Hera Resources Federation Project EIS

Cobar LGA
Nymagee NSW

Biodiversity Development Assessment Report

November 2021

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- Environmental impact assessment, auditing, and approvals
- High level preliminary environmental assessment (PEA)
- Review of environmental factors (REF)
- Peer review
- Community engagement
- Biobanking and biodiversity offsetting assessments
- Aboriginal heritage assessments and community walkovers
- Landscape design
- Independent environmental auditors

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Document controls

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Executive summary

This Biodiversity Development Assessment Report (BDAR) documents environmental impact of the Federation Project (the Project), a proposed underground metalliferous mine development State Significant Development (SSD). SSDs are regulated under the *Environmental Planning and Assessment Act 1979* (EP&A Act), which requires proponents to apply to the Minister of Planning for development consent or infrastructure approval, supported by an environmental impact statement (EIS).

AREA Environmental & Heritage Consultants (AREA) has been commissioned by Hera Resources Pty Ltd (Hera Resources, the proponent) to complete this BDAR to support an EIS being prepared by SLR. The Federation Project will impact native vegetation and exceed the threshold for clearing under section 7.2 (2)(b) of the *Biodiversity Conservation Regulation 2017*, therefore a full site-based assessment has been undertaken by appropriately experienced and qualified personnel using the Biodiversity Assessment Methodology 2020 (BAM 2020).

Hera Resources own and operate the Hera Mine in the Cobar Local Government Area approximately 80km south-east of Cobar approximately 5km south of the township of Nymagee in western NSW (Figure 1-1). Federation Site is 10km south of the Hera Mine and approximately 15km south of Nymagee. A proposed Services Corridor will link Hera Mine to Federation Site (Figures 1-2 to 1-4).

The Federation Project is comprised of the following activities and infrastructure:

- underground mining activities and surface infrastructure at the Federation Site
- amendments at Hera Mine to facilitate processing of ore from the Federation Site
- a water pipeline and bore network
- a Services Corridor connecting the Federation Site with Hera Mine.

The Project area includes areas of disturbance associated with exploration activities. An activity approval for assessable prospecting operations (i.e. exploration activities), supported by a Review of Environmental Factors (REF), was approved by NSW Resources Regulator in August 2021 under the NSW *Mining Act 1992* (Mining Act), (the REF for the exploration decline program was supported by a comprehensive BDAR[1]). This approval allowed for the construction of an underground exploration decline and associated surface infrastructure at the Federation Site and a water pipeline between Federation Site and Hera Mine. This is referred to as the 'exploration decline program'.

This BDAR refers to the following terms:

The Project is all activities and infrastructure required for mining under one or more future mining leases. Any use of the term 'the proposal' or 'the development' is synonymous with 'the Project'.

The Project area is all areas where activities and infrastructure for mining will occur (i.e. 92.52 ha). This term is synonymous with 'Project footprint'. The Project area includes the 'exploration decline program disturbance area'.

[1] The Federation Exploration Decline BDAR can be provided electronically with approval by the proponent on request

The Project disturbance area is all areas that require clearing for the Project (i.e. 56.83 ha). The 'Project disturbance area' includes 55.78 ha of native vegetation and 1.05 ha of pre-cleared vegetation. Any use of the term 'development site' is synonymous with 'Project disturbance area'.

The exploration decline program disturbance area is all areas already approved for clearing under the State activity approval for the exploration decline program (i.e. 35.69 ha).

The study area is the Project area and the broader area surrounding the Project area assessed through field surveys and desktop analysis, with information from the study area used to assess potential direct and indirect Project impacts.

The Project boundary is the nominal extend of the State planning approval and associated mining lease (ML) boundaries, noting that ML applications have yet to be made for the Project. This term is synonymous with 'subject land'.

This BDAR does not consider the exploration decline program disturbance area because the Proponent elected to voluntarily enter into the NSW Biodiversity Offsetting Scheme (BOS) for the exploration decline program. As part of the REF approval, honouring the biodiversity offsetting obligation is a condition of development consent (see Appendix H for the Biodiversity Assessment Method Calculator [BAM-C] credit requirement report for the exploration decline program).

The Project includes a number of separate components which will require offsetting under the NSW BC Act. All components are included in this BDAR. For the purposes of State offsetting requirements under the BC Act, these components are referred to as stages. The proponent has elected to separate the Project into components (or stages) as some components may occur in later years of mine life or may not occur at all, and therefore staging allows for State offsets to be provided as and when a disturbance is scheduled to occur. By including all potential components in the assessment, the proponent has adopted a conservative approach in estimating the Project disturbance area (i.e. overestimating the potential Project disturbance area).

This BDAR considers the impact of each stage separately, so the proponent is only liable for offsets if/when a stage occurs. For planning purposes, the total offsetting requirement for all stages has been determined in this BDAR. The offsetting requirement for each stage separately has then been calculated by working out the percentage area of each native vegetation plant community type (PCT) zone impacted by each stage and applying that percentage to the total offsetting requirement for each zone; resulting in an allocation of the offsetting requirement of each stage. As per the requirements of the Environment, Energy and Science (EES) department of the NSW Department of Planning, Industry and Environment (DPIE), a sufficient number of BAM vegetation plots have been done to satisfy the plots requirement for each stage. It is acknowledged that, due to ongoing updates to the BAM-C, the offsetting obligation for each stage is required to be recalculated before a stage occurs.

This BDAR includes an assessment of landscape values in the study area, the vegetation communities present in the study area (including the Project disturbance area) and their condition, the known or potential presence of threatened flora or fauna species and populations as well as potential matters of Serious and Irreversible Impact (SAII) listed in NSW under the *Biodiversity Conservation Act 2016* (BC Act) and/or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The disturbance history in the study area includes modification from past land-uses for mining (including timber cutting), rural settlement associated with the former Nymagee Copper Mine and thereafter continuous sheep and goat grazing. More recently there has been disturbance and clearing for the construction of Hera Mine and the existing Hera Mine accommodation village, however, there is still approximately 93 percent cover of native vegetation within 1500 metres of the Project area.

The Project has been designed to avoid impact to native vegetation as far as possible by locating the infrastructure within previously disturbed areas such as existing and previously cleared areas, roads and fence lines. This includes, for example, locating the new process plant within the existing Hera Mine disturbance areas. Ecological constraints have been considered and avoided where possible, especially in regard to the water pipeline and bore network which has been redesigned to avoid impact to waterways and significantly minimises harm to native vegetation.

Approximately 1.05 hectares of 'not native vegetation' is present in the Project disturbance area. These areas are a result of previous disturbance or clearing under exploration approvals, including roads, tracks and an existing waste disposal area in the proposed solar farm area. This BDAR considers 55.78 hectares of native vegetation in the Project disturbance area. All native vegetation outside the Project area will be retained.

Vegetation zones have been allocated based on plant community types (PCT's) and difference in plant species assemblage and density. Vegetation zones in the Project disturbance area (Figures 3-4 to 3-8) are defined as follows:

Zone	PCT	PCT description	Area in Project disturbance area
1	103	*Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	33.48
2	103 Cleared	*Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	0.32
3	174	*Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*	14.46
4	104	*Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*	3.86
5	180	*Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*	2.35
6	258	*Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*	0.86
7	184	*Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*	0.45
		Total	**55.78**

Threatened Ecological Community (TEC) *Acacia Ioderi Shrublands,* an endangered ecological community listed under the BC Act (not EPBC listed), has an association with PCT174. Ground

truthing of native vegetation determined this TEC is not present in the study area. No TECs listed under the BC Act or EPBC Act occur in the Project disturbance area.

Eighteen BAM (2020) vegetation plots were used to describe the vegetation values present in the Project disturbance area. Data from these plots was entered into the BAM Credit Calculator (BAM-C) which provided a vegetation integrity score for each zone and generated predicted and candidate species lists.

The BAM-C identified 35 predicted species (ecosystem credit species) assumed to occur based on known association with PCTs. Nineteen candidate species (species credit species) were identified by the BAM-C.

The proponent accepted the burden of proof and undertook targeted threatened species assessment following the threatened species survey guidelines for listed species identified by the BAM-C and the EPBC Act Protected Matters Report. Threatened species survey effort included targeted search transects, bird searches and ultrasonic bat recording over five days 12 to 16 July 2021 (winter). Additional BAM vegetation plots and threatened species surveys were undertaken 1-3 October 2021 (spring) to completely cover off on survey effort required.

This BDAR also draws on additional survey effort to identify environmental constraints for other Hera Resources related projects, including the exploration decline program, previously undertaken by AREA in 2018, 2019, June 2020 (winter), October 2020 (spring) and January 2021 (summer). Survey effort in and around the Project area from June 2020 to October 2021 includes the following:

- a reconnoitre of the Project area to refine the proposed field methods
- call playback and spotlighting over nine nights
- targeted bat ultrasonic assessments (2 x SM2+ and 1 x SM4) and a Song Meter SM4BAT-FS ultrasonic recorder in place for six nights in June 2020, 7 nights in October 2020 and 4 nights in July 2021
- 50 Type A Elliot traps in place for eight days/seven nights (a total of 350 trap nights)
- five cage traps for seven nights (a total of 35 trap nights)
- 14 camera traps positioned over baited lures containing rolled oats, peanut butter and honey in place for eight days/seven nights (98 trap nights)
- species credit species search transects throughout the Project area
- mapping and observation of hollows in and around the Project area
- opportunistic observation
- over 30 BAM plots in and around the Project area since January 2020.

No BC Act or EPBC Act listed threatened species were recorded in the Project disturbance area during field survey in June 2020 (winter), October 2020 (spring), January 2021 (summer), July 2021 (winter) and October 2021 (spring). Three threatened fauna species listed under the BC Act (not EPBC listed) known to occur adjacent to the Project disturbance area were sighted outside the Project disturbance area. An individual Hooded Robin (south-eastern form) *Melanodryas cucullata cucullate* was observed in habitat west of the Project disturbance area (where there is a known local population); Major Mitchell's Cockatoo *Lophochroa leadbeateri* was observed flying southwest over the Project disturbance area on two occasions and Grey-crowned babblers *Pomatostomus temporalis temporalis* were observed in the southeast of the Project disturbance

area. All three species are commonly recorded in the area and are included in BAM calculations as ecosystem credit species.

Three threatened species of insectivorous bats listed under the BC Act were confidently identified during targeted assessment. Little Pied Bat *Chalinolobus picatus* and Yellow-bellied sheathtail bat *Saccolaimus flaviventris* were already predicted to occur by the BAM-C. Eastern bentwing bat *Miniopterus orianae oceanensis* was not predicted to occur so this species was included in the BAM calculations as both a predicted species and a candidate species.

Overall, a total of 36 predicted species and 20 candidate species were assessed by the BAM-C. Two predicted species were excluded as habitat constraints for them are not present in the Project area. No survey is required for the remaining 34 and potential impact to these species is calculated in the ecosystem credits generated by the BAM-C.

Candidate species (species credit species) cannot be reliably predicted to occur. These species are assumed present unless survey effort undertaken in accordance with relevant guidance material proves otherwise. Six candidate species were excluded from being present and affected by the Project based on required habitat or geographic constraints not being present in the Project disturbance area. The remaining fourteen candidate species were excluded after targeted survey effort following requisite guidelines.

As a result of the survey effort applied, this BDAR determines the total offsetting obligation required for the Federation Project SSD is **2045 ecosystem credits**:

- 1282 ecosystem credits for PCT103
- 5 ecosystem credits for PCT103 (cleared)
- 574 ecosystem credits for PCT174
- 100 ecosystem credits for PCT104
- 52 ecosystem credits for PCT180
- 26 ecosystem credits for PCT258
- 6 ecosystem credits for PCT184.
- No species credits
- No Serious and Irreversible Impacts (SAII's).

A summary of the offsetting requirement for each proposed development stage is as follows:

Stage	Total Credits Required
1	1265
2	287
3	262
4a	81
4b	97
5	53
Total	**2045**

Credit classes allocated to the Project, as well as credit breakdown per stage and PCT are outlined at the end of this BDAR.

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Tables

1 Introduction

1.1 Requirement for assessment under the BAM

The Federation Project (the Project) proposed underground metalliferous mine development is a State Significant Development (SSD) under *State Environmental Planning Policy* (State and Regional Development) *2011*, Schedule 1 (5) (3). SSDs are regulated under the *Environmental Planning and Assessment Act 1979* (EP&A Act), which requires proponents to apply to the Minister of Planning for development consent or infrastructure approval, supported by an environmental impact statement (EIS). These applications are also subject to biodiversity assessment requirements under the *Biodiversity Conservation Act 2016* (BC Act).

This Biodiversity Development Assessment Report (BDAR) has been prepared to support the EIS being prepared by SLR as the Project will impact native vegetation and exceed the threshold for clearing under section 7.2 (2)(b) *Biodiversity Conservation Regulation 2017*. The minimum lot size (MLS) for the Project disturbance area is 1000 hectares. Therefore, the trigger for a BDAR for this proposal is clearing two hectares or more of native vegetation (Table 1-1).

Table 1-1: Area Clearing Thresholds (section 7.2 *Biodiversity Conservation Regulation 2017*)

Minimum lot size of land	Threshold for clearing
Less than 1 hectare	0.25 hectare or more
Less than 40 hectares but not less than 1 hectare	0.5 hectare or more
Less than 1,000 hectares but not less than 40 hectares	1 hectare or more
1,000 hectares or more	2 hectares or more

The Federation Project will occur on 92.52 hectares of land, of which 35.69 hectares within the Project area has been assessed and approved under the activity approval for the exploration decline program and is not included in this assessment. This BDAR considers disturbance to 56.83 hectares of land (the Project disturbance area, see Section 1.5), the majority of which (55.78 hectares) is native vegetation. As the threshold of impact to native vegetation is two hectares or more, the Project triggers assessment by the Biodiversity Assessment Method 2020 (BAM).

AREA Environmental & Heritage Consultants (AREA) has been commissioned by Hera Resources Pty Ltd (the client), to complete this BDAR to inform the Federation Project EIS. A full site-based assessment has been undertaken using the BAM 2020.

The following guidance materials from NSW Government Department of Planning, Industry and Environment (DPIE) and the Australian Government Department of Agriculture, Water and the Environment (DAWE) were followed to inform this assessment:

- Biodiversity Assessment Method 2020
- Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method
- NSW Survey Guide for Threatened Frogs ‘A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method’
- ‘Species credit’ threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft
- Survey requirements (birds, bats, reptiles, frogs, fish and mammals) for species listed under the EPBC Act.

See Appendix J for a list of BAM 2020 definitions and acronyms.

Note: throughout this BDAR, when referring to species or ecological community's conservation status, they are all listed under the BC Act, unless otherwise stated as under the EPBC Act (or both).

1.2 Description of the Project

Hera Resources Pty Limited (Hera Resources) is a wholly owned subsidiary of Aurelia Metals Limited (Aurelia). Hera Resources own and operate the Hera Mine located approximately 80km south-east of Cobar and approximately 5km south of the township of Nymagee in western NSW. Aurelia also owns and operates the Peak Gold Mine (PGM) near Cobar in western NSW and the Dargues Mine in the southern tablelands of New South Wales, approximately 60 km south-east of Canberra.

Hera Resources is evaluating the development of the Project. The Project comprises underground mining activities and surface infrastructure at the Federation Site, amendments at Hera Mine to facilitate processing of ore from the Federation Site, and a Services Corridor connecting the Federation Site with Hera Mine. The Federation Site is located approximately 15km south of Nymagee and 10km south of the Hera Mine (Figure 1-1).

The Federation Project will be a State Significant Development (SSD) as defined by the *State Environmental Planning Policy* (State and Regional Development) *2011* (the SRD SEPP). The Project comprises:

- underground mining activities and surface infrastructure at the Federation Site
- amendments at Hera Mine to facilitate processing of ore from the Federation Site
- a water pipeline and bore network
- a Services Corridor connecting the Federation Site with Hera Mine.

Total ore production from the Federation Site is approximately 6.95 Mt over the life of the mine. Most ore produced will be sent to Hera Mine for processing. However up to 200 ktpa will be transported to PGM during the initial years of operation (total of 750 kt over this period), whilst the new processing plant at Hera Mine is being commissioned and ramped up.

Access to the underground mine will be via a portal developed through the base of a box cut. The main decline will be developed to gain access to all production levels, where stopes will be excavated. The loosened ore from the stopes will be brought to the surface via underground truck and placed on the Federation Site Run of Mine (ROM) ore stockpile near the boxcut. Ore will then be transported by surface trucks via Burthong Road to the Hera Mine ROM stockpile at the Hera Mine process plant.

Hera Mine infrastructure is proposed to be modified to facilitate the Project including a new 750 ktpa processing plant and solar farm. To avoid harm to native vegetation, the existing processing plant will continue to operate at Hera Mine until the commissioning of the new plant. The new plant

will be within the existing approved footprint of Hera Mine. The new processing plant will produce silver and gold doré and separate lead, zinc and copper concentrates.

Additional infrastructure will be constructed at Hera to support the Project including d a proposed solar farm. The Project will also require production bores for water supply and associated pipelines.

A total of 5.8 Mt of tailings will be generated from processing of Federation ore. Of this approximately 5.2 Mt will be produced at Hera Mine, with the remaining 0.6 Mt at PGM. Approximately 60% of total tailings produced will be returned to Federation Site to backfill underground stopes.

Hera Mine and Federation Site will be connected by a Services Corridor. The nominated width of the corridor is 23 metres with an approximate length of 14.3 kilometres. Clearing of native vegetation will be required to install the proposed services infrastructure, including a power transmission line, water pipeline, access track and potentially a tailings slurry pipeline. The access track will be used for maintenance and inspection requirements and will not be used for haulage or ore transporting. Concentrate from Hera Mine will be trucked to the Hermidale rail siding for transport, as per the current concentrate transport methods and truck sizing. The Federation Project will also require production bores for water supply and associated pipelines.

Federation Site is shown in Figure 1-2 and Hera Mine site existing and proposed infrastructure is illustrated in Figure 1-3. An overview of the Federation Project and relevant boundaries, including indicative locations[2] of the bore and pipeline network is shown in Figure 1-4.

This BDAR does not consider the exploration decline program disturbance area because the Proponent elected to voluntarily enter into the NSW Biodiversity Offsetting Scheme (BOS) with the Federation Exploration Decline BDAR (February 2021) and offsets have already been determined for this area. As part of the REF approval, honouring the biodiversity offsetting obligation is a condition of development consent. See Section 1.4 for more information and see Appendix H for BAMC credit requirement report for the exploration decline program.

