Appendix B

Fauna handling procedure

The purpose of the fauna handling procedure is to outline and specify the actions to be undertaken when handling and relocating fauna during vegetation clearing or Project operations. The following procedures will take effect when a fauna species is discovered and requires handling to remove it from threat, or if it is injured, during the vegetation clearing phase or during Project operations to get it to care. This program has been developed in accordance with the Code of Practice for Care of Sick, Injured or Orphaned Protected Animals in Queensland (DES 2011).

The objective and scope of this procedure is to minimise impacts on native fauna as a result of the Project and is applicable to all native species.

i Fauna Handling procedures

Considerations for the general handling procedures of different species of different Taxa are outlined in Table B1. Depending on the circumstances certain activities (outlined in Table B2) will need to take place in response to the animals listing status (Critically Endangered, Endangered or Vulnerable), physiological requirements and condition.

Table B1 Handling of animals

Taxa	Techniques/procedures
Arboreal animals	Trees that have been identified to support hollows will be taken down with extra care and hollows will be checked by fauna spotter-catcher for arboreal mammals. Trees with hollows large enough to support Greater Glider are being managed from an elevated work platform and any species present will be removed (where possible) to avoid injury during tree clearing process. In the event an arboreal mammal is identified and caught it will be placed in a hessian bag and kept in a cool, shady place until it can be released that night into a pre-identified release site. Handling time is to be minimised.
Mammals	Potential injury from mammals to fauna spotter/catchers, if handled incorrectly, is a risk. Handling time of each individual animal should be minimised and animals should be placed in a hessian bag, canvas bag or box with ample ventilation (depending on the animal's ability to escape).
Bats	A number of bat species are carriers of the Australian Bat Lyssavirus (ABL) which any individual conducting Fauna spotter/catcher work should be vaccinated against. All bats will be stored in individual calico bags or bat nest box. Microbat species will use tree hollows and decorticating bark to roost during daylight hours therefore an assessment of each tree to be cleared will need to be completed prior to removal.
Birds	Potential injury from birds to fauna spotter/catchers, if handled incorrectly, is a risk. Handling time of each individual animal should be minimised and animals should be placed in a hessian bag, canvas bag or box with ample ventilation (depending on the animal's ability to escape).

Table B1 Handling of animals

Taxa	Techniques/procedures
Amphibians	Frogs are the only native Amphibians in Australia. Handling of frogs needs to be done with care in order to not spread the Amphibian Chytrid Fungus and is to be undertaken with the correct hygiene protocols according to the Interim hygiene protocol for handling amphibians (DEHP) and Hygiene protocols for the control of diseases in Australian frogs 2011 (DAWE 2011). Frogs and tadpoles are to be placed in disinfected plastic containers/buckets with a small amount of water and native vegetation between capture and relocation.
Non-serpentine reptiles	All reptiles should be transported in breathable hessian or canvas bags depending on the strength of the animal. Handling time of each individual should be minimised and conducted by the appropriate personnel. Varanid species are known to possess venom and bacteria in their bite with the potential to cause significant harm to personnel.
Snakes	Due to the potential lethality of a bite from many species of snakes, handling of these species should only be attempted, where required, by appropriately qualified personnel utilising the appropriate tools (snake hooks and bags) for no-contact handling.

Table B2 Activities when handling animals

Activity	Techniques/procedures
Threatened species	If habitat features with the potential to harbour threatened species (such as hollows for greater gliders) occur within the clearing path it is requirement that thorough searches are conducted in order to rule out impacts to threatened species. Searches of tree hollows large enough to support Greater Glider will be checked from an elevated work platform. If a threatened species is located within the clearing area, it will be re-located to a safe pre-determined release area.
Nests and Juveniles	If young animals or eggs are located within a nest, defer clearing (where possible) until eggs have hatched or juveniles have left the nest. If this is not possible, carefully capture or pick up any hatchlings and keep them warm. Turn over juveniles to a pre-determined wildlife carer or vet. If young arboreal mammals or birds are located within a hollow, they will be transported in boxes with appropriate furniture and placed in previously prepared nesting boxes at the pre-determined relocation site. The method of relocation will be dependent on the species.
General relocation	Animals should only be released one at a time and within the correct habitat containing the requirements for the individual animal's survival. This should not occur during times of heavy rainfall.
Release of nocturnal species	Nocturnal species, when captured during the day, must immediately be placed in a dark, secure location and re-released shortly after dusk so as to not overly stress the animal.
Injured animals	Injured animals need care according to the condition they are caught in. This needs to undertaken in accordance with the Code of Practice for Care of Sick, Injured or Orphaned Protected Animals in Queensland under the NC Act. A pre-determined veterinarian or wildlife carer will be assigned the task or tending to injuries and recovery before release. Prior to any injured fauna being taken for treatment the on site Environment Manager is to be notified, incident form provided, and approve of vet and/or carer to ensure they are appropriate and care is given in a timely manner.
Euthanasia	Euthanasia will be carried out in instances where pest animals are caught or native animals have been critically injured. Euthanasia may need to occur on site by trained and qualified fauna spotter catchers. Or euthanasia may occur by a veterinarian after the animal has been assessed.

Table B2 Activities when handling animals

Activity	Techniques/procedures
Release site selection	All release sites will be pre-selected to coincide with the quality and features of the vegetation being cleared. This will be done in order to make sure the habitat requirements of each species is met when released and gives the optimal chance for survival. Release sites will be assessed and finalised during pre-clearance ecology surveys (prior to clearing).

ii Fauna likely to be affected by vegetation clearing

Some species, such as birds or macropods are largely mobile and will not be directly impacted by the vegetation clearing procedures. Other species likely to be impacted by the vegetation clearing are:

- Arboreal species such as possums;
- Microbats residing on trees;
- Less mobile species and those dependent on certain habitat features such as lizards or nesting birds; and
- Species utilising tree hollows.

Vegetation clearing activities will result in the loss of habitat and potential injury or mortality if depending on clearing procedure. Mobile species are at risk of vehicle collision.

iii Relocation procedure

Relocation will be undertaken by a licenced Ecologist and all species records will be maintained in a register. Each individual animal will be released according to the following procedure:

1. Appropriate release sites for all predicted species will be pre-determined by the project lead ecologist;
2. Sites where habitat is suitable and similar and located close to the original capture location is preferential;
3. Relocation of nocturnal species such as Owl's or Greater Gliders will be undertaken after dusk;
4. Release during periods of heavy rainfall will be avoided; and
5. Species dependent on hollows, such as Greater Gliders, and those with young will be released into an appropriately sized nest box set-up at a pre-determined release site.

iv Fauna capture recordings

The fauna spotter catcher will maintain records of all fauna captured and relocated during the vegetation clearing works. The following details are required to be recorded by the operating fauna spotter catcher for both the capture and release locations of an individual animal:

- Collector's name;
- Start date;

- GPS location of capture;
- Number of individuals;
- Status for the period between capture and release;
- Species scientific name;
- Count;
- Date; and
- Any additional comments.

v Reporting

The lead ecologist will report all records of fauna found, relocated and euthanised to DES. The lead ecologist will report any animal injury or death of a threatened species to the Pembroke Environmental Manager.

Appendix C

Implementation schedule

Table 9.1 Implementation schedule of management actions

Activity	Management actions	Project stages and phases*																Timing and/or frequency	Related monitoring
		Stage 1				Stage 2				Stage 3				Stage 4					
		VC	C	O	D	VC	C	O	D	VC	C	O	D	VC	C	O	D		
Clearing native vegetation	Delineate exclusion areas	✓				✓				✓				✓				Prior to any vegetation clearing occurring for that stage.	Internal approval of exclusion areas prior to clearing commencing. Two general monitoring inspections per year (refer to Section 6.1 for further details).
	Fence riparian buffer zones and exclude livestock	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Fencing to exclude livestock will be installed in Stage 1. Fencing will be maintained throughout Project.	Two general monitoring inspections per year (refer to Section 6.1 for further details).
	Pre-clearance surveys	✓				✓				✓				✓				At least 3 weeks prior to clearing commencing in a designated area.	A Fauna Spotter will use results of pre-clearance surveys, and be present to monitor clearing activities (refer to Section 4.3 for further details).
	Use of fauna spotter-catchers	✓	✓			✓	✓			✓	✓			✓	✓			Immediately prior to and during any vegetation clearing occurring for that stage. As required during construction phase.	A Fauna Spotter will be present to monitor clearing activities (refer to Section 4.3 for further details).
	Koala monitoring for Stage 1	✓	✓															At least 3-4 weeks prior to clearing. Koala tracking will continue during clearing phase and continue 3 months post clearing. Applies to Stage 1 only at this stage.	Monitoring for at least 3 months post-clearing. Refer Section 5.2.8 for further detail.
	Nest box installation for Stage 1	✓	✓	✓	✓													50% of required nest boxes will be installed prior to clearing commencing.	Monitoring of nest boxes is detailed in Section 6.2 which