This BDAR assesses potential impact to biodiversity from the following Project activities and infrastructures within the Project disturbance area:

- Federation Site
- Hera Mine Site
- Services Corridor
- Water pipeline and bore network.

This BDAR addresses requirements of the following legislative frameworks:

- *NSW Environmental Planning and Assessment Act 1979* (EP&A Act)
- *NSW Biodiversity Conservation Act 2016* (BC Act)
- N*SW Local Land Services Act 2013* (LLS Act)
- *State Environmental Planning Policy (Vegetation in Non-Rural Areas)* 2017 (Veg SEPP).

[2] Bore and pipeline locations are indicative only and actual impact location may vary slightly. However total impact will not be greater than already indicated. Pipeline and bore locations have been refined to avoid constraints identified and will continue to avoid any identified constraints.

This BDAR informs the EIS being prepared for the Project.

The Project includes a number of separate components which will require offsetting under the NSW BC Act. All components are included in this BDAR. For the purposes of State offsetting requirements under the BC Act, these components are referred to as stages. The proponent has elected to separate the Project into components (or stages) as some components may occur in later years of mine life or may not occur at all, and therefore staging allows for State offsets to be provided as and when a disturbance is scheduled to occur. By including all potential components in the assessment, the proponent has adopted a conservative approach in estimating the Project disturbance area (i.e. overestimating the potential Project disturbance area).

The BDAR considers the impacts of each stage separately, so the proponent is only liable for offsets if a stage occurs. The metric for each stage will be recalculated when the obligation is required. This is discussed further in the following section.

Figure 1-1: Regional context of the Federation Project (Source: SLR)

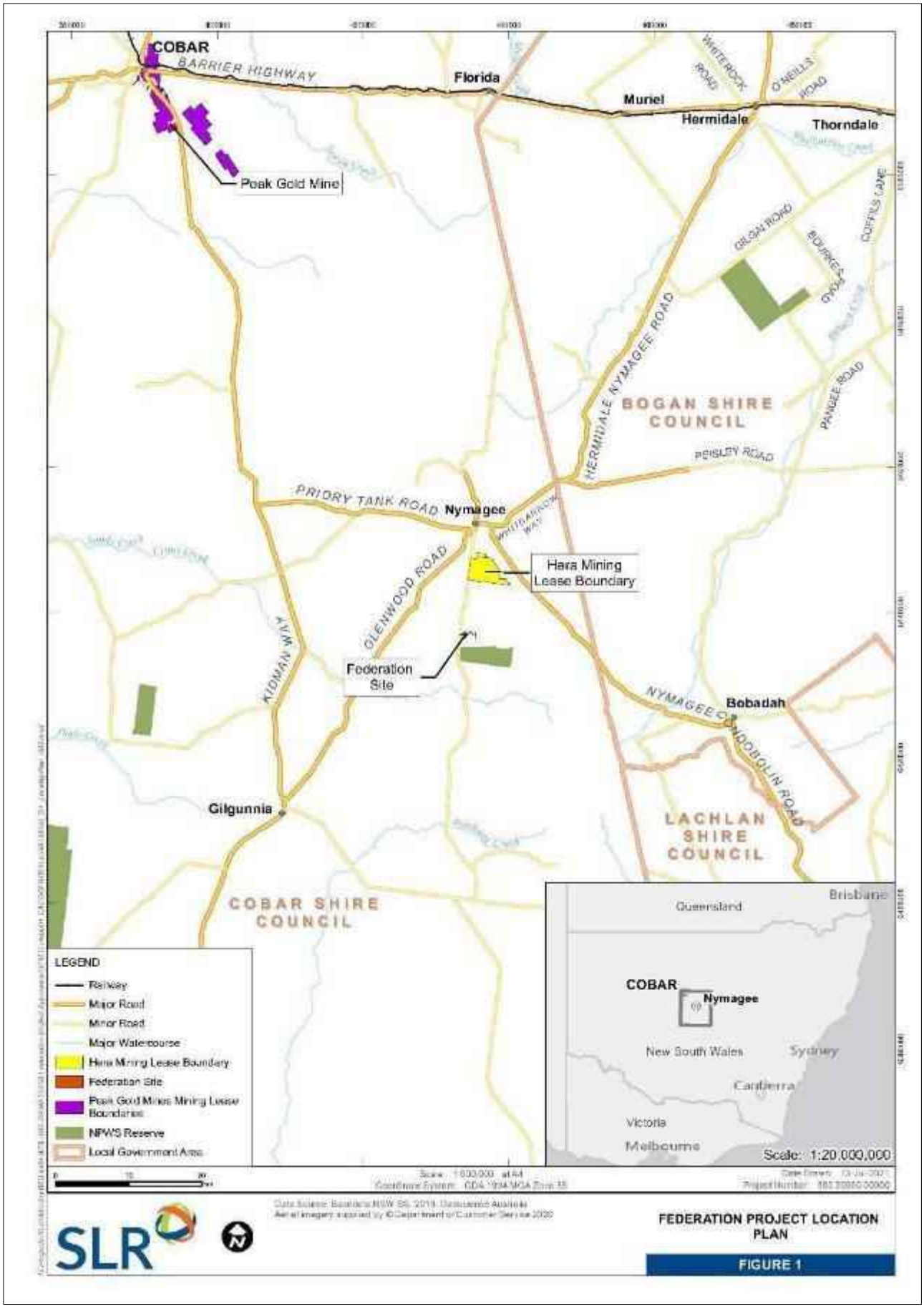


Figure 1-2: Federation site plan (Source: SLR)

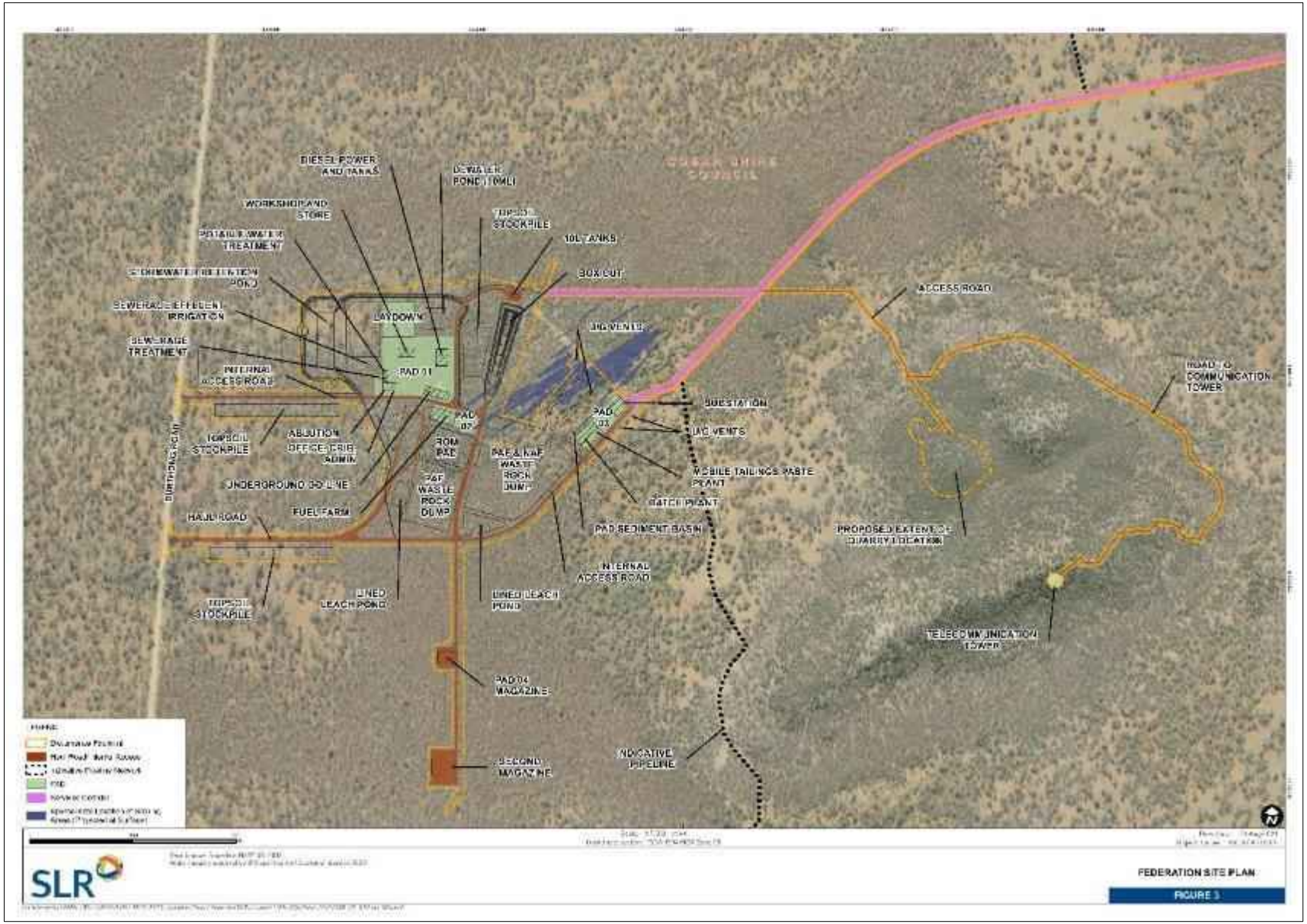


Figure 1-3: Hera Mine Site (Source: SLR)

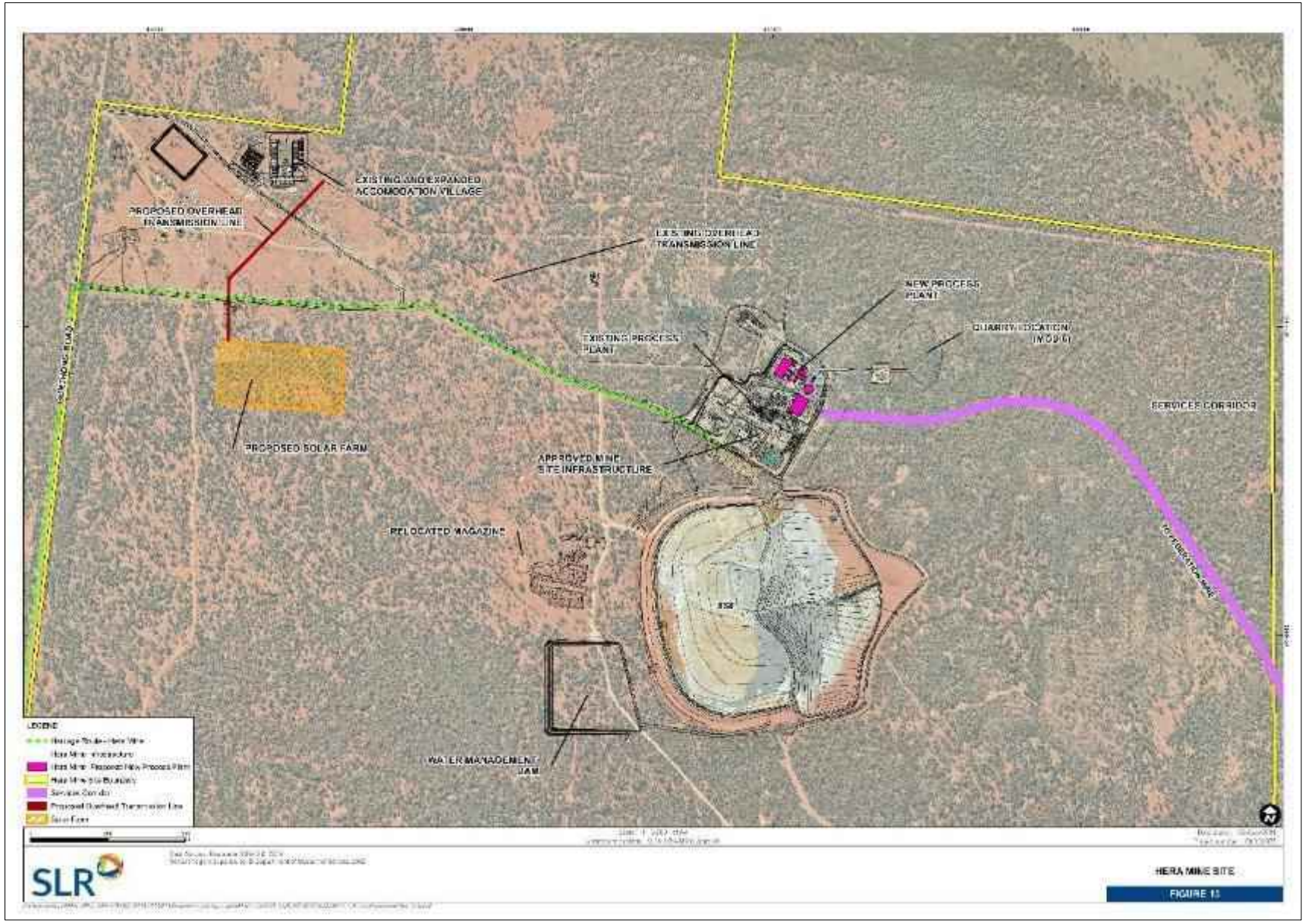
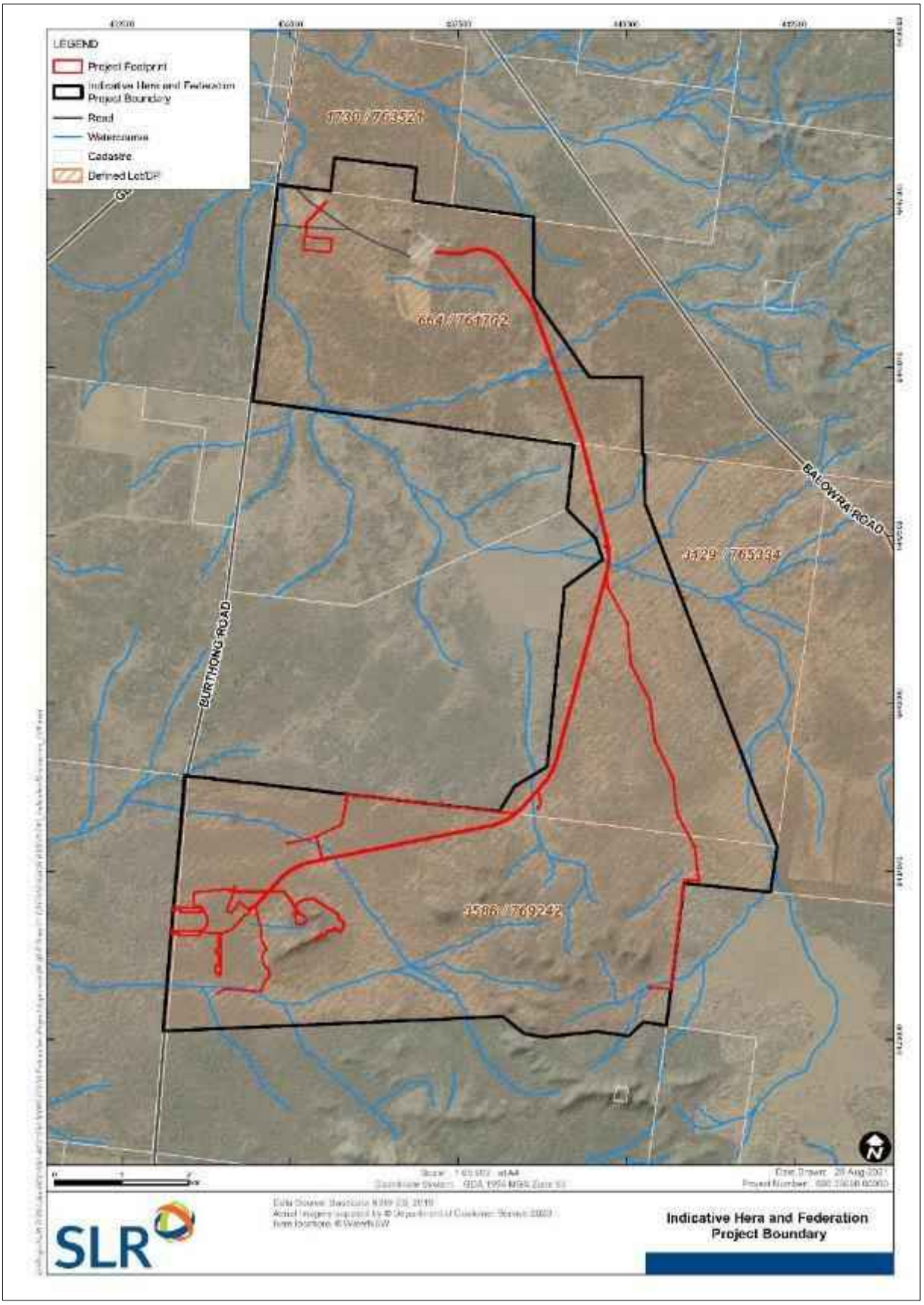


Figure 1-4: Indicative Hera and Federation Project Boundary and Project Area (Source: SLR)



1.3 Proposed stages

The BDAR considers the impact of each stage separately, so the proponent is only liable for offsets if a stage occurs.

Proposed stages are as follows, and are illustrated in Figure 1-5:

- Stage 1: Federation Site, Services Corridor and Communications Tower
- Stage 2: Solar Farm and Associated Powerline
- Stage 3: Potential Tailings Pipeline and Return Water Pipeline
- Stage 4a: Bore and Pipelines, eastern alignment (locations indicative only)
- Stage 4b: Bore and Pipelines, west and southern alignments (locations indicative only)
- Stage 5: Quarry

The total offsetting requirement for all stages has been determined. The offsetting requirement for each stage has then been calculated by working out the area of each native vegetation plant community type (PCT) impacted by each stage and converting that area to a percentage of the total impact to each PCT by the whole Federation Project proposal. The percentage for each stage has then been applied to the total offsetting requirement, resulting in an allocation of the offsetting requirement of each stage.

The extent of each stage, impact to vegetation zones and the locations of the relevant BAM vegetation plots for each stage are further discussed and illustrated in Section 3.