																		50% of required nest boxes will be installed prior to end of Stage 1 clearing phase.	includes use of cameras and visual inspections. .
Training site personnel	Inductions and pre-starts to include information on MNES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Once during site induction. Pre-starts to inform of updates as required. Training and inductions are ongoing for all stages and phases.	Internal audits of training to be undertaken annually.
Fauna connectivity structures	Koala exclusion fencing	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		Post vegetation clearing occurring in the area. Installation will be progressive as areas are ready to be fenced.	Two general monitoring inspections per year (refer to Section 6.1 for further details).
	Greater Glider rope crossings	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Post vegetation clearing occurring in the area including clearing for the river crossings. Prior to main construction activities occurring.	Rope crossings will be monitored. Further details are provided in Section 6.2.
	Fauna exit ramps		✓	✓			✓	✓			✓	✓			✓	✓		During construction. As required during operations.	Monitoring within two hours of sunrise and trapped fauna released. Additional monitoring following rainfall events (refer to Table 4.2 for further details).
	Bridge crossing Isaac River		✓				✓											First bridge to be constructed in Stage 1. Second bridge crossing to be constructed in Stage 2.	Two general monitoring inspections per year (refer to Section 6.1 for further details).
Weed management	Reducing extent of existing weeds and minimising the risk of introduction of additional weed species	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually.	Two general monitoring inspections per year (refer to Section 6.1 for further details).

Pest animal management	Minimising introduction of invasive animals and manage existing invasive animal populations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually.	Annually for the first 3 years, followed by every 2 years for the (refer to Section 6.4.2 for further details).
Grazing management	Strategic grazing to manage fuel loads and weeds	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Ongoing basis.	Fuel loads monitored regularly as outlined in Section 5.2.3. Two general monitoring inspections per year (refer to Section 6.1 for further details).
Fire management	Manage fuel load Fire break establishment and management Cool burns (when required)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Ongoing basis.	Fuel loads monitored regularly as outlined in Section 5.2.3. Two general monitoring inspections per year (refer to Section 6.1 for further details).
Sediment and erosion management	Prevent soil runoff into watercourses	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Ongoing basis.	Two general monitoring inspections per year (refer to Section 6.1 for further details).
Dust management	Water down dirt tracks Speed limits of 60km or less to be enforced	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Ongoing basis.	To be outlined in an Air Quality Management Plan to be prepared (refer to Section 6.6 for further details).
Rehabilitation	Progressive rehabilitation			✓	✓			✓	✓		✓	✓				✓	✓	Progressively as mining areas are completed and infrastructure no longer required.	To be outlined in a Rehabilitation Management Plan to be prepared.
MNES Habitat Quality Monitoring	Undertake habitat quality monitoring and scoring to detect any decrease in habitat quality. Undertake MNES habitat utilisation surveys.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Baseline scores to be established in 2022. HQ surveys will be yearly for first 5 years. Every second year for next 5 years. Then every 5 years until Project completion. MNES targeted surveys will be annually for Years 2 to 5. Then every 5 years until Project completion. .	Habitat quality monitoring is summarised in Section 6.3.

Reporting	Post-clearing report	✓				✓				✓				✓				Once after clearing.	Refer to Section 7.1 for reporting details.
	Annual report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Annually.	
	5 yearly interim report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Every five years.	
	MMP formal review				✓				✓				✓					First formal review is Year 6. Prior to commencement of Stage 3. MMP must be approved prior to commencement of each stage.	

*VC – vegetation clearing, C – construction, O – operations, D- decommissioning

Appendix D

Weed control methods

Species details	Control method (s)	Control period	Threat to biodiversity
Bellyache Bush *Jatropha gossypiifolia* QLD Biosecurity Act: Cat 3 National Status: WONS	*General controls* Mechanical control: For small infestations mechanical control will be used. As bellyache bush is shallow rooted, grubbing the plant by hand is effective. Grazing management: Pasture management to maintain ground cover post treatment significantly reduces seedlings survival through competition. Fire: If deemed suitable fire may be used to control larger infestations. Fire wouldn't be suitable along watercourses, but more if there is a larger infestation in an open grassland or open woodland. This would only occur as part of an approved fuel reduction burn. *Chemical control* Many herbicides are currently or about to be registered for bellyache bush. Below are just two examples of registered chemicals. In native pastures, apply Mtsulfuron-methyl 600g/kg, at a rate of 10 g/100 L + penetrant. Thoroughly wet plants and apply when actively growing.	Annually. September to April* At least one control event per year. * As Bellyache bush flowers throughout the year when moisture is adequate control can also occur at these times. The proposed months are designed to maximise weed-control efficiency across the entire Stage 1 and 2 offset area.	Dense infestations can occur on river flats and other areas of good loamy soil. It can take over these riparian areas reducing biodiversity values and prohibiting fauna use of the area. Fruits of bellyache bush are poisonous to humans and animals.
Brazilian Nightshade *Solanum seaforthianum* QLD Biosecurity Act: N/A National Status: N/A	*Chemical control* Cut and dab method followed by the Foliar spray method. Apply herbicide immediately to a stump that has been cut to within 15 cm of the ground. Cut-stump method. Spray herbicide to cover all leaves and stems, and ensure the area is not disturbed for 24 hours to allow herbicide uptake. *Mechanical control* For larger infestations mechanical control can be used including slashing. This will only be conducted where it won't impact on native vegetation communities.	Annually. September to April. At least one control event per year.	Species is classified as an environmental weed as it can take over bushland and riparian areas. Fruit and leaves are toxic to humans.

Species details	Control method (s)	Control period	Threat to biodiversity
Buffel Grass *Cenchrus ciliaris* QLD Biosecurity Act: N/A National Status: N/A	*Strategy* Buffel Grass is a pervasive species that is drought tolerant and grows quickly after summer rainfall. Buffel Grass has proved useful for pasture and soil retention in a wide range of environments due to its drought tolerance, high biomass, deep roots, rapid response to summer rains, relative palatability and resistance to overgrazing. However, it can outcompete native grasses and trees regenerating and increase fuel loads substantially therefore increasing risk of hot fires occurring. Therefore, the approach will be to target the reduction of Buffel Grass where it occurs in forested areas or where it is outcompeting regeneration of native grasses and trees. *Smaller outbreaks in forested areas* For small outbreaks physical removal or herbicide, or combined treatment will be undertaken. Follow-up treatment is essential. *Larger outbreaks in forested areas or regenerating areas* For mixed native-buffel pasture: manage grazing and fire to maintain diversity, eg allow native plants to recruit seedlings and set seed in good seasons. Don't graze these areas while native plants are seeding. For cleared/improved pasture: manage seed production and minimise spread into adjacent areas, remove seedlings from outside planted area. Prevent fires spreading from pastures. Apply herbicide after heavy rain to impact both mature plants and seedlings. Plants must be actively growing. Plants may be flowering but must not be seeding. Herbicide should be applied to as much of the green leaf as possible. This is best achieved through spot spraying. Repeated treatment is often required. Slashing of old foliage followed by spraying after effective rainfall can be very effective. It may be desirable to leave slashed material on the ground to protect the soil from erosive rainfall. Follow up with further spraying or grubbing of surviving plants and seedlings when actively growing. Slashing will only be done if native saplings are not impacted.	Two events per year. This is due to follow up treatment being required. Control most effective after summer rains when in growth phase.	Buffel Grass has spread well beyond planted areas and can dominate the ground layer in many native plant communities. It reduces native plant diversity and can affect vegetation structure by changing fire regimes. It has potential to outcompete regeneration of native grasses and trees and increase risk of hot bushfires.