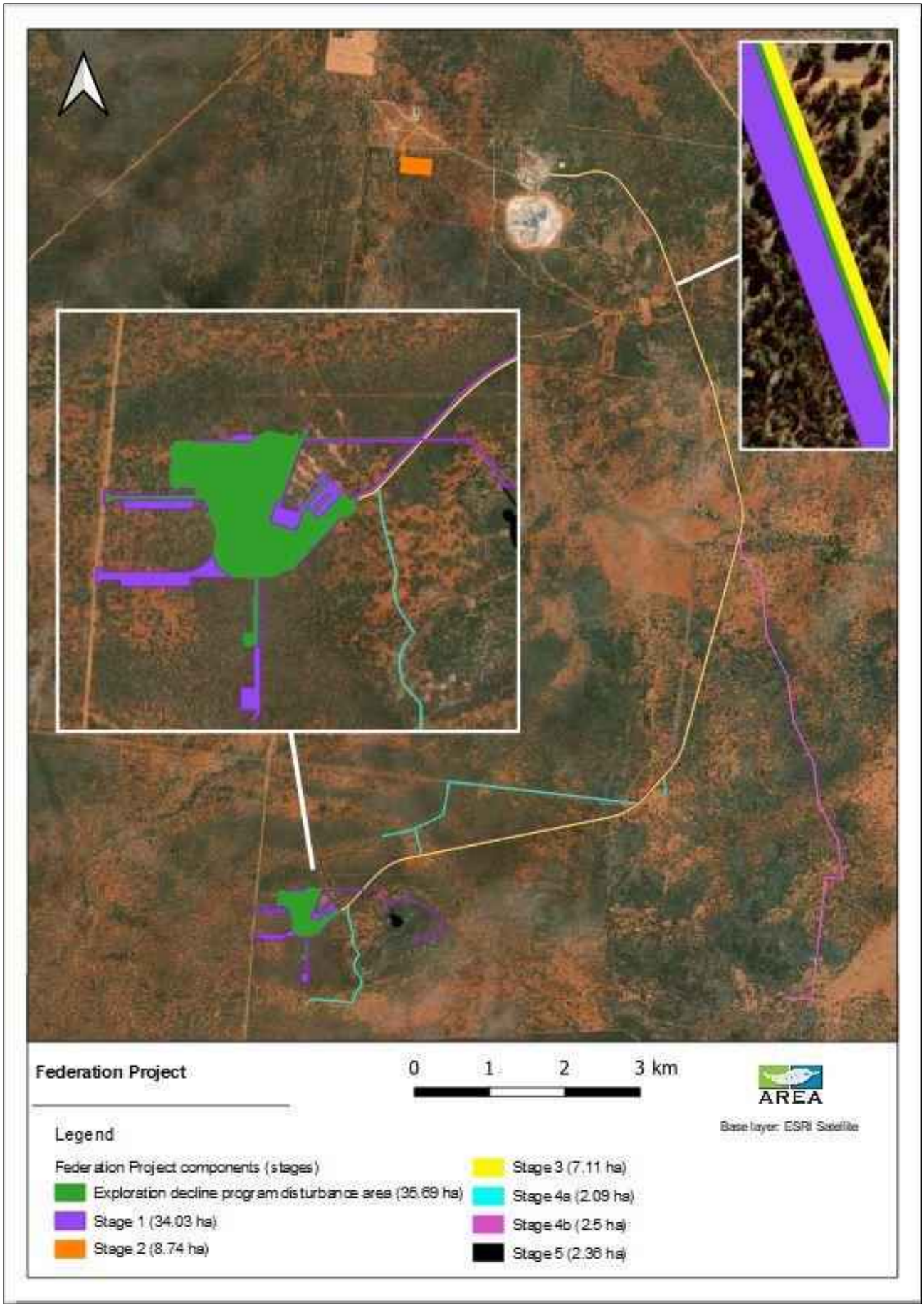
Due to ongoing updates to the BAM-C, the metric of this requirement will be recalculated using the BAM-C when each stage requires an offsetting obligation to be honoured before work on the stage begins.

1.4 Exploration decline program disturbance area

The Federation Exploration Decline BDAR was prepared in February 2021 for the exploration decline program disturbance area and offsets have already been determined for this area. The Federation Exploration Decline BDAR assessed a total area of 37.32 hectares, of which approximately 1.6 hectares is not native vegetation.

The exploration decline program disturbance area covers an area of vegetation of 35.69 hectares.

Figure 1-5: Federation Project proposed components (stages)



1.5 The subject land

Nymagee township was founded by 1879 and the Nymagee Cooper Mine was developed by 1888. As the mine had a wood-fired smelter, significant areas of timber were cleared from the surrounding country including on Hera Mine and the Federation Site, where historical tree removal (stumps) is still evident.

Hera Mine has been operational since 2012. The Federation Site is located approximately 10 kilometres south of the existing Hera Mine with the proposed Services Corridor to connect the two locations.

This BDAR uses the following definitions:

- **The Project** is all activities and infrastructure required for mining under one or more future mining leases. Any use of the term 'the proposal' or 'the development' is synonymous with 'the Project'.
- **The Project area** is all areas where activities and infrastructure for mining will occur (i.e. 92.52 ha). This term is synonymous with 'Project footprint'. The Project area includes the 'exploration decline program disturbance area'.
- The **Project disturbance area** is all areas that require clearing for the Project (i.e. 56.83 ha). The 'Project disturbance area' includes 55.78 ha of native vegetation and 1.05 ha of pre cleared vegetation. Any use of the term 'development site' is synonymous with 'Project disturbance area'.
- The **exploration decline program disturbance area** is all areas already approved for clearing under the State activity approval for the exploration decline program (i.e. 35.69 ha).
- **The study area** is the Project area and the broader area surrounding the Project area assessed through field surveys and desktop analysis, with information from the study area used to assess potential direct and indirect Project impacts.
- **The Project boundary** is the nominal extend of the State planning approval and associated mining lease (ML) boundaries, noting that ML applications have yet to be made for the Project. This term is synonymous with 'subject land'.

Relationship between the Project area (92.52 ha) and the approved exploration decline program disturbance area (35.69 ha) is shown in Figure 1-6. The relationship between the Project disturbance area assessed by this BDAR (56.83 ha) and the approved exploration decline program disturbance area (35.69 ha) is shown in Figure 1-7.

Throughout this BDAR the Project area is sometimes used in figures in place of the Project disturbance area for illustrative purposes, due to its similar shape and unbroken lines. However only the Project disturbance area is used for all BAM-C calculations.

The subject land (which contains the Project area) covers Lot 3586 DP769242, Lot 3129 DP 765334 and Lot 664 DP 761702 (Figure 1-8). The mapped land uses of the subject land are 'Grazing native vegetation', 'Other minimal use' and 'River[3]' (Figure 1-9). A summary of the subject land is shown in Table 1-2 below.

[3] *Ground truthing determined a river does not exist in or near the mapped area*

Table 1-2: Summary of the subject land

Criteria	Study Area
Central coordinates (GDA94 z55)	Approximately GDAz55 E434078, N6437013
Interim Biogeographic Regionalisation for Australia (IBRA Region)	Cobar Peneplain Bioregion - Nymagee subregion
State	New South Wales
Topographical map sheet	Nymagee 8133
Local Government Area	Cobar LGA
Local Aboriginal Land Council area (LALC)	Condobolin LALC
IBRA and subregion	Cobar Peneplains, Nymagee Downs Subregion
Nearest town / locality	Nymagee NSW
Accessed from nearest town by	Burthong Road
Land use / disturbance	Primarily grazing naïve vegetation; Mining
Nearest waterway (Name, Strahler Order)	There are no identified, permanent watercourses running through the Federation Project area, however, there are a number of unnamed, ephemeral and mostly indistinct watercourses.
Spot point Australian Height Datum (AHD)	310m to 340m AHD
Surrounding land use	Grazing native vegetation; road corridor; mining; residential and farm infrastructure; no specific use
Expected Project area land use	Mining excavation, stockpiling, bores, pipelines, roads and associated infrastructure

As a result of historic widespread removal of eucalyptus trees from the region to fuel the Old Nymagee Copper Mine wood-fired smelter, and heavy and continuous grazing by sheep and goats, the pre-European vegetation composition in the study area has changed. The ground stratum was effectively stripped, and in some areas White Cypress Pine *Callitris glaucophylla* has dominated the landscape which significantly suppresses biodiversity.

Photos of example vegetation in the different areas of the Project disturbance area are shown in Table 1-3.

Figure 1-6: Overview of the relationship between the Project area (92.52 ha) and the approved exploration decline program disturbance area (35.69 ha)

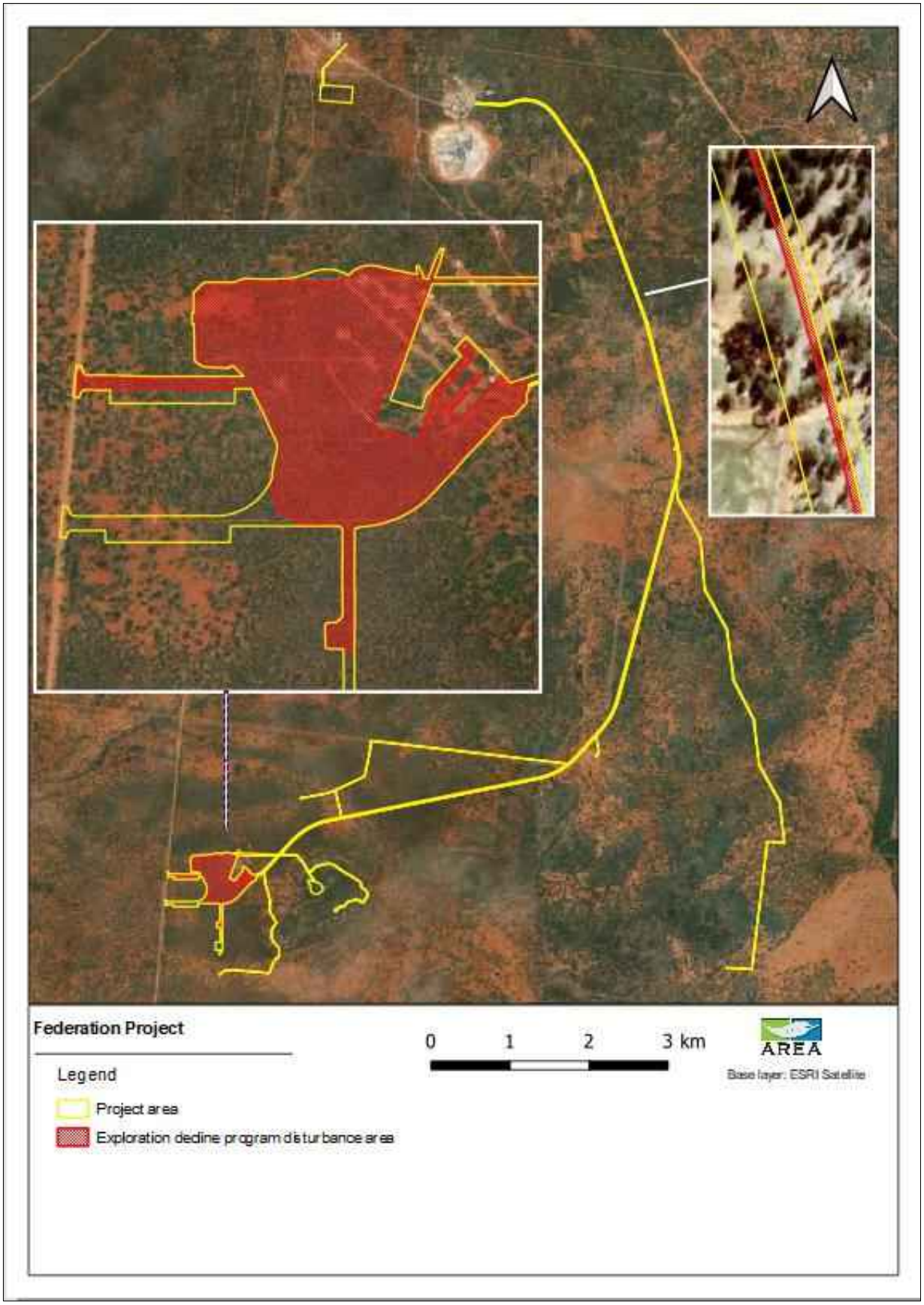


Figure 1-7: The relationship between the Project disturbance area assessed by this BDAR (56.83 ha) and the approved exploration decline program disturbance area (35.69 ha)