Species details	Control method (s)	Control period	Threat to biodiversity
Castor Oil Plant *Ricinus communis* QLD Bio Act: N/A National Status: N/A	*Manual control* Individual plants or small infestations may be removed by cut stump and foliar spray. *Chemical controls* Fluroxypyr 333 g/L (eg Starane Advanced) applied at a rate of 30 mL/10 L water. This requires PVMA permit PER11463; the permit expires 30/06/2023. Method: Foliar spray (backpack). Read permit and label carefully. Fluroxypyr is suitable for native and exotic areas (DoAF 2020a).	Annually. September to April. At least one control event per year.	It is regarded as an environmental weed due to its ability to dominate understorey of bushland areas. In particular along watercourses.
Green Panic *Megathyrsus maximus* QLD Biosecurity Act: N/A National Status: N/A	*Strategy* Green Panic (or Guinea Grass) is a pervasive grass species that that can dominate understorey in bushland areas and riparian vegetation. Therefore, the approach will be to target the reduction of green panic where it occurs in forested areas or where it is outcompeting regeneration of native grasses and trees. *Grazing* Grazing is an effective method to manage green panic as it is a palatable species. *Chemical controls* There are no products specifically registered for the control of guinea grass in Queensland. However, a permit held by the Department of Agriculture and Fisheries allows people generally to use some herbicide products to control guinea grass as an environmental weed in various situations. Understand permit PER11463 before using these herbicides. Use either: • Glyphosate 360 g/L at 360 g/L water (either foliar spray, or cut and dab), or • Fluazifop 212 g/L, at a rate of 2–4 L per ha. Spray young vegetative growth with 3–6 leaves per shoot when growing actively. Use up to 4 L per ha for well-established infestations or where greater control is required in one season.	Annually. September to April. At least one control event per year.	Regarded as an environmental weed. It is common and widespread in bushland and riparian vegetation in the tropical, sub-tropical, warmer temperate and semi-arid regions of Australia.

Species details	Control method (s)	Control period	Threat to biodiversity
Harrisia Cactus *Harrisia martini* QLD Biosecurity Act: Cat 3 National Status: N/A	Control of this plant is difficult as it has a deep underground tuberous root system and use of a combination of physical, biologic and herbicide controls is recommended. *Manual control* Dig out plants completely and burn. Ensure all tubers are removed and destroyed. Spot spray with registered herbicide. *Biological control* Biological control includes two introduced insects: • a stem-boring longicorn beetle (*Alcidion cereicola*) • a mealybug (*Hypogeococcus festerianus*). Stem-boring beetle only attacks older woody stems. In Collinsville area, large beetle colonies developed and contributed to collapse of dense areas of cactus. Populations of *Alcidion cereicola* have declined with reduction in cactus in recent years. More successful biological control agent is mealybug *Hypogeococcus festerianus*, which is now present in most areas infested with harrisia cactus. Mealybug is considered more effective in more northern areas of central Queensland. *Herbicide* Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L (eg Slasher) or Triclopyr as tea 200 g/L + Picloram as tipa 100 g/L + Aminopyralid 25 g/L (eg Tordon RegrowthMaster) (eg Tordon DSH®).	Annually. September–March (Herbicide). September–December (Biological).	Highly invasive species. Produces large quantities of seed that is highly viable and easily spread by birds and other animals. Any broken-off portions of the plant will take root and grow.