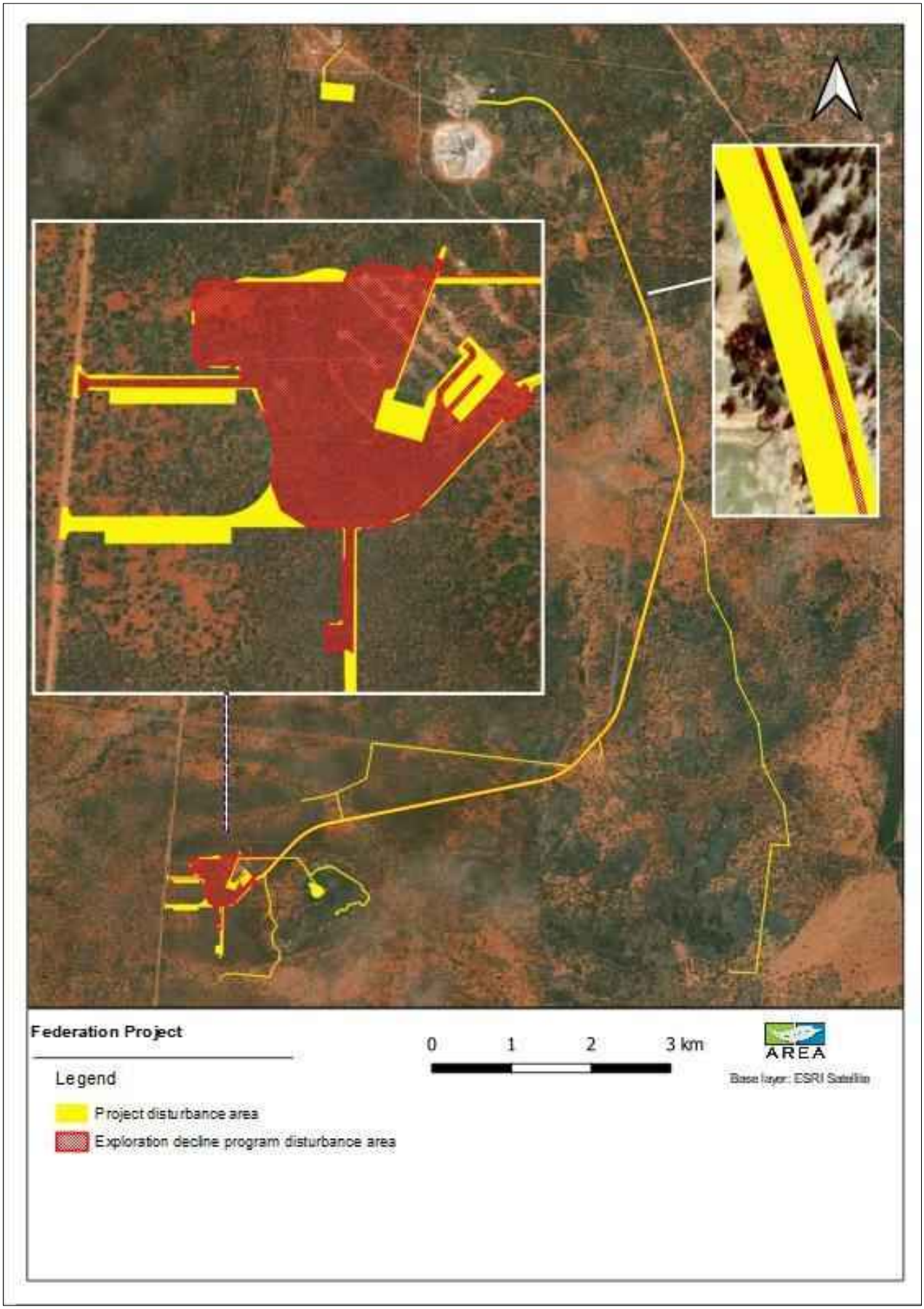


Figure 1-8: Lot and DP covered by Project area

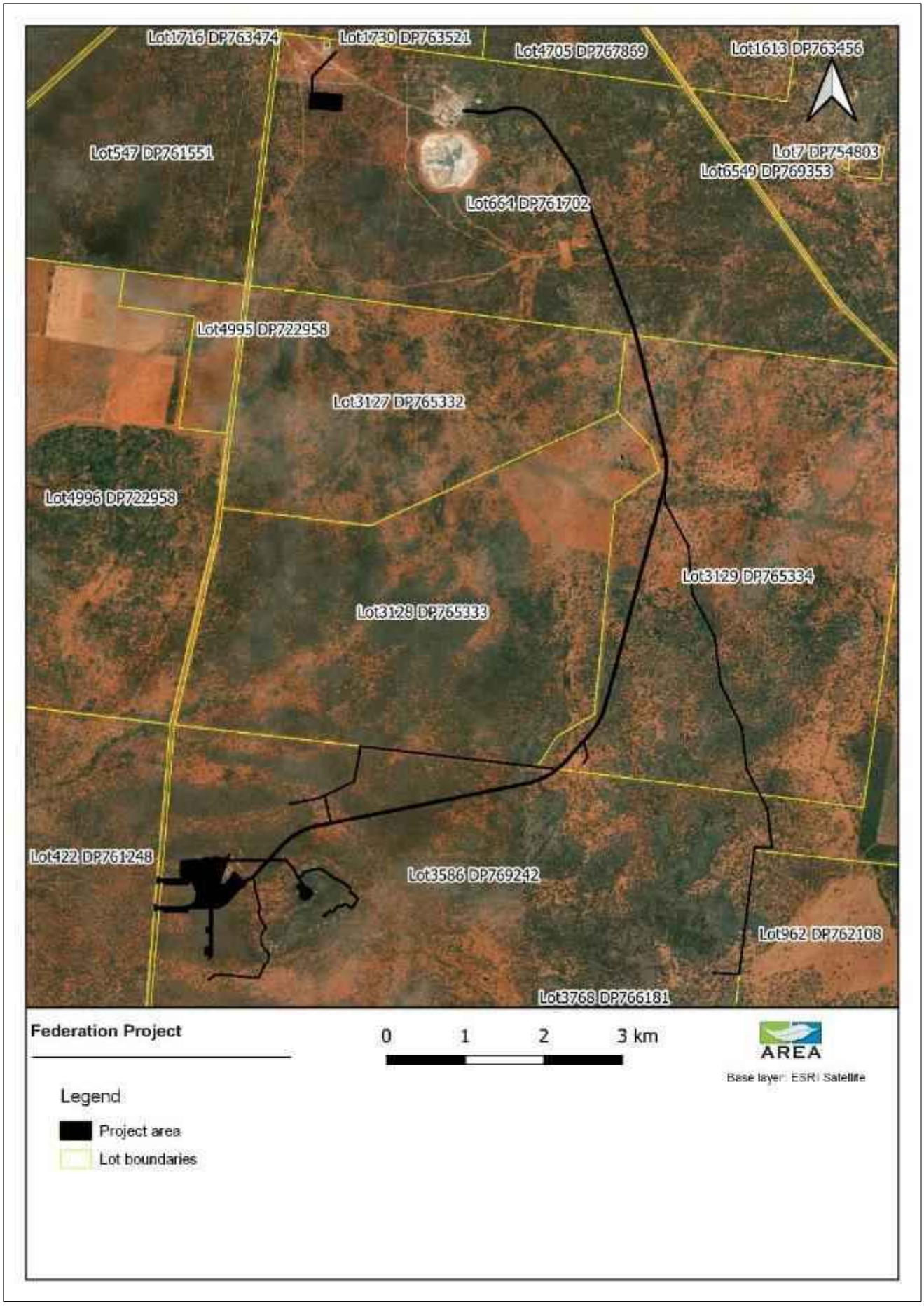


Figure 1-9: Land use mapped in and around the Project area

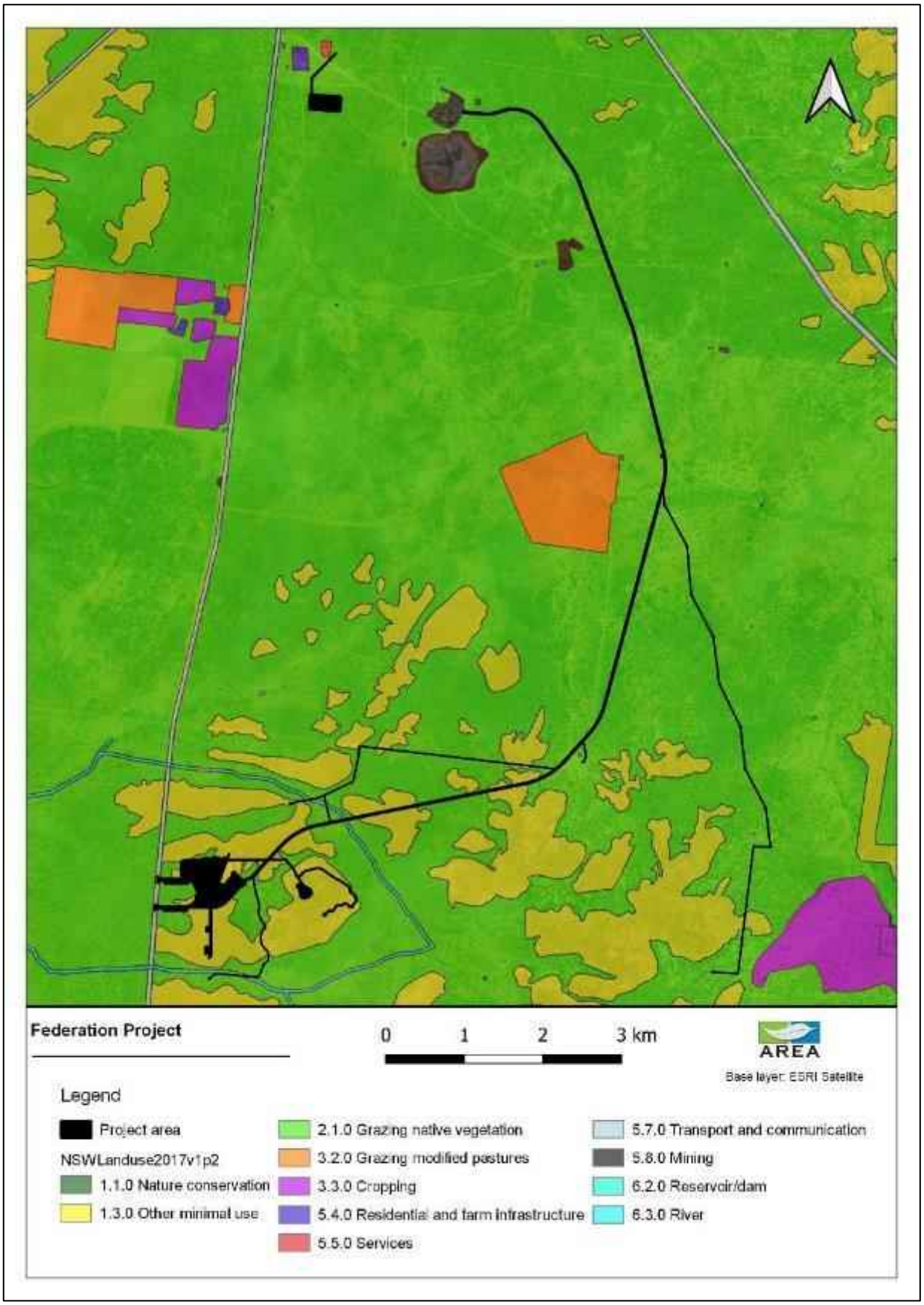


Table 1-3: Visual overview of the Project disturbance area

Location	Vegetation description	Photo
Project disturbance area – proposed haul road access to Federation from Burthong Road	PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	
Project disturbance area – solar farm power easement	PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	
Project disturbance area – solar farm	PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	

Location	Vegetation description	Photo
Project disturbance area - Services Corridor between Federation and Hera	PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	
Project disturbance area – Services Corridor, Hera end	PCT104 Gum *Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*	
Project disturbance area - additional magazine south of Federation	PCT174 *Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*	

Project disturbance area - indicative bore pipeline north of Federation	PCT174 *Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*	
Project disturbance area – Federation proposed quarry	PCT180 - *Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*	
Project disturbance area – Services Corridor, Hera end	PCT258 *Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*	

Project disturbance area – tele-communications tower, Federation end	PCT184 Dwyer's *Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*	

1.6 Personnel contributing to this document

This assessment was carried out by appropriately qualified and experienced ecologists (Table 1-4).

Table 1-4: Summary of AREA project team qualifications

Name	Position	CV Details	Role in this project
Phillip Cameron	Managing Director	• BSc. Major in Biology. Macquarie University • Ass Dip App Sci. University of Queensland • Dip Landscape Design (In prep) • Cert III Captive Animal Management • Certified Environmental Practitioner (EIANZ) and practicing member • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117 • **NSW DPIE Biodiversity Assessment Method Assessor: accreditation number BAAS17082** • NSW OEH Scientific License: 101087 • NSW DPI Ethics Approval 17/459 (3) • Practicing member of the NSW Ecological Consulting Association • President of the NSW Malleefowl Recovery Group	Project management Report editing and quality assurance / certification
Dave Sturman	Environmental Consultant	• B. Env. Sc. Charles Sturt University • Cert III (Horticulture) • WHS White Card and Blue Card • Senior First Aid • Chainsaw operator ticket • Confined Space worker and atmospheric monitoring • Risk assessment training • AHCPCM201- Recognising grasses	Fieldwork Data analysis
Genevieve Peel	Environmental Consultant	• Bachelor of Science, Environmental (Hons) UNSW • Cert III Captive Animal Management • Cert IV Veterinary Nursing	Report writing Fieldwork

Name	Position	CV Details	Role in this project
Greg Bible	Environmental Consultant	• BEnvSc University of New England • BSc Honours University of New England • WHS White Card	Fieldwork
Addy Watson	Manager Biodiversity	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW • B. Env. Sc. University of New England. • **NSW DPIE Biodiversity Assessment Method Assessor: accreditation number BAAS19066** • Diploma Project Management	Fieldwork Report editing
Dr Heidi Kolkert	Principal Ecologist	• PhD (Science) University of New England • BSc. (Hons) and Bachelor of Arts University of Tasmania • NSW OEH BioBanking and Bio-certification Assessor TAFE NSW • Practicing member of the NSW Ecological Consulting Association	Bat call analysis

1.7 Limitations

There were no limitations in the preparation of this BDAR.

1.8 Sources of information

Information sources used to inform this BDAR have been provided in the following sections.

1.8.1 Spatial Data

Table 1-5: Spatial data used in this report

GIS layer name	Reference
IBRA bioregions and subregion	NSW data portal
NSW landscape regions	Mitchell Landscapes V3
Rivers and streams	Six Viewer / SEED WMS topographic layer
Wetlands	Directory of Important Wetlands
Waterways	Waterway NSW Final
Key Fish Habitat	DPI Key Fish Habitat GIS layer
Connectivity of different areas of habitat	Western State Vegetation Plant Community Type map 4492 and ESRI Satellite
Native vegetation extent	Western State Vegetation Plant Community Type map 4492 and ESRI Satellite

1.8.2 Web sites (and links to documents)

Table 1-6: Web sites and links to documents used in this report

Title	Web address
Legislation	
Commonwealth Environment Protection & Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N

Title	Web address
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/~/view/act/2016/63
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2 000+cd+0+N
Local Land Services Act 2013	https://www.legislation.nsw.gov.au/~/view/act/2013/51
Biodiversity	
Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (2020)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/surveying-threatened-plants-and-habitats-nsw-survey-guide-biodiversity-assessment-method-200146.pdf
NSW Survey Guide for Threatened Frogs A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (2020)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/nsw-survey-guide-for-threatened-frogs-200440.pdf
'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (2018)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf
Biodiversity Assessment Methodology (DPIE, 2020)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-200438.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/draft-threatened-biodiversity-survey-guide.pdf
Survey requirements (birds, bats, reptiles, frogs, fish and mammals) for species listed under the EPBC Act	https://www.environment.gov.au/epbc/policy-statements
BAM Credit Calculator	http://www.environment.nsw.gov.au/biobanking/calculator.htm
Survey requirements (birds, bats, reptiles, frogs, fish and mammals) for species listed under the EPBC Act	http://www.environment.gov.au/topics/environmentprotection/environment-assessments.
Threatened biodiversity profile search	http://www.environment.nsw.gov.au/threatenedspeciesapp/
NSW BioNet	http://www.bionet.nsw.gov.au/
Vegetation Types databases	http://www.environment.nsw.gov.au/biobanking/vegtypedatabase. htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org.au/
Threatened Species Assessment Guideline - The Assessment of Significance (DECCW, 2007)	http://www.environment.nsw.gov.au/resources/threatenedspecies /tsaguide07393.pdf
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance	http://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip .htm

1.8.3 Reports and books

The Federation Site and surrounding areas (e.g. Hera Mine and Chelsea offset area) have received significant survey effort from AREA's ecologists since 2010. The surveys described in Table 1-7 were reviewed or were considered for this BDAR (Table 1-7 does not include surveys after Jan 2021 [i.e. the July 21 and Oct 21 surveys], which are discussed further in Section 4.2). All projects are within a 10-kilometre radius of the Project area, except for Chelsea which is within 15 kilometres. AREA's Dr Heidi Kolkert and Phil Cameron have been working in the region and on the property since April 2010.

Table 1-7: Prior and current ecological survey, monitoring and assessment activities undertaken on or within 15 kilometres of the Federation Project

Survey date	Survey personnel	Survey area	Report title	Company / Report date
25 – 29-Apr-2010	Heidi Kolkert Phil Cameron	Hera	Hera Project, via Nymagee – Ecology Assessment	OzArk Nov-2011
15-Oct-2011	Phil Cameron	Hera	Hera Project, via Nymagee – Ecology Assessment	OzArk Nov-2011
15-Oct-2011	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Preliminary Biobanking Assessment: Hera Project Via Nymagee NSW	OzArk Feb-2012
24-Oct-2011	Phil Cameron	Hera	Letter Re: Cobar Greenhood Orchid, *Pterostylis cobarensis*, (V) EPBC Act	OzArk Jul-2012
15-Oct-2011	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Hera Mine, via Nymagee - Biodiversity Offset Strategy	OzArk Oct-2012
15-Oct-2011	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Hera Mine, via Nymagee - Biodiversity Management Plan	OzArk Nov-2012
20-May-2013	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Tailings Dam (Stage 1) and Workshop Area	OzArk May-2013
3-Jun-2013	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Workshop Area	OzArk Jul-2013
14-Aug-2013	Rowan Murphy	Hera	Re: Pre-clearing Assessment for Tailings Dam Stage II and III & Back Tank East	OzArk Aug-2013
4 – 8-Nov-2013	Phil Cameron Rowan Murphy Heidi Kolkert	Hera, Nymagee Copper Mine and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report: Hera Mine and the 'Chelsea' Biodiversity Offset Areas	OzArk Dec-2013
14-Feb-2014	Rowan Murphy	Hera	Pre-clearing survey of a small area for clay extraction	OzArk Feb-2014
15-18-Dec-2014	Phil Cameron Rowan Murphy Heidi Kolkert	Hera, Nymagee Copper Mine and Chelsea (Biodiversity Offset Area)	2014 Flora and Fauna Monitoring Report: Hera Mine and the 'Chelsea' Biodiversity Offset Areas	OzArk Mar-2015
6-7-Jul-2015	Phil Cameron	Hera	Framework for Biodiversity Assessment: Biodiversity Assessment Report - Hera Mine Modification 3 Pa10_0191	OzArk 29-Jul-2015
6-7-Jul-2015	Phil Cameron	Hera	Ecology Field and Heritage Desktop Assessment: Proposed Air Vent at Hera Gold Mine	OzArk Oct-2015
11-13-Jan- 2016	Rowan Murphy Nikki Allen Heidi Kolkert	Hera, Nymagee Copper Mine and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2015	OzArk Jan-2016
17-May-2016	Phil Cameron Nick Warren (RWC) Jon Thompson (Aurelia)	Hera and Chelsea (Biodiversity Offset Area)	Biodiversity Management Plan (incorporating a Biodiversity Offset Strategy)	R.W. Corkery / OzArk May-2016
6-12-Jan-2017	Rowan Murphy Nikki Allen Heidi Kolkert Dave Sturman	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2017	OzArk Aug-2017
16-21-Sept-2018	Phillip Cameron Lynda Marshall Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2018	AREA - Jan 2019

Survey date	Survey personnel	Survey area	Report title	Company / Report date
22-25-Sept-2018	Phillip Cameron Heidi Kolkert	Nymagee Copper Mine	Flora and Fauna Monitoring Report – Nymagee Copper Mine, 2018	AREA - Jan 2019
22-25-Sept-2018	Phillip Cameron Lynda Marshall	MOD5 Hera	BDAR for MOD5 Hera Mine	AREA - Feb 2019
7-8-Nov-2018	Phillip Cameron	Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW	Exploration on the Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW Ecology Report Cobar LGA, November 2018	AREA - Nov 2018
6-7-Nov-2018	Phillip Cameron Nick Harrop	Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW	Exploration on the Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW Aboriginal Cultural Heritage Due Diligence Assessment Cobar LGA NSW November 2018	AREA - Nov 2018
21-Mar-2019	Phil Cameron Dave Sturman	Burthong Rd water pipeline	Nymagee Water Pipeline ecology and heritage reports March 2019	AREA – March 2019
22-Jul-2019	Phil Cameron	Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW	2019B Exploration on the Federation and Dominion North Prospects (EL6162) Lot3586 DP769242, Nymagee NSW Ecology Report Cobar Local Government Area, July 2019	AREA – July 2019
22-Jul-2019	Phil Cameron	Dominion Prospect (EL6162) Lot3586 DP769242, Nymagee NSW	2019B Exploration on the Federation and Dominion North Prospects (EL6162) Lot3586 DP769242, Nymagee NSW Aboriginal Cultural Heritage Due Diligence Assessment Cobar LGA NSW July 2019	AREA – July 2019
19-25-Nov-2019	Dave Sturman Lynda Marshall Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2019	AREA - Dec 2019
19-25-Nov-2019	Dave Sturman Lynda Marshall Heidi Kolkert	Nymagee Copper Mine	Flora and Fauna Monitoring Report – Nymagee Copper Mine, 2019	AREA - Dec 2019
12-17-Jun-2020	Phil Cameron Addy Watson Dave Sturman	Proposed Federation Development Site	Federation ecology and heritage assessments	AREA - Nov 2020
19-28-Oct-2020	Phil Cameron Gabbi Green Dr Heidi Kolkert	Nymagee Copper Mine	Microbat Monitoring Report – Nymagee Copper Mine, 2020	AREA - Nov 2020
19-28-Oct-2020	Addy Watson Gabbi Green Anna Darby	Hera Mine Camp Expansion	Hera Mine Camp Expansion ecology and heritage assessments	AREA - Nov 2020
19-28-Oct-2020	Addy Watson Phil Cameron Anna Darby	Federation Communications Tower	Federation Communications Tower ecology and heritage assessments	AREA - Nov 2020
19-28-Oct-2020	Greg Bible Phil Cameron Anna Darby Dr Heidi Kolkert	Federation surface exploration activities	Federation surface exploration activities ecology and heritage assessments	AREA - Nov 2020
19-28-Oct-2020	Addy Watson Greg Bible Phil Cameron Gabbi Green Dave Sturman Anna Darby Dr Heidi Kolkert	Federation decline	Federation decline ecology and heritage assessments	AREA - Nov 2020

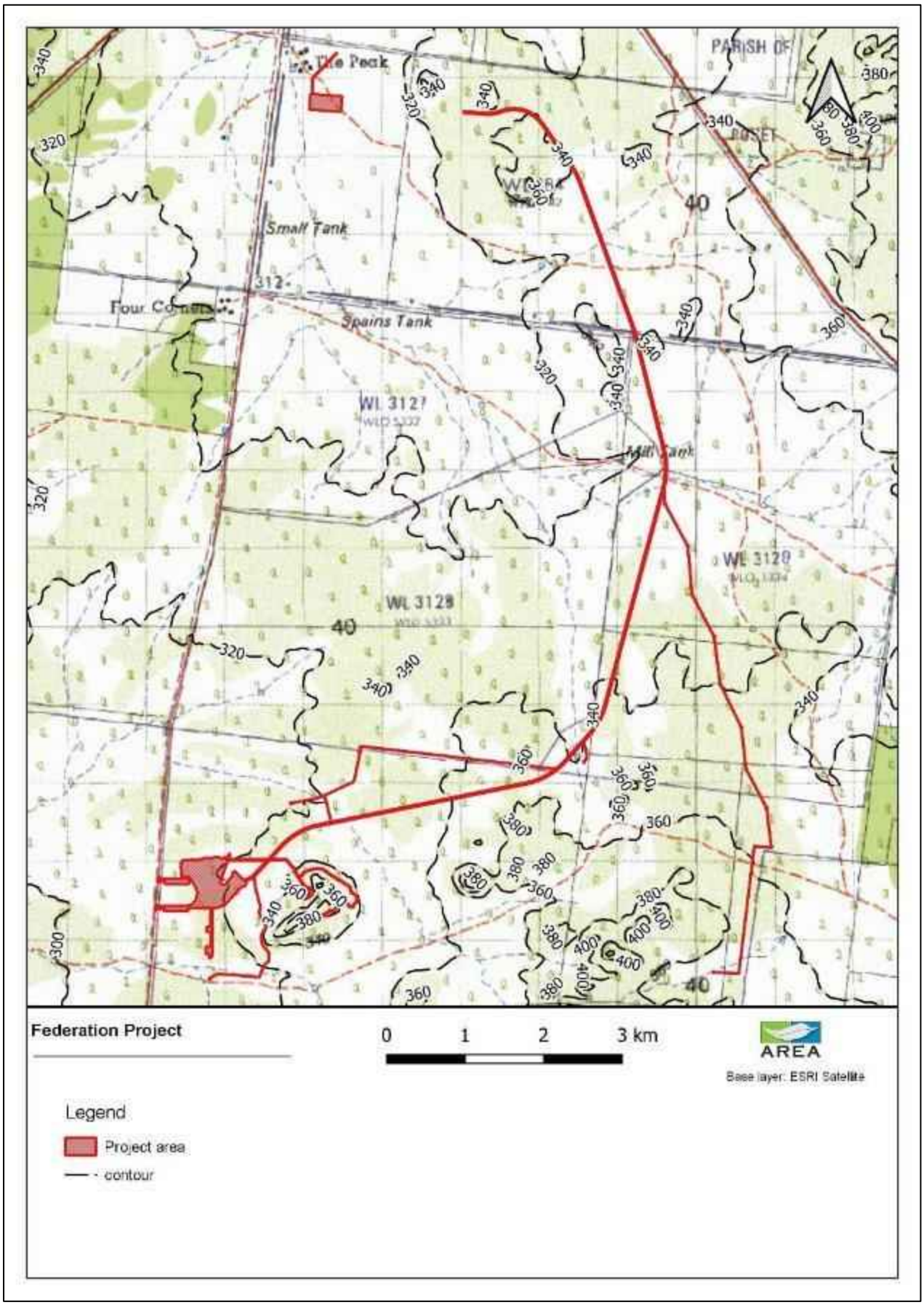
Survey date	Survey personnel	Survey area	Report title	Company / Report date
19-28-Oct-2020	Addy Watson Phil Cameron Gabbi Green	MOD5	Preclearing assessment and relocation of Grey-crowned Babbler nests	AREA - Nov 2020
19-28-Oct-2020	Gabbi Green Dave Sturman	Back Dam East	Preclearing assessment	AREA - Nov 2020
19-28-Oct-2020	Addy Watson Greg Bible Phil Cameron Gabbi Green Dave Sturman Anna Darby Dr Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2020	AREA - Jan 2021
19-28-Oct-2020	Addy Watson Greg Bible Phil Cameron Gabbi Green Dave Sturman Anna Darby Dr Heidi Kolkert	Federation 81-hectare SSD proposed mine site	Federation SSD ecology and heritage assessments	AREA - Feb 2021
27-Jan-2021	Phil Cameron	Hera Mine Camp Expansion	Hera Mine Camp Expansion additional survey	AREA - Nov 2020

2 Landscape context

2.1 Topography

Topography of the Project area is generally flat, ranging from approximately 320 to 340 metres Australian Height Datum (AHD). The south-eastern corner of the Project area begins to rise to a ridgeline up to approximately 400 metres (Figure 2-1).

Figure 2-1: Elevation and topography in and around the Project area

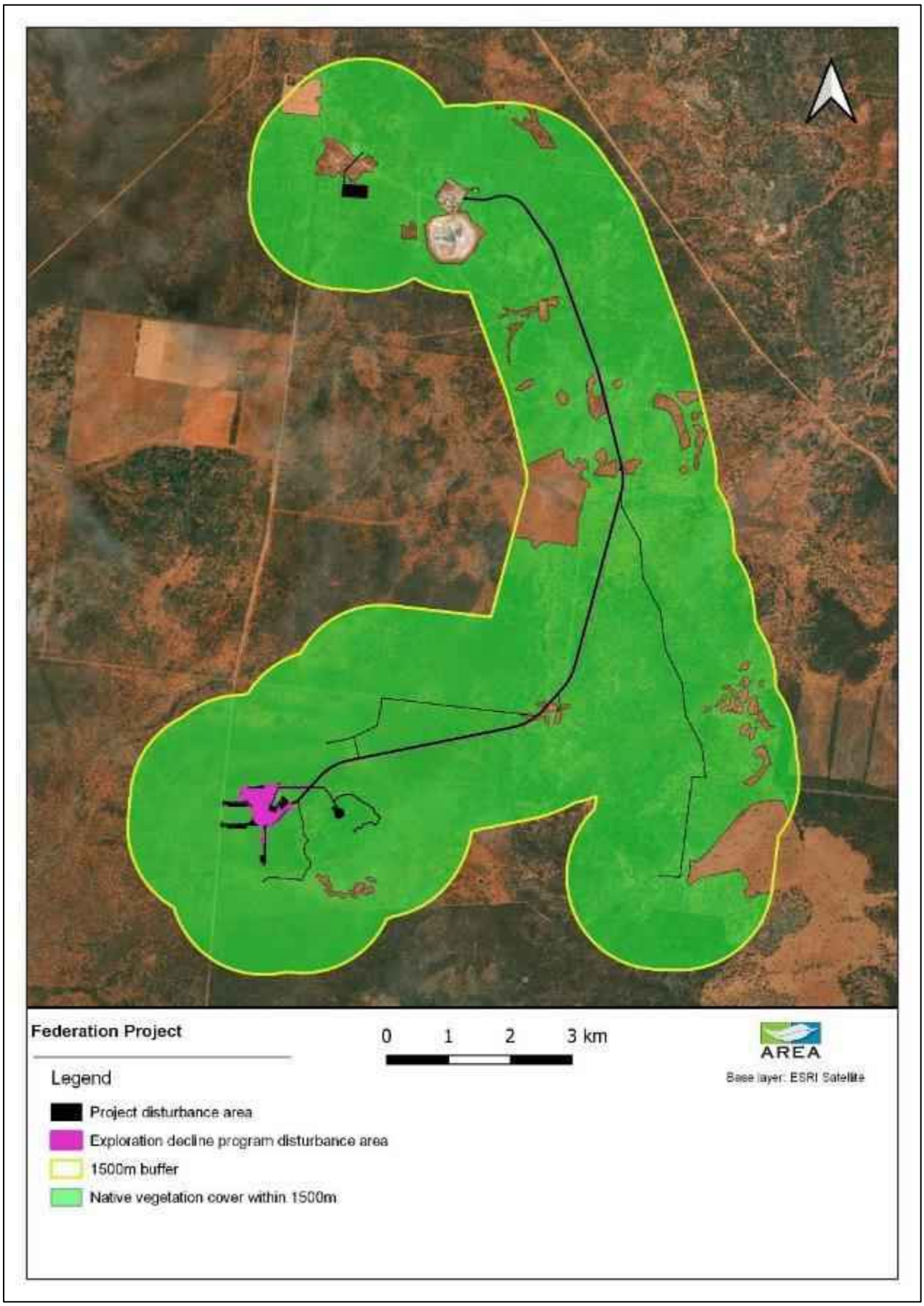


2.2 Vegetation cover

The Project area is in an agricultural region which has been historically cleared and altered. As a result of historical disturbance, the pre-European vegetation composition on the Project disturbance area has changed. The ground stratum was effectively stripped, and White Cypress Pine *Callitris glaucophylla* dominates the landscape which significantly suppressed biodiversity (AREA, 2019). Historical clearing for logging is evident across the Project area and its surrounds. More recently there has been disturbance and clearing for the construction of Hera Mine.

Vegetation cover is high with approximately 90 per cent of the Project disturbance area covered in remnant or regenerating native vegetation, and approximately 93 percent vegetated cover within a 1500 metre buffer (Figure 2-2). Existing and approved breaks in vegetation are the exploration decline program disturbance area, Burthong Road to the west, various farm/private roads, Hera mine and associated infrastructure, farm fence lines, exploration access tracks and natural breaks in vegetation.

Figure 2-2: Native vegetation within 1500 metres of the Project disturbance area



2.3 IBRA bioregions and subregions

The Project area lies within the Cobar Peneplain Bioregion and the Nymagee Subregion (Figure 2-3).

The Cobar Peneplain Bioregion lies in central NSW and is entirely with NSW. The Bioregion extends from south of Bourke to north of Griffith. The bioregion has a total area of 7,334, 664 hectares and occupies 9.2 per cent of the state.

In the north of the bioregion, Yanda Creek, a major stream, discharges directly into the Darling River which meanders across the bioregional boundary in the northwest. In the east, several small streams flow occasionally into the Bogan River as it criss-crosses the eastern boundary of the bioregion (Morgan and Terrey 1992). The Lachlan River traverses the bioregion in the south with contributions of minor runoff from smaller streams (Morgan and Terrey 1992). The bioregion lies wholly within the Murray-Darling Basin and includes the Barwon, Macquarie, Yanda, Darling, Lachlan and Murrumbidgee catchments.

An overview of the Nymagee Downs BBSR Subregion is shown below (Source: DPIE https://www.environment.nsw.gov.au/bioregions/CobarPeneplain-Subregions.htm):

Geology

Ordovician to Devonian granites, quartzose sandstones, phyllites, slates and acid volcanics. Quaternary aeolian sands and alluvium.

Characteristic landforms

Low hills and ridges with steep slopes. Form controlled by rock type, rounded hills with tors on granite, asymmetric strike ridges in sedimentary rocks. Sandplains from adjacent bioregions lap onto lower slopes.

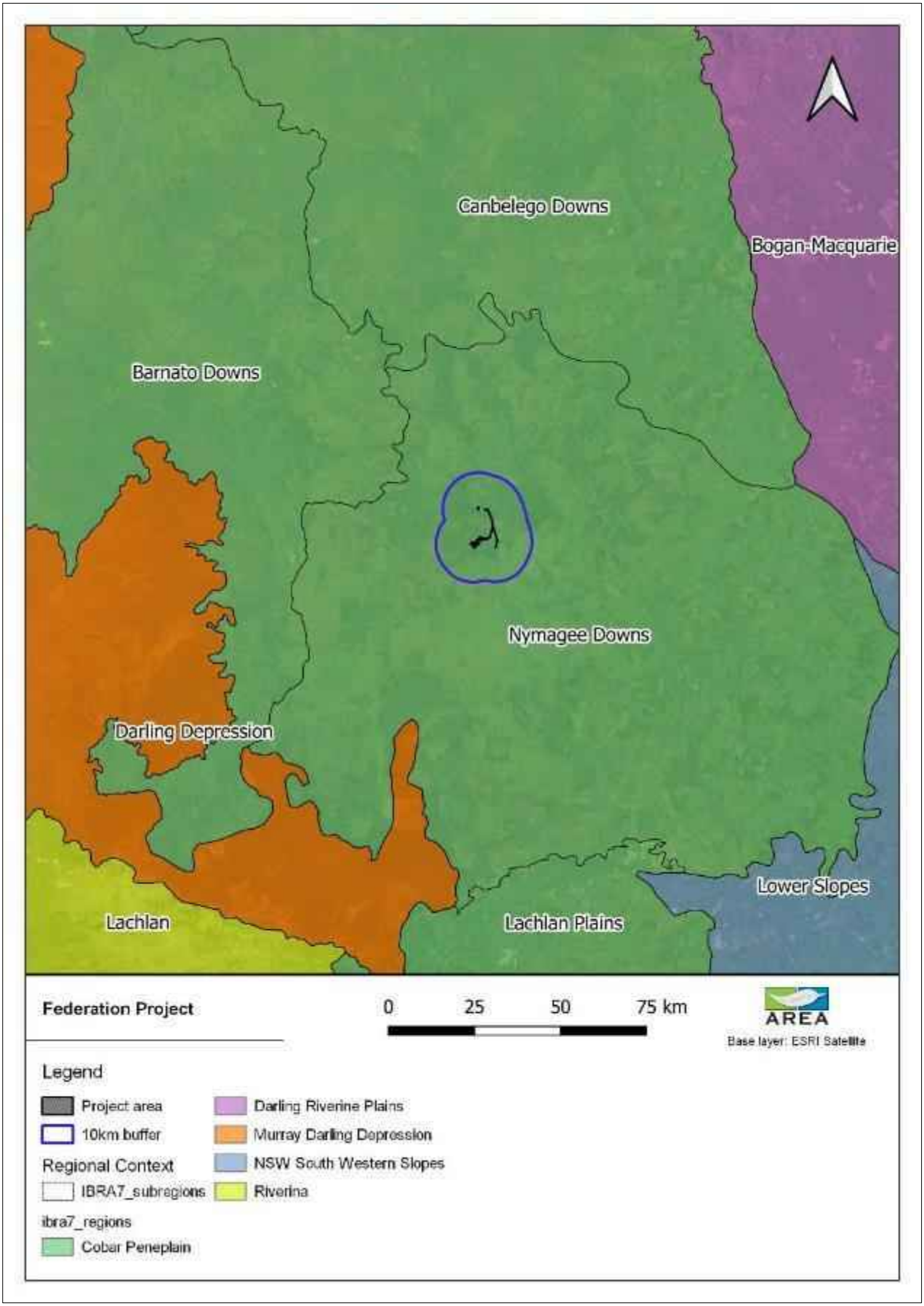
Typical soils

Gritty red and yellow earthy sands on granite. Stony red earths and texture contrast soils on sedimentary rocks. Calcareous red earths in sandplains, minor earths and grey clays in alluvium.

Vegetation

Dwyer's mallee gum, white cypress pine, kurrajong, golden wattle on granite crests, poplar box and red box on slopes and creeks. White cypress pine, red box, belah with mallee, western wattle grey box and rosewood on crests and slopes of Sedimentary rocks. Mallee communities on sandplains. Dense poplar box and white cypress pine in creek lines.

Figure 2-3: IBRA regions



2.4 NSW Landscapes

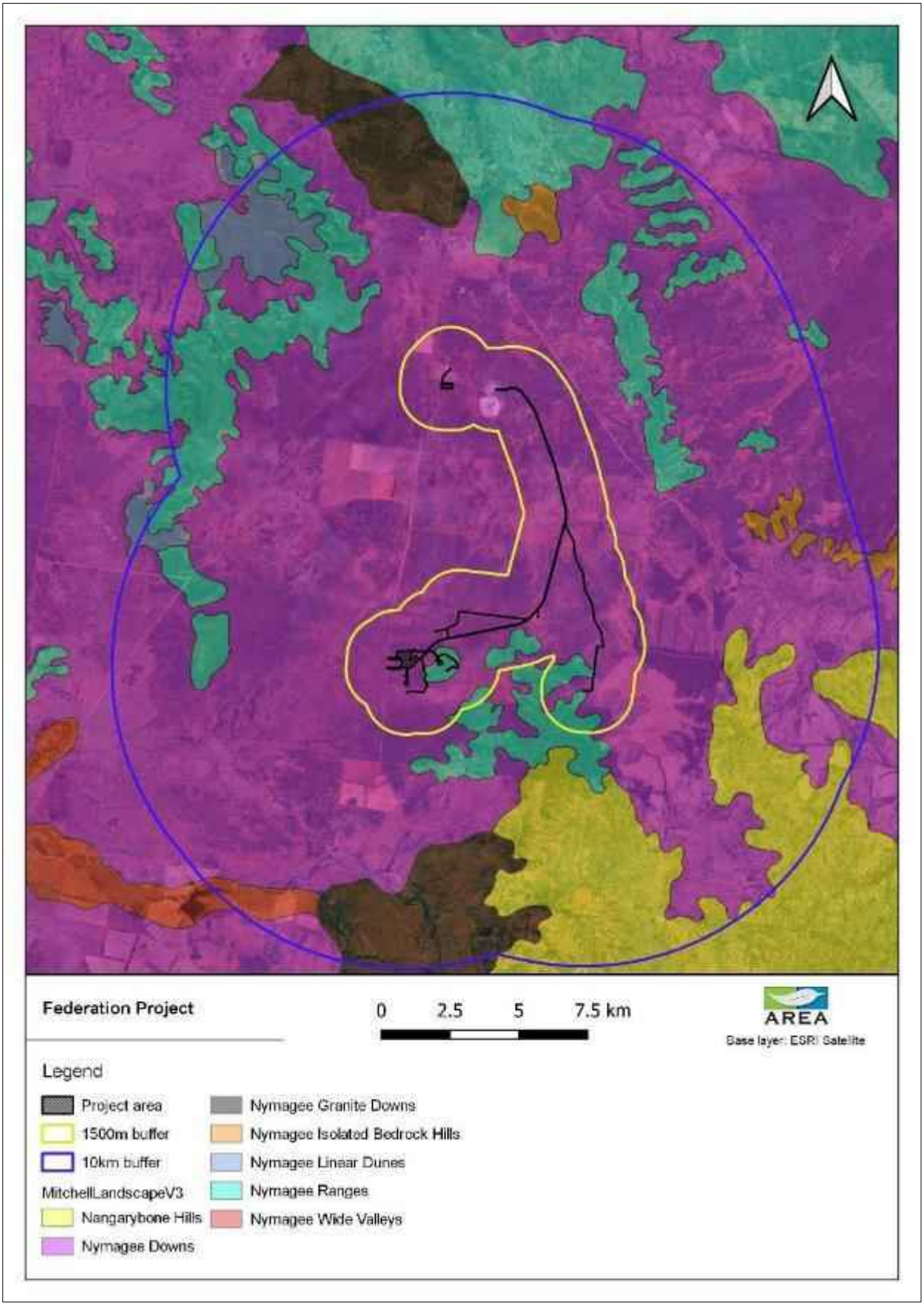
Two Mitchell Landscapes occur within 1500 metres of the Project area (Figure 2-4). The landscapes are summarised in Table 2-1.