Species details	Control method (s)	Control period	Threat to biodiversity
Lantana *Lantana camara* QLD Biosecurity Act: Cat 3 National Status: WONS	*Manual control* For single-stemmed lantana, basal bark spraying and cut-stump methods give good results at any time of year (but best when the plant is actively growing). For large Lantana infestations, treatment with herbicides by foliar spraying is usually not economically feasible. However, fire and slashing/cutting, can reduce dense infestations, making follow-up spot treatments with chemicals more economically viable. Lantana seed banks remain viable for at least four years, so follow-up control to kill seedlings before they mature is vital to ensure initial management efforts to control the parent bush are not wasted. *Herbicide control* On multi-stemmed varieties, best results by carefully applying herbicide to each stem. When treating actively growing plants less than 2-m tall, spray foliage overall to the point of run-off. Splatter gun techniques are effective and particularly useful in hard-to-access areas. This is best done in autumn, when sap-flows draw the poison down into the root stock, but before night temperatures get too cold.	Annually Manual removal any time of year. March–May for herbicide control.	It forms dense thickets that smother and kill native vegetation and are impenetrable to animals, people and vehicles. Research indicates more than 1400 native species are negatively affected by lantana invasion, including many endangered and threatened species. As lantana is a woody shrub that has thin, combustible canes, its presence can also create hotter bushfires, altering native vegetation communities and pastures.
Mimosa Bush *Acacia farnesiana* QLD Bio Act: N/A National Status: N/A	*Chemical controls* Basal bark spray: For stems up to 15 cm diameter, carefully spray completely around base of plant to a height of 30 cm above ground level. Thoroughly spray into all crevices. Larger trees may be controlled by spraying to a greater height, up to 100 cm above ground level. The best time for treatment is during autumn when plants are actively growing, and soil moisture is good. Cut and dab treatment: At any time of year, cut stems off horizontally as close to the ground as possible. Immediately (within 15 seconds) swab cut surface with herbicide mixture.	Annually March–May for basal bark spray treatment. Any time of year for cut and dab treatment.	Mimosa Bush is an environmental weed. Seeds sprout readily and plants grow rapidly. Mimosa bush does well in dry localities and on loamy or sandy soils, forming thickets along watercourses.

Species details	Control method (s)	Control period	Threat to biodiversity
Noogoora Burr *Xanthium orientalis* QLD Bio Act: N/A National Status: N/A	*Biological control* Some level of control has been achieved with biological control agents including stem-boring and stem-galling insects, and a rust fungus (Puccinia xanthii). This form of control has been more effective in tropical areas where temperatures and moisture conditions are favourable. *Mechanical control* Cultivation or hand pulling isolated plants is effective if performed before flowering or burr formation. *Chemical control* Few chemicals approved for use in native vegetation. Therefore, use chemical control as a last resort. Spraying with 2,4-D or MCPA before flowering will give favourable results. As plants mature, higher rates are necessary (DoAF 2020b).	Annually Any time of year for manual control. If chemical control to be done before flowering.	Species is an environmental weed. It can be found along river and creek flats, on roadsides and in pasture land. Noogoora burr spreads by seed in burrs. Burrs are spread by attaching to animals, clothing and bags. Burrs can also float on water.
Parthenium *Parthenium hysterophorus* QLD Bio Act: Cat 3 National Status: WONS	*Management through grazing* Grazing management is the most useful method of controlling large-scale parthenium infestations. Objective is to maintain high levels of grass crown cover, which will limit parthenium colonisation. *General controls* No manual method because of the health hazard from allergic reactions and the danger of mature seeds dropping and increasing the infestation area. *Chemical control* Spot spray with registered herbicide early before plants can set seed. Keep a close watch on treated areas for at least 2 years. Preferred method for smaller infestations. Treat small and/or isolated infestations immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying may be required even within a single growing season to prevent further seed production. Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium is removed when plants are small and before seeding has occurred.	Two events per year. This is due to follow up treatment being required. Spray before seeding occurs.	Parthenium can colonise brigalow, gidgee and softwood scrub soils. It will take over pastures with sparse ground cover. Parthenium is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.
Phasey Bean, Siratro *Macroptilium lathyroides* QLD Bio Act: N/A National Status: N/A	*Manual control* Phasey Bean can be hand pulled, chipped or mowed. Removing the whole crown by grubbing is the most effective manual/mechanical control method. Tangled growth may need to be cleared using a brush cutter. Cannot tolerate grazing. Manual removal suited to small infestations. *Chemical control*	Annually. Manual control any time of year.	An environmental weed. Can dominate groundcover of open woodland and riparian areas.