Table 2-1: Summary of Mitchell Landscapes within 1500 metres

(https://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf)

NSW Landscape	Relation to Project	Descriptions
Nymagee Downs	Mapped in the Project area and surrounds	Undulating rounded Ordovician, Silurian or Devonian quartzite, sandstone or phyllite ridges with narrow and broad drainage flats, relief 10 to 20m. Undulating silcrete ridges with long low slopes and broad level plains, relief to 20m. Drainage lines up to 1 km wide. Shallow, stony, loamy and sandy soils on crests, deep, calcareous red earths and solonized brown soils with gilgai on plateau, grading to deeper acid, neutral or calcareous red earths and red texture contrast soils with hardpan down slope. Bimble box (*Eucalyptus populnea*), western red box (*Eucalyptus intertexta*), mallee (*Eucalyptus sp*.), mulga (*Acacia aneura*), warrior bush (*Apophyllum anomalum*), rosewood (*Alectryon oleifolius*), turpentine (*Eremophila sturtii*), narrow-leaf hopbush (*Dodonaea attenuata*), western golden wattle (Acacia decora), budda (*Eremophila mitchellii*), kurrajong (*Brachychiton populneus*), silver cassia (*Senna artemisioides*), broad-leaved hopbush (*Dodonaea viscosa*), wire grass (*Aristida sp*.), rough spear grass (*Austrostipa scabra*), red-leg grass (*Bothriochloa macra*), and windmill grass (*Chloris truncata*) on crests. Bimble box, red box, wilga (*Geijera parviflora*), turpentine, budda, punty bush (*Senna eremophila*), hopbush (*Dodonaea sp*.), yarran (*Acacia homalophylla*) and ironwood (*Acacia excelsa*) with many other woody shrubs and grasses on lower slopes. Western red box, bimble box, yarran and budda with grasses in drainage lines.
Nymagee Ranges	Mapped in the Project area and surrounds	Rounded strike ridges of folded Ordovician and Silurian sandstone, quartzite, phyllite and shale with strongly-benched slopes, relief to 140m. Rounded ridges of Devonian quartzite, conglomerate, and sandstone, over Ordovician or Silurian phyllite and schist, narrow incised drainage lines, relief to 180m. Steep hillcrests and low ridges with tors of granite or Silurian quartz-feldspar porphyry, relief to 30m. Abundant rock outcrop with sandy and loamy lithosols becoming deeper down slope and in drainage tracts. Abundant surface grit on granite hills. Moderate to dense grey mallee (*Eucalyptus morrisii*), green mallee (*Eucalyptus viridis*), Dwyer's mallee gum (*Eucalyptus dwyeri*), white cypress pine (Callitris *glaucophylla*), currawang (*Acacia doratoxylon*), mulga (*Acacia aneura*), western golden wattle (*Acacia decora*), twiggy daisy bush (*Olearia ramulosa*), wedge-leaf hopbush (*Dodonaea viscosa*), silver cassia (*Senna artemisioides*), mint bush (*Prostanthera sp*.) and rock fern (*Cheilanthes sieberi*) on upper slopes. Dense green mallee (*Eucalyptus viridis*), white cypress pine, bimble box (*Eucalyptus populnea*), wonga vine (*Pandorea pandorana*), western red box (*Eucalyptus intertexta*), broad-leaf hopbush (*Dodonaea viscosa*), long greybeard grass (*Amphipogon caricinus*), rough spear grass (Austrostipa scabra) and wire grasses (*Aristida sp*.) on lower slopes. White cypress pine and bimble box with western golden wattle (*Acacia decora*) and kangaroo grass (*Themeda triandra*) becoming dominant in drainage lines. River red gum (*Eucalyptus camaldulensis*) and bimble box along major creeks.

Figure 2-4: Mitchell Landscapes



2.5 Rivers, streams, wetlands

Waterways within 1500 meters of the Project disturbance area are shown in Figure 2-5. The Project occurs in a relatively arid area with no wetlands of international or national importance located within relevant distance and no major waterways occurring within 1500 metres. There are however several unnamed ephemeral tributaries and topographic drainage lines which intersect the Services Corridor and Project linear infrastructure.

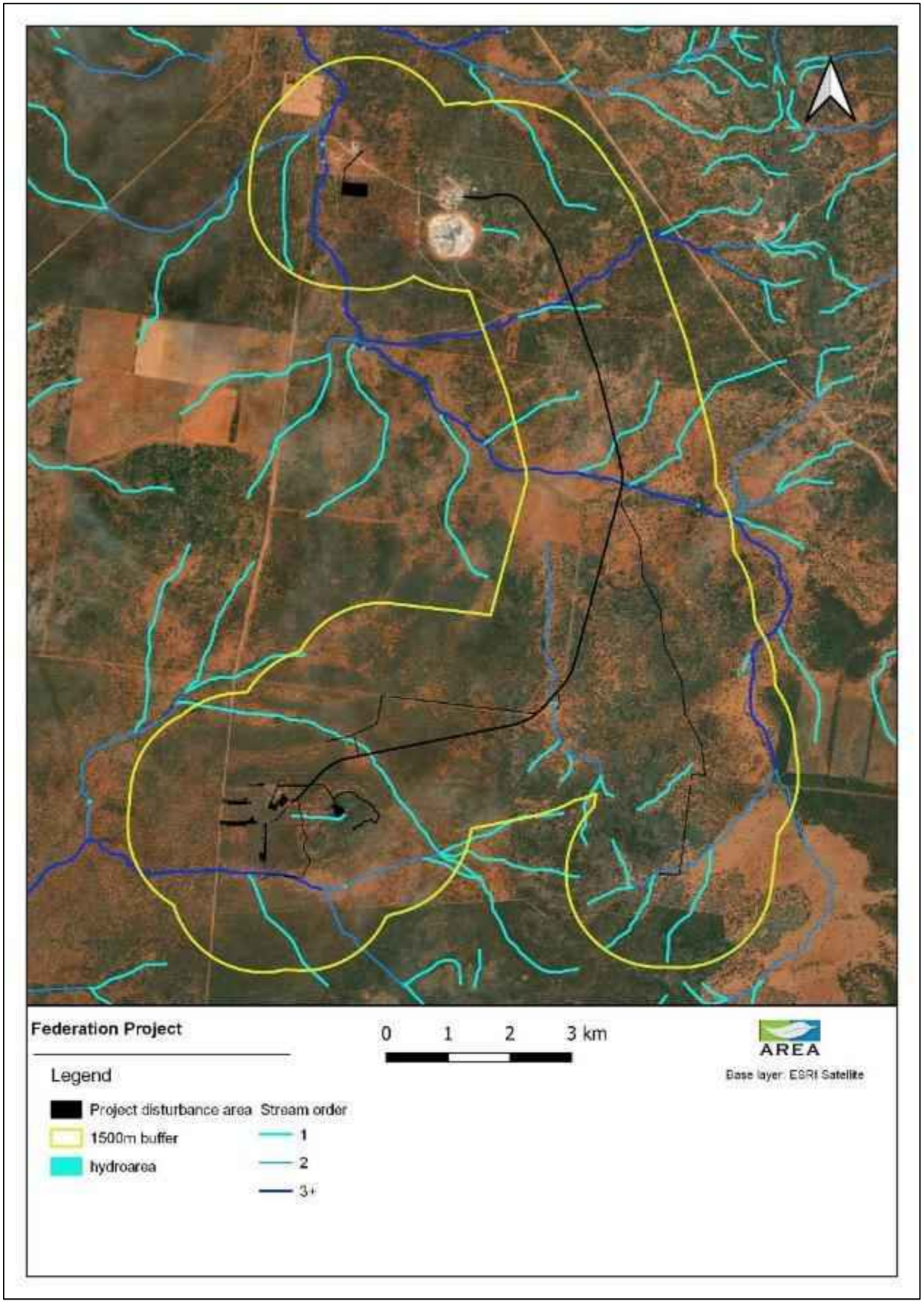
The nearest named waterway is Box Creek, a third Strahler Order waterway approximately 2.5 kilometres to the west of Hera Mine. Hydrolines which are the upper reaches of Box Creek intersect the northern section of the Services Corridor.

Hydrolines in the southern section of the study area flow in a south-westerly direction toward Sandy Creek, a third (or greater) Strahler Order waterway approximately 6 kilometres south of the Federation Site.

Dams and hydrolines in the study area lack aquatic habitat which would attract insects and amphibian species. No waterways mapped as Key Fish Habitat exist within ten kilometres of the Project area.

The Project is unlikely to significant impact waterways if mitigation measures in Section 5.6 are implemented.

Figure 2-5: Waterways mapped in and around the Project disturbance area



2.5.1 Groundwater dependent ecosystems

A Groundwater Dependent Ecosystem (GDE) is an ecosystem which has its species composition and natural ecological processes determined by groundwater. That is, GDEs are natural ecosystems that require access to groundwater to meet all (obligatory), or some (facultative) of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services. If the availability of groundwater to GDEs is reduced, or if the quality is allowed to deteriorate, these ecosystems will be impacted (GHD Pty Ltd, 2021). Groundwater plays an important ecological role in directly and indirectly supporting terrestrial and aquatic ecosystems. Groundwater sustains terrestrial and aquatic ecosystems by supporting vegetation and providing discharge to channels, lacustrine and palustrine wetlands, and both the estuarine and marine environment. Aquifer ecosystems are inherently groundwater dependent (Queensland Government, 2021)

The Australian Government Bureau of Meteorology Groundwater Dependent Ecosystems (GDE's) Atlas maps covering the Project area are included in Appendix A.

The BoM Aquatic GDE maps no potential interactions within the Project area.

The BoM GDE maps a number of potential terrestrial GDEs in the vicinity of the Project area. The terrestrial GDE layer expresses the potential for groundwater and mapped vegetation communities across Australia to interact. It shows the vegetation communities that interact with groundwater from the water table or in the capillary zone. It does not imply an entire mapped ecosystem is using groundwater, but rather groundwater interaction may be occurring somewhere within the mapped ecosystem. The mapping generally identifies potential GDEs based on regional mapping and therefore the potential GDEs often correspond with areas of vegetation. It is considered highly unlikely that these vegetative communities are GDEs given the deep-water levels identified at the site.

A Groundwater Assessment undertaken by GHD for the Federation Project (GHD Pty Ltd, 2021) confirms it is unlikely there are any GDEs in the vicinity of Federation due to the deep water table (approximately 45 to 90 metres below ground level). There are no GDEs within or near the Project that are classified as 'high priority' listed in the relevant Water Sharing Plan. Groundwater in the study area is too deep to support GDEs therefore there will be no impact to groundwater dependent vegetation

The BoM Subterranean GDE map layer has no data for the Project area.

2.6 Habitat connectivity

Habitat connectivity within the Project area is high. Remnant and regenerating woodland cover much of the Project area and surrounds (see Section 2.2). The Project area is well connected to native vegetation from all directions, there are no officially mapped wildlife corridors in the Project area. The Project will have a minor effect on connectivity in the immediate vicinity, but overall connectivity will not be reduced in any significant capacity.

2.7 Karsts, caves and other rock features

No Karsts or caves were identified in the study area.

The Project area does intersect two ridges containing rocky features (surface rocks) however this area does not contain karsts or caves (Figure 2-6). This is taken into consideration when assessing the potential impact to threatened species which utilise rocky habitat.

2.8 Soils and geology

Land systems are areas or groups of areas throughout which there is a recurring pattern of topography, soils and vegetation. Three Land Systems are mapped in the Project area, see Table 2-2 and Figure 2-7.

Table 2-2: Land systems mapped in the Project area

Land system Name	Range type	Major Range	Physiography	SUMMARY
Glenown	Ranges and hills with white cypress pine	Bimble Box - Pine	Ranges	Folded ranges west of Nymagee
Kopyje	Plains and ridges with bimble box and white cypress pine	Bimble Box - Pine	Rolling Downs and Lowland	Slightly undulating hard-red country with mallee crests
Yackerboon	Plains and ridges with bimble box and white cypress pine	Bimble Box - Pine	Rolling Downs and Lowland	Low ridge country, west and south of Nymagee

No soil hazard features were mapped in the Project area on the DPIE eSPADE spatial viewer.

No areas of other geological significance or soil hazards are known in Project area.

2.9 Areas of outstanding biodiversity value

There are no areas of outstanding biodiversity value mapped within 1500 metres of the Project area.

Figure 2-6: Rocky features within 1500 metres of the Project area

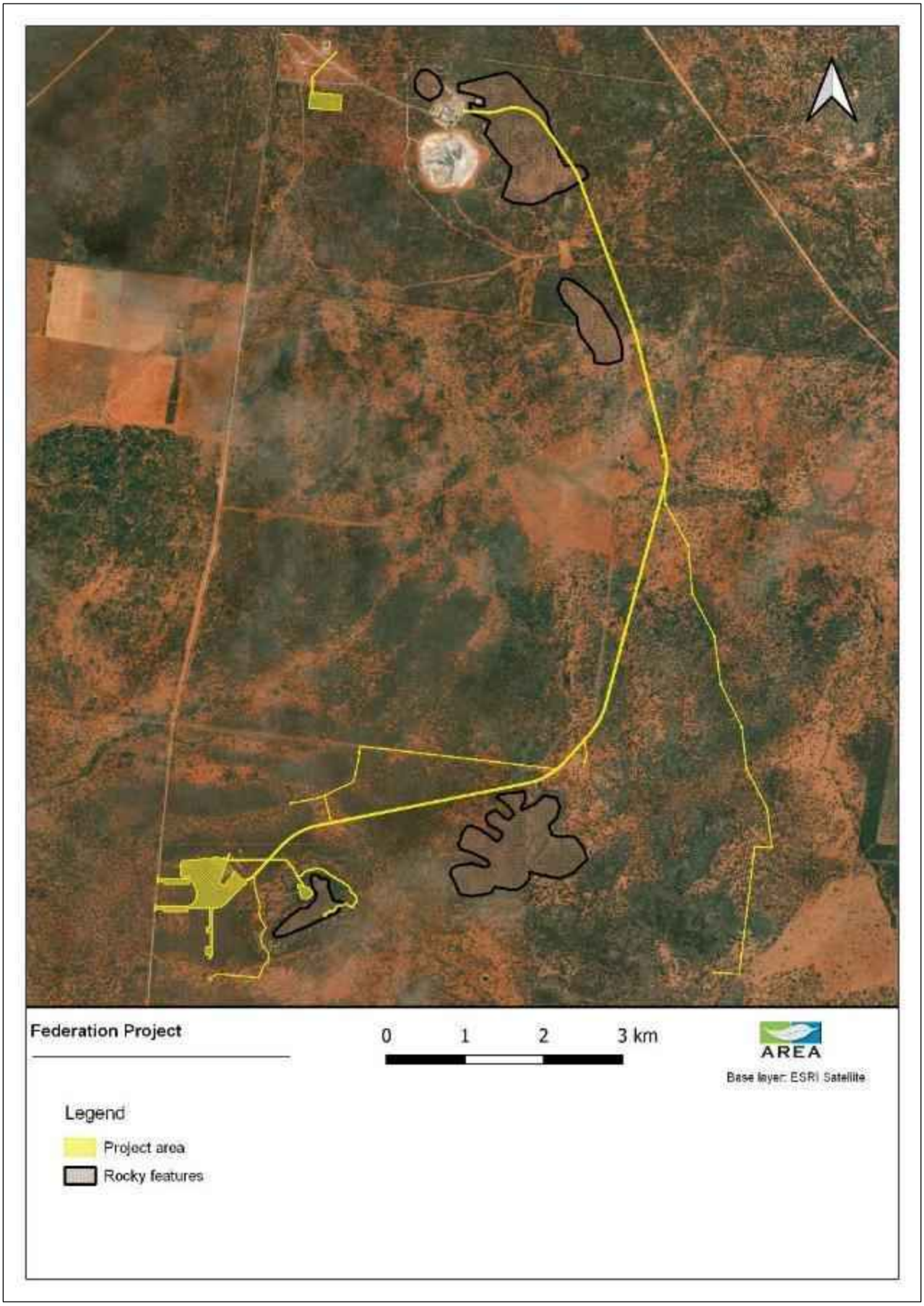
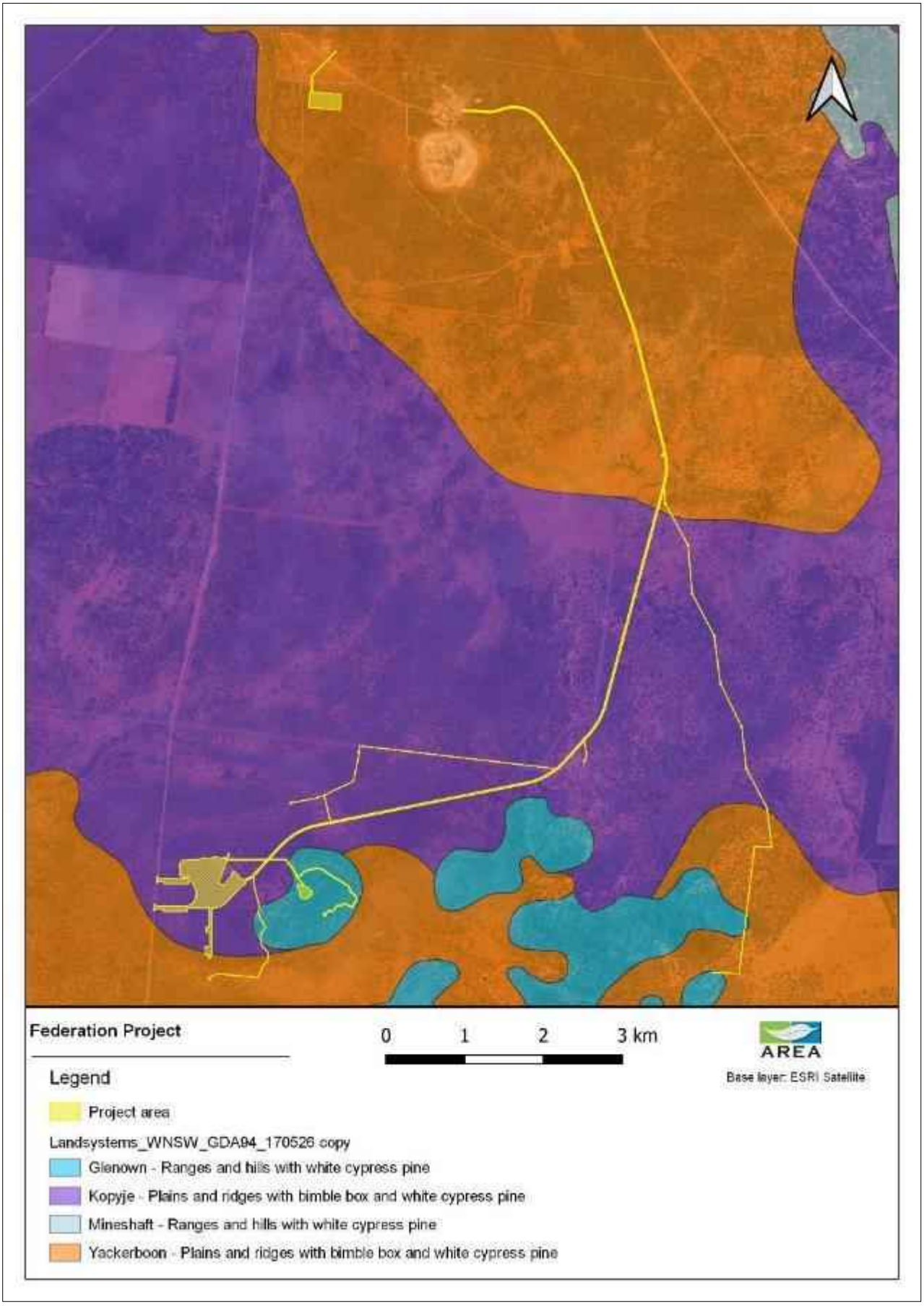


Figure 2-7: Land systems mapped in and around the Project area



3 Native vegetation

3.1 Survey methods

AREA conducted field survey in the Project disturbance area specific to this proposal over five days 12 to 16 July 2021 and three days 1 to 3 October 2021 following BAM (2020) guidance materials listed in Section 1.8 of this BDAR. Additional surveys to identify environmental constraints for other Hera Resources related projects have been previously undertaken by AREA in 2018, 2019, June 2020, October 2020 and January 2021 (including for the exploration decline program), and results of these previous surveys have contributed to this assessment.

BAM (2020) is approved by the NSW government as it is scientifically robust and transparent. BAM (2020) ensures all accredited assessors can assess the same location and with the BAM credit calculator (BAM-C) get a same or very similar score. The BAM Credit Calculator generates a number against a benchmark to indicate quality i.e., a Vegetation Integrity Score of 67 equals 67 percent of the benchmark for the described PCT.

The field assessment to map native vegetation was undertaken to groundtruth map layer - Western State Vegetation Plant Community Type Map 4492 aerial imagery and to correct any errors. The Project disturbance area was first assessed to broadly indicate what Plant Community Types (PCTs) and zones were likely present and where BAM (2020) plots and further assessment could be located. Plots were placed in representative native vegetation zones likely to be impacted by the Project.

Eighteen 20 by 20 metre in 20 by 50 metre plots following BAM (2020) were used to inform this BDAR. These plots, collectively known as a ‘nested plots’, were placed in and around the Project area, preferentially in an expected Project disturbance area (Note: the design detail has been refined and modified since conception to avoid impact, so survey effort extends beyond the Project disturbance area in places). The 20 by 20 metre area measures biodiversity (plant composition or floral biodiversity, hence evidence to identify the PCT and its quality) and the 20 by 50 metre structure plot, including the one-by-one-metre leaf litter plots, measure the function of the same area. Function includes an assessment of size classes of trees and tree hollows, which are both indicative of the age of trees assessed, ground logs and the amount of leaf litter. These attributes indicate the quality of habitat present and influences what species of listed fauna or flora can use the vegetation.

Effort was made to have all vegetation plots used in this assessment located within the Project disturbance area. Two are just outside the Project disturbance area, however they are representative of the vegetation type and condition within the Project disturbance area. Additional plots which ended up being outside the final Project disturbance area and were too far away to be relevant were not used in this assessment.

AREA’s team observed and recorded characteristics of each plot including species composition and abundance for each layer (including upper/canopy, mid-storey/shrub stratum, and groundcover/ orbs and grasses). The number of species and height of all flora

observed, the percentage groundcover and signs of disturbance were recorded. Using this data, PCTs in the Project disturbance area were identified.

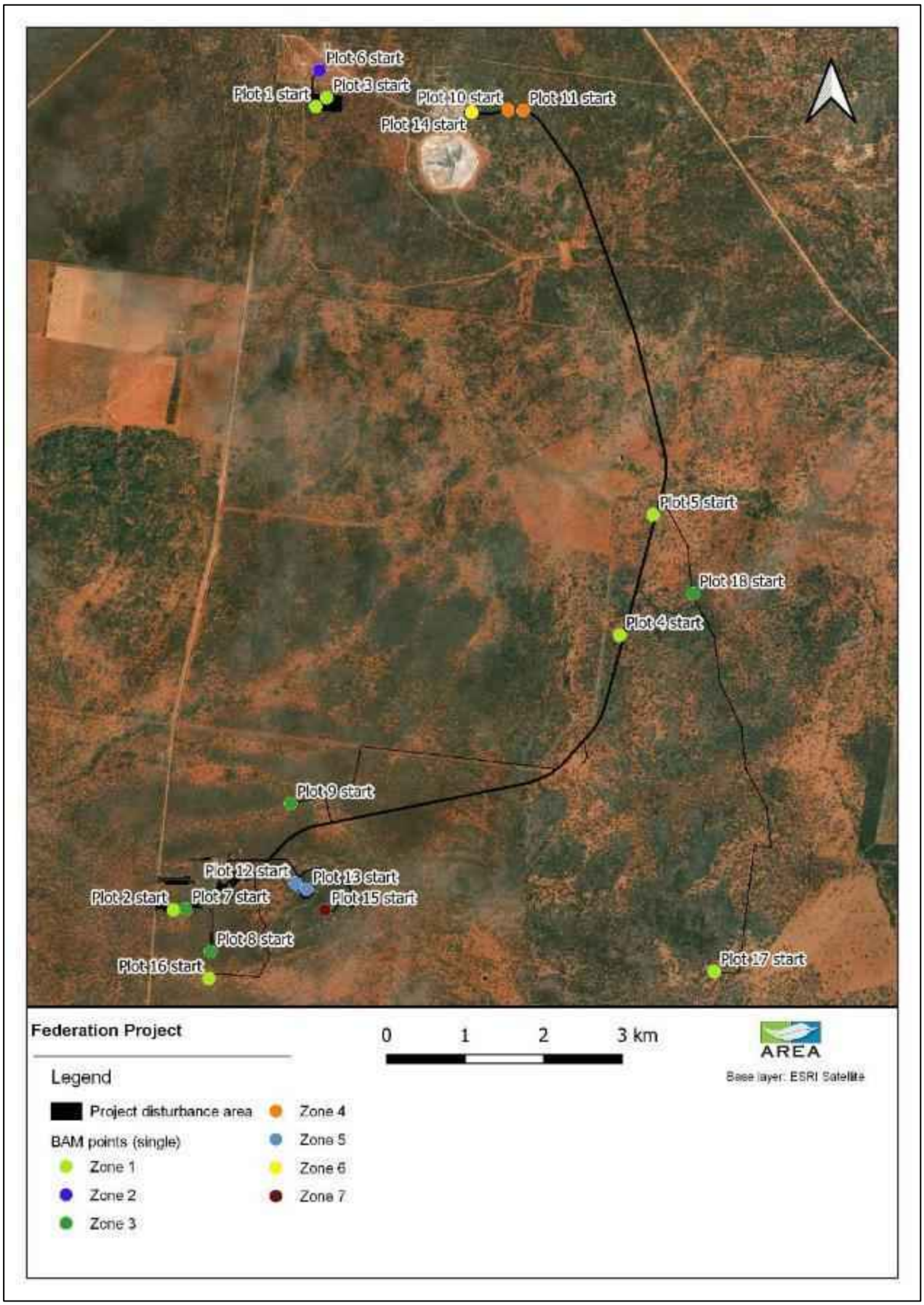
If the presence of a listed threatened species was detected in a plot, relevant NSW or Commonwealth guidelines were employed to find others in or next to the plot to indicate the extent of the local viable population.

No threatened flora species were identified in the Project disturbance area through targeted pedestrian transects or within plots, see Section 4.2.5.

Plot data collected per BAM (2020) was entered into the BAM-C. Completed field plot data sheets are presented in Appendix B. Plot photos are collated in a table which, due to its size, is presented in Appendix C.

Figure 3-1 shows the plot locations in the Project disturbance area.

Figure 3-1: BAM (2020) vegetation survey effort in the Project disturbance areas



3.2 Plant Community Types

Plant Community Types (PCTs) are the master community-level typology used in NSW's planning and assessment tools and vegetation mapping programs.

The Western SVM (state vegetation map) v1_0_PCT_E_4492 maps the following PCTs in and adjacent to the Project area (Figure 3-2):

- PCT72 *White Cypress Pine - Poplar Box woodland on footslopes and peneplains mainly in the Cobar Peneplain Bioregion*
- PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*
- PCT104 *Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*
- PCT105 *Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion*
- PCT174 *Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*
- PCT176 *Green Mallee - White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Peneplain Bioregion*
- PCT184 *Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*
- PCT193 *Red Mallee - White Mallee extremely tall tree mallee on silty-loam-clay soils of central south-western NSW*
- PCT218 *Grey Mallee - Mulga shrubland of the north-western Cobar Peneplain Bioregion.*

Flora species, formation, class and type were recorded on each BAM (2020) data sheet and this data was entered into the BioNet Vegetation Classification Community Identification Tool to provide statistically valid options on what PCT best matched the native vegetation in the Project disturbance area. After consideration of the upper, mid and ground-stratum species recorded in the Project disturbance area and the regional context, PCT's were groundtruthed and mapped across the whole Project area and the following PCT's occurred within the Project disturbance area (Figure 3-3):

- PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*
- PCT104 *Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*
- PCT174 *Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*
- PCT180 *Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*
- PCT258 *Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*
- PCT184 *Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion.*

Justification for the PCT selection is discussed in the following section.

The ground surface in the Project disturbance area consists of both native vegetation and no native vegetation (cleared or bare patches). Approximately 1.05 hectares of 'no vegetation' is present in the Project disturbance area because of previous disturbance or clearing under previous exploration approvals, including roads, fence lines and an existing waste disposal area in the proposed solar farm. These areas are recorded as PCT0 – Not Native in this report.

Table 3-1 outlines the areas and zones of each PCT in the Project disturbance area. Zones are explained further in Section 3.3.

Table 3-1: Plant Community types in the Project disturbance area

PCT ID	PCT name	Zone	Vegetation class	Vegetation formation	Est. % cleared in NSW	Extent in Project disturbance area (hectares)	Associated with TEC
103	*Poplar Box – Gum Coolabah – White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	1 Dense	Western Peneplain Woodland	Semi-arid Woodlands (Shrubby sub-formation)	50	33.48	N/A
		2 Open	Western Peneplain Woodland	Semi-arid Woodlands (Shrubby sub-formation)	50	0.32	N/A
174	*Mallee – Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*	3	Sand Plain Mallee Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	56	14.46	*Listed BC Act, E: Acacia loderi shrublands (Part)*
104	*Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*	4	Inland Rocky Hill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	25	3.86	N/A
180	*Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*	5	Inland Rocky Hill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	18	2.35	N/A
258	*Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*	6	Inland Rocky Hill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	38	0.86	N/A
184	*Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*	7	Inland Rocky Hill Woodlands	Semi-arid Woodlands (Shrubby sub-formation)	20	0.45	N/A
Total Native Vegetation						**55.78**	
0	No vegetation	-	-	-	-	1.05	-
					Total	**56.83**	

One Threatened Ecological Community (TEC) listed as endangered under the BC Act, *Acacia Ioderi Shrublands (part)* is associated with PCT174. Ground truthing the native vegetation in the study area confirmed there is no *Acacia Ioderi*, nor associated species or ancillary attributes present in the Project disturbance area; and therefore this TEC is not present.

Figure 3-2: PCT's mapped on SVM 4492 within 1500 metres of the Project area

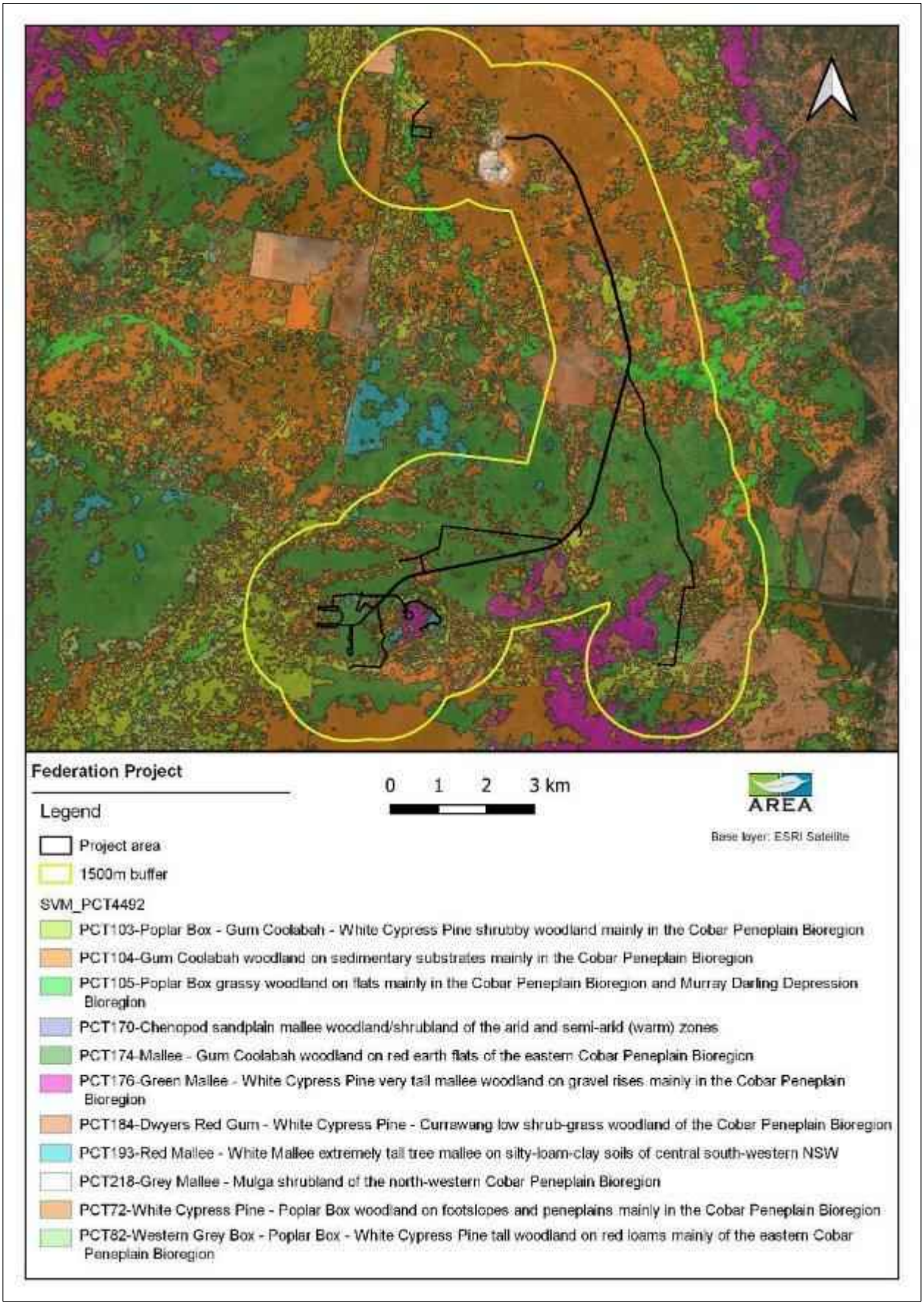
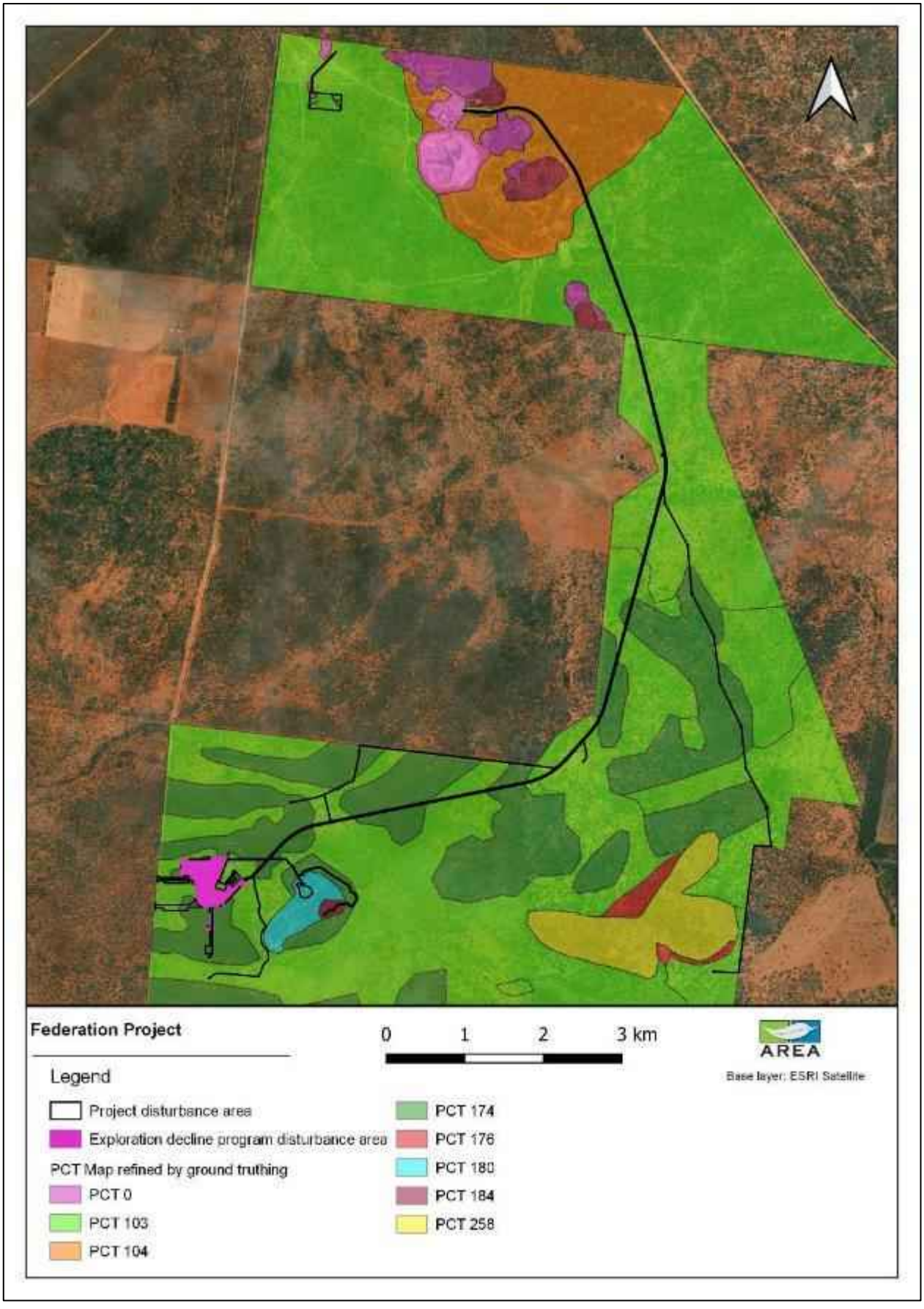


Figure 3-3: PCT map of Project area refined by ground truthing



3.2.1 Justification of PCTs mapped in this BDAR

AREA's PCT map is slightly different to Western State Vegetation Map 4492. The NSW DPIE BioNet Vegetation Classification website was consulted to consider descriptions for each PCT considered by AREA likely to be present in the Project disturbance area against those mapped on Western State Vegetation Map 4492. The following information provides notes showing why the following PCT's were confirmed as present:

PCT103

- Bioregion and sub-region are correct
- Position in landscape (foot slopes and plains) is consistent
- Vegetation description is consistent - Open woodlands to 25 metres high
- There is a difference in the canopy composition. *Eucalyptus intertexta* dominates in preference to *Eucalyptus populnea* however the footprint has been historically cleared so some discrepancies are expected
- Shrub layer is consistent with descriptions (dense to sparse) containing *Geijera parviflora, Eremophila mitchellii, Eremophila sturtii, Dodonaea sp, Senna sp*
- Ground stratum is consistent with PCT description
- PCT103 was previously mapped in the area during previous exploration assessments.
- PCT Zones 1 and 2 were further classified on level of clearing.