Species details	Control method (s)	Control period	Threat to biodiversity
	Two herbicides are currently registered for the control of Phasey Bean in non-crop situations in Queensland: 2,4-D amin and Glufosinate. Glufosinate ammonium is non-selective and needs to be used with care. Use the foliar spray method. Use chemical control as a last resort (DoAF 2020c).		
Purple Top Grass *Chloris inflata* QLD Bio Act: N/A National Status: N/A	Otherwise known as Rhodes Grass. *Mechanical control* Slashing or mowing. This would only be appropriate where it is in large infestations in cleared areas where native vegetation won't be impacted. *Chemical control* Foliar spray with herbicide – water mixture.	Annually. Any time of year.	Environmental weed. Aggressive invader of degraded land and coastal sites, spreading from roadsides and pastures into natural habitats, where it out-competes native species.
Red Natal Grass *Melinis repens* QLD Bio Act: N/A National Status: N/A	*Chemical control* Foliar spray with herbicide – water mixture, or Complete removal via weed lifting (should have their major root structures lifted out entirely to prevent re-shooting). All plant material should be hung up as leaving plants on the ground can lead to them re-shooting.	Annually.	Environmental weed.

Species details	Control method (s)	Control period	Threat to biodiversity
Rhodes Grass *Chloris gayana* QLD Bio Act: N/A National Status: N/A	*Chemical control* Foliar spray with Glyphosate – water (1L per 100 L of water) mixture. *Manual control* Complete removal via weed lifting (should have their major root structures lifted out entirely to prevent re-shooting). All plant material should be hung up as leaving plants on the ground can lead to them re-shooting.	Annually.	Environmental weed. It was recently listed among the top 50 invasive plants in south-eastern Queensland, where it spreads from roadsides and pastures to invade native bushland and rainforest margins. Its tolerance of a wide range of conditions and its ability to rapidly reproduce, combined with its capacity to smother native ground cover species and form almost pure stands, has led to its developing reputation as an invasive species.

Species details	Control method (s)	Control period	Threat to biodiversity
Rubber Vine *Cryptostegia grandiflora* QLD Bio Act: Cat 3 National Status: WONS	Effective control of rubber vine can be achieved by a number of methods, alone or in combination depending on the situation and the severity of infestation. All areas treated must be periodically checked and any regrowth treated or the initial treatment efforts will be wasted. Any isolated plants located should be treated promptly. *Chemical control* Basal bark treatment - For single stem plants, thoroughly spray around the base of the plant to a height of 20−100 cm above ground level, spraying higher on larger plants. Cut stump treatment - This is the most successful method, but also the most labour intensive. The following should be followed carefully: Cut stems off horizontally as close to ground as possible and immediately swab or spray cut surface and stem with herbicide mixture. *Mechanical control* Scattered or medium-density infestations: Where possible, repeated slashing close to ground level is recommended. Slashing will only occur where native vegetation won't be impacted.	Two events per year. This is due to follow up treatment being required. Optimal when plant is actively growing in summer months.	Rubber Vine generally invades waterways first, where the seeds germinate in moist silt layers after rain. The plant smothers riparian vegetation and forms dense, sometimes impenetrable, thickets. Prevents movement of animals within riparian corridors.
Velvety Tree Pear *Opuntia tomentosa* QLD Bio Act: Cat 3 National Status: WONS	*Chemical control* Spot spray with registered herbicide. *Biological control* Includes eight insects and the mite in Queensland. These species are: • Stem-boring moths: Cactoblastis cactorum; • Cochineal scale insects: Dactylopius ceylonicus, D. opuntiae, D. confuses and D. austrinus; • Cell-sucking bugs: Chelinidea tabulate; • Stem-boring moths: Tucumania tapiacola; • Stem-boring beetles: Archlagocheirus funestus; • Prickly pear red spider mites: Tetranychus opuntiae; and • Catoblastis spp. and Dactylopius spp. provide the most success.	Annually September−April	Dense infestations compete with native vegetation, limiting the growth of small shrubs and groundcover species. The plant's sharp spines or barbs can cause injury to stock and native animals.

Appendix E

Tree marking procedure

Clearing Protocols
Olive Downs Coking Coal Project

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Appendix A

Tree marking guideline

Do not Fell Tree

Potential Greater Glider denning place – requires inspection by FSC using 10-30m EWP.

Do not Fell Tree

Potential Greater Glider denning place – requires inspection by FSC using a 10m EWP

Habitat Tree required to be inspected

Tree may contain fauna and breeding places such as nests, peeling bark and hollows under 5 cm. FSC must inspect tree, and be present when being felled.

Glider Habitat Tree may be felled

Tree has been inspected by EWP.

FSC must be present during felling.

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