PCT 104

- Bioregion and sub-region are correct
- Position in landscape (footslope, hillslopes and plains) is consistent
- Vegetation description is consistent – Mid to high woodland dominated by *Eucalyptus intertexta* with patches of *Callitris glaucophylla*
- Sparse shrubby understory
- Grades into PCT103 on the lower slopes.

PCT174

- Bioregion and sub-region are correct
- Position in landscape (foot slopes and plains) is consistent
- Vegetation description is consistent - about eight metres tall dominated by mallee with a sparse shrub layer.
- Vegetation composition is consistent (as identified in plots where the data was run though the VIS classification Tool)
- Upper stratum species is mostly consistent - *Eucalyptus viridis, Acacia doratoxylon, Geijera parviflora, Callitris glaucophylla, Eucalyptus socialis, Eucalyptus dumosa*
- PCT174 was previously mapped in the area during previous exploration assessments.

PCT180

- Bioregion and sub-region are correct
- Position in landscape (steep hills and ridges) is consistent
- Vegetation description is consistent – mid-high woodlands

- Dominated by Grey Mallee *Eucalyptus morrisii* to about eight metres high, with an overstorey of White Cypress Pine *Callitris glaucophylla*
- Upper stratum species consistent with PCT description
- Lower stratum species consistent with PCT description
- Vegetation class consistent with floral assemblage and other ancillary features

PCT258

- Bioregion and sub-region are correct
- Position in landscape (hillslopes or footslopes) is consistent
- Vegetation description is consistent – Low to mid-high woodland (not a mallee community)
- Dominated by *Eucalyptus sideroxylon* in upper stratum and *Acacia doratoxylon* in the mid stratum
- Upper stratum species consistent with PCT description
- Lower stratum species consistent with PCT description
- Vegetation class consistent with floral assemblage and other ancillary features

PCT184

- Bioregion and sub-region are correct
- Position in landscape (stony rises) is consistent
- Vegetation description is consistent – low, open woodland
- Dominated by dominated by Dwyer's Red Gum *Eucalyptus dwyeri,* and White Cypress Pine *Callitris glaucophylla*
- Upper stratum species consistent with PCT description
- Lower stratum species consistent with PCT description
- Vegetation class consistent with floral assemblage and other ancillary features.

3.3 Vegetation zones

Vegetation zones are defined as a 'relatively homogeneous area of native vegetation within a proposal that is the same PCT and broad condition state' (OEH 2014a). The minimum number of BAM plots required per vegetation zone is shown below:

Vegetation zone area (ha)	Minimum number of plots
<2	1 plot
>2–5	2 plots
>5–20	3 plots
>20–50	4 plots
>50–100	5 plots
>100–250	6 plots
>250–1000	7 plots; more plots may be needed if the condition of the vegetation is variable across the zone
>1000	8 plots; more plots may be needed if the condition of the vegetation is variable across the zone

Seven zones (Table 3-2) were mapped in the Project disturbance area (areas of native vegetation affected by the Project subject to this BDAR). An appropriate number of plots has been undertaken for each zone. Approximately 1.05 hectares of 'no vegetation' is present in the Project disturbance area because of previous disturbance or clearing under previous exploration approvals. These areas are not included in the vegetation zones.

Table 3-2: Vegetation zones

Zone	PCT	PCT description	Area in Project disturbance area	Number of plots required by total area: number of plots done*
1	103	*Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	33.48	4:7
2	103 Cleared	*Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*	0.32	1:1
3	174	*Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*	14.46	3:4
4	104	*Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion*	3.86	2:2
5	180	*Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*	2.35	2:2
6	258	*Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*	0.86	1:1
7	184	*Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*	0.45	1:1

**Additional plots were done to cover Project staging, this is discussed further in Section 3.4*

PCT103 varies slightly from north to south in species assemblage across the Project disturbance area, but variations are not significant enough to change vegetation integrity scores, so this PCT was only given two zones based on level of clearing where there was an evident difference in structure and function.

The extent of each zone is mapped on Figures 3-4 to 3-8 (the exploration decline program disturbance area is shown in black in these figures).

The property on which Federation Site is located shares a boundary with the Balowra State Conservation Area. Patch size[4] used in the BAMC for all vegetation zones for this assessment is 5000 hectares. This area includes the Project disturbance area and the adjoining vegetated areas. The actual patch size would probably be larger than 5000 hectares as connected native woody vegetation extends kilometres in all directions, however the patch size used provides certainty the patch size is greater than 100 hectares.

No local or other benchmarks were used in the analysis of the vegetation zones.

[4]A patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems). A patch may extend onto adjoining land (BAM 2020).

Figure 3-4: Vegetation zones Hera Mine (north)

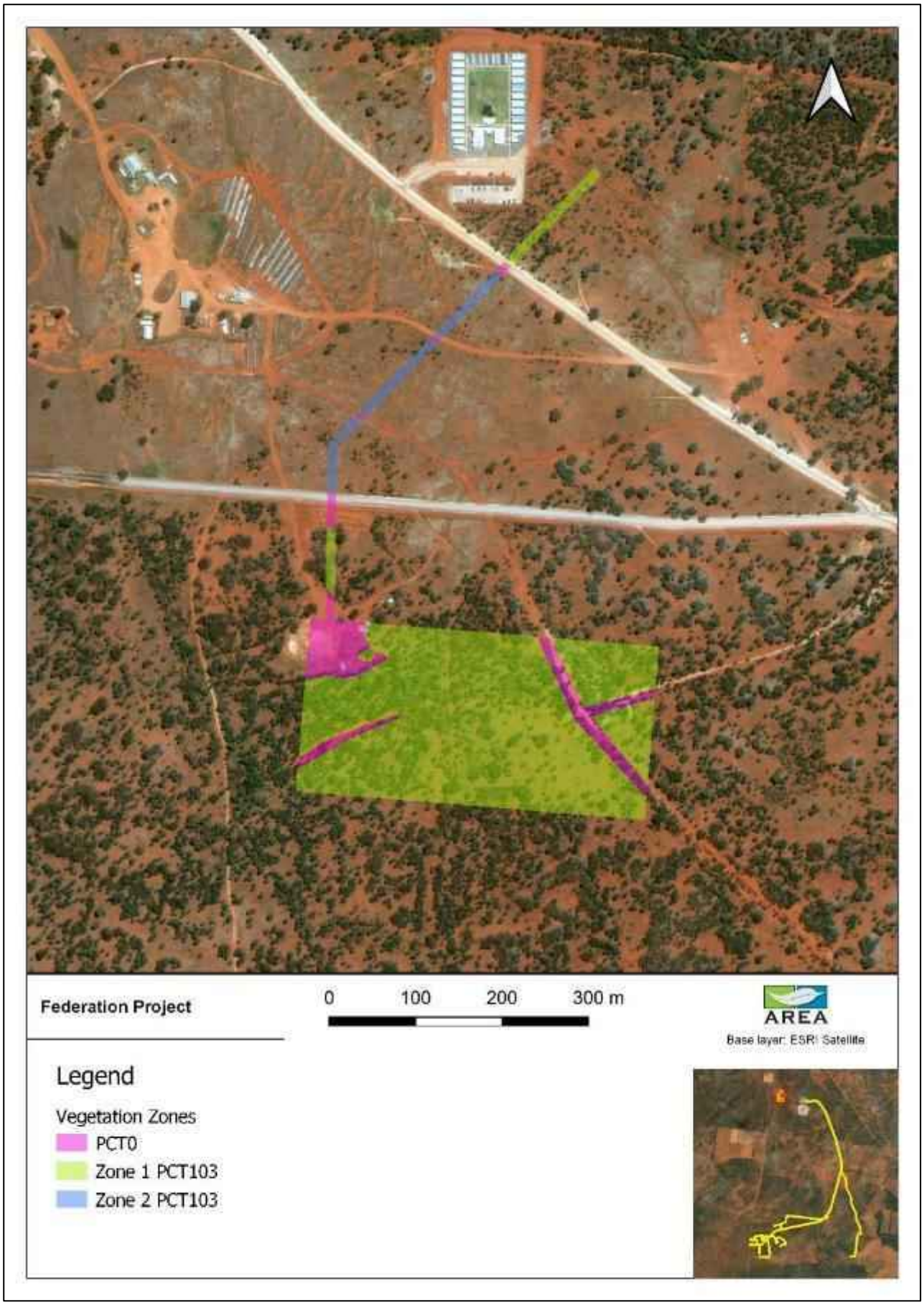


Figure 3-5: Vegetation zones (Hera Mine)

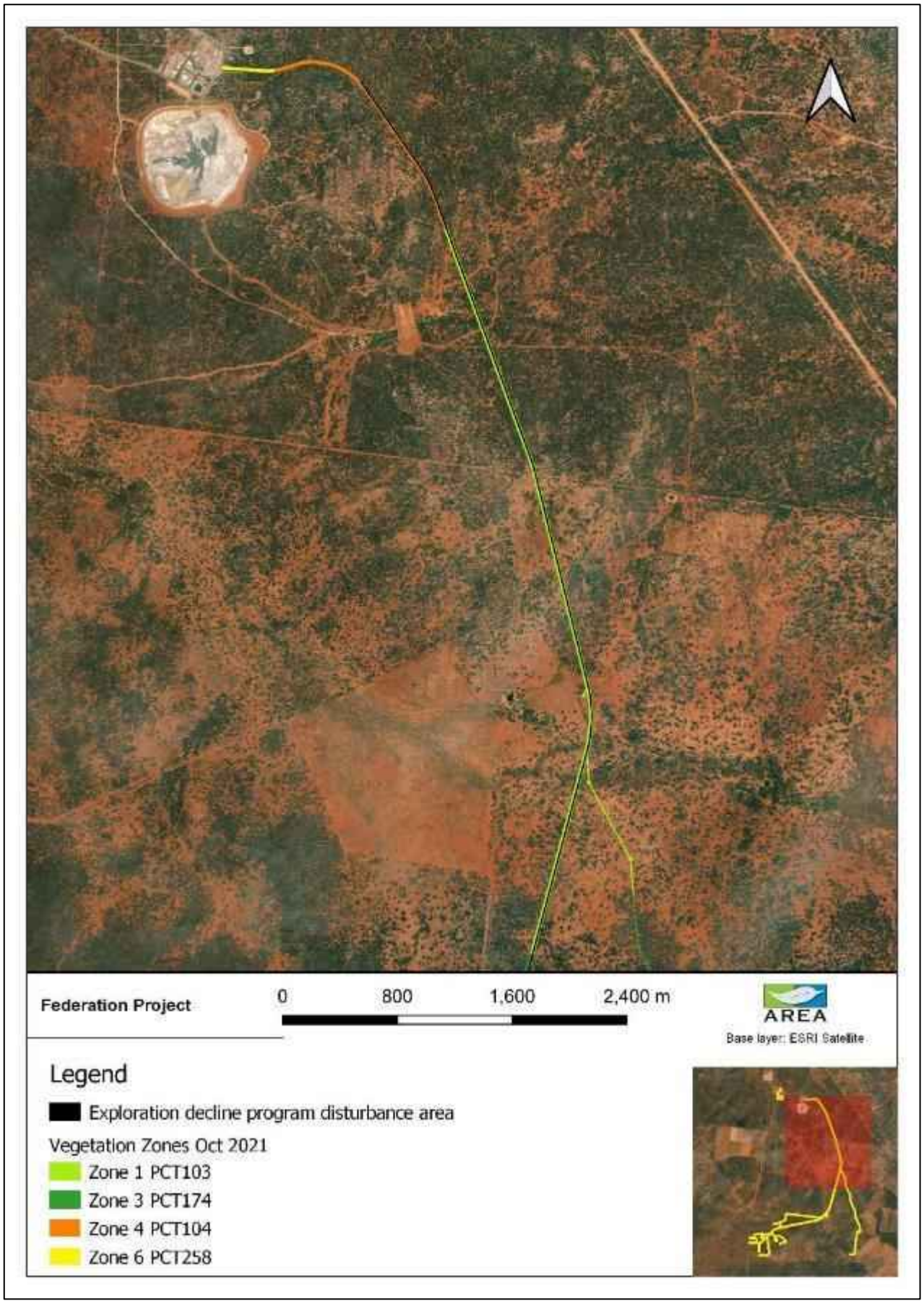


Figure 3-6: Vegetation zones (mid 1 north)

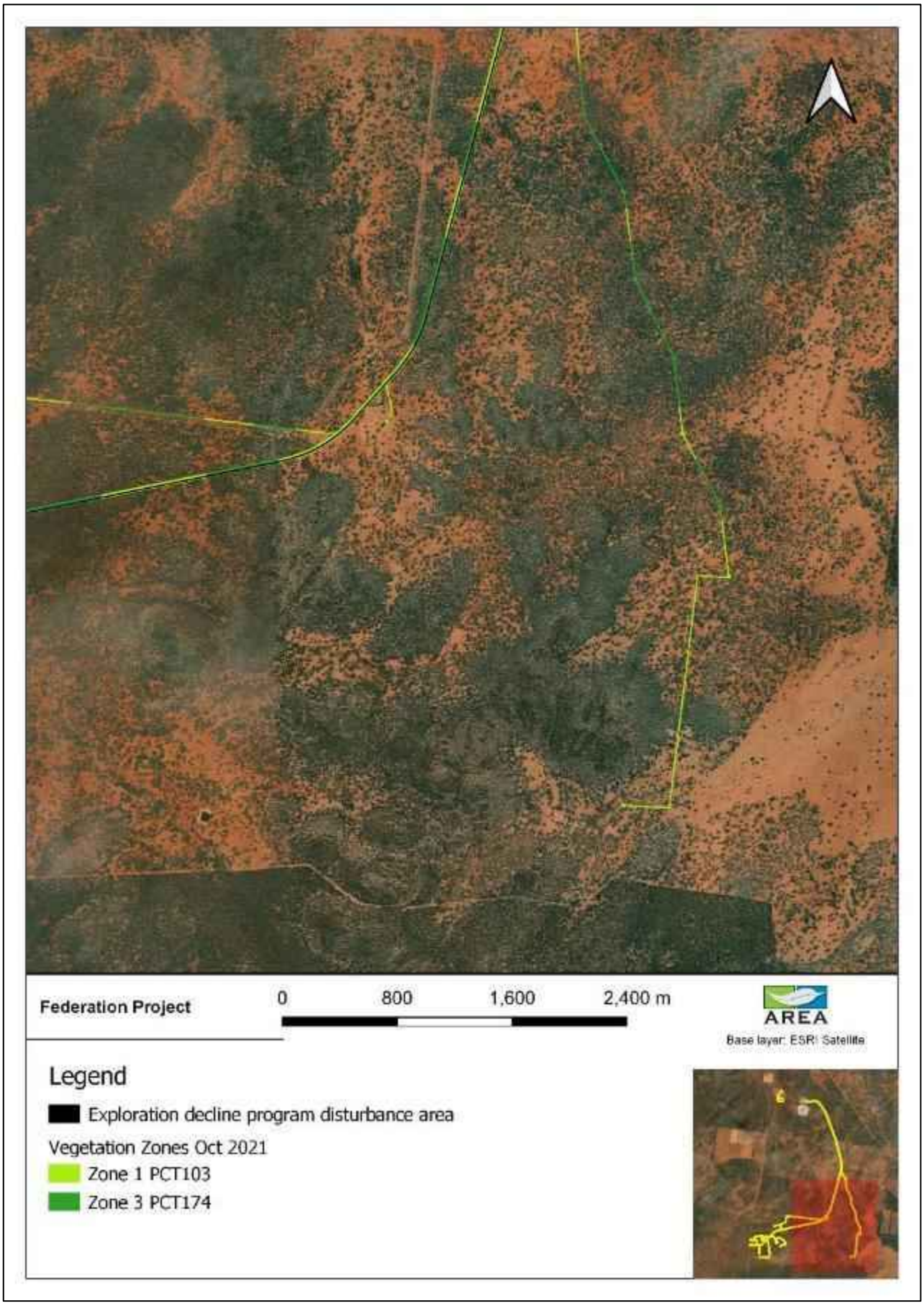


Figure 3-7: Vegetation zones (mid 2 south)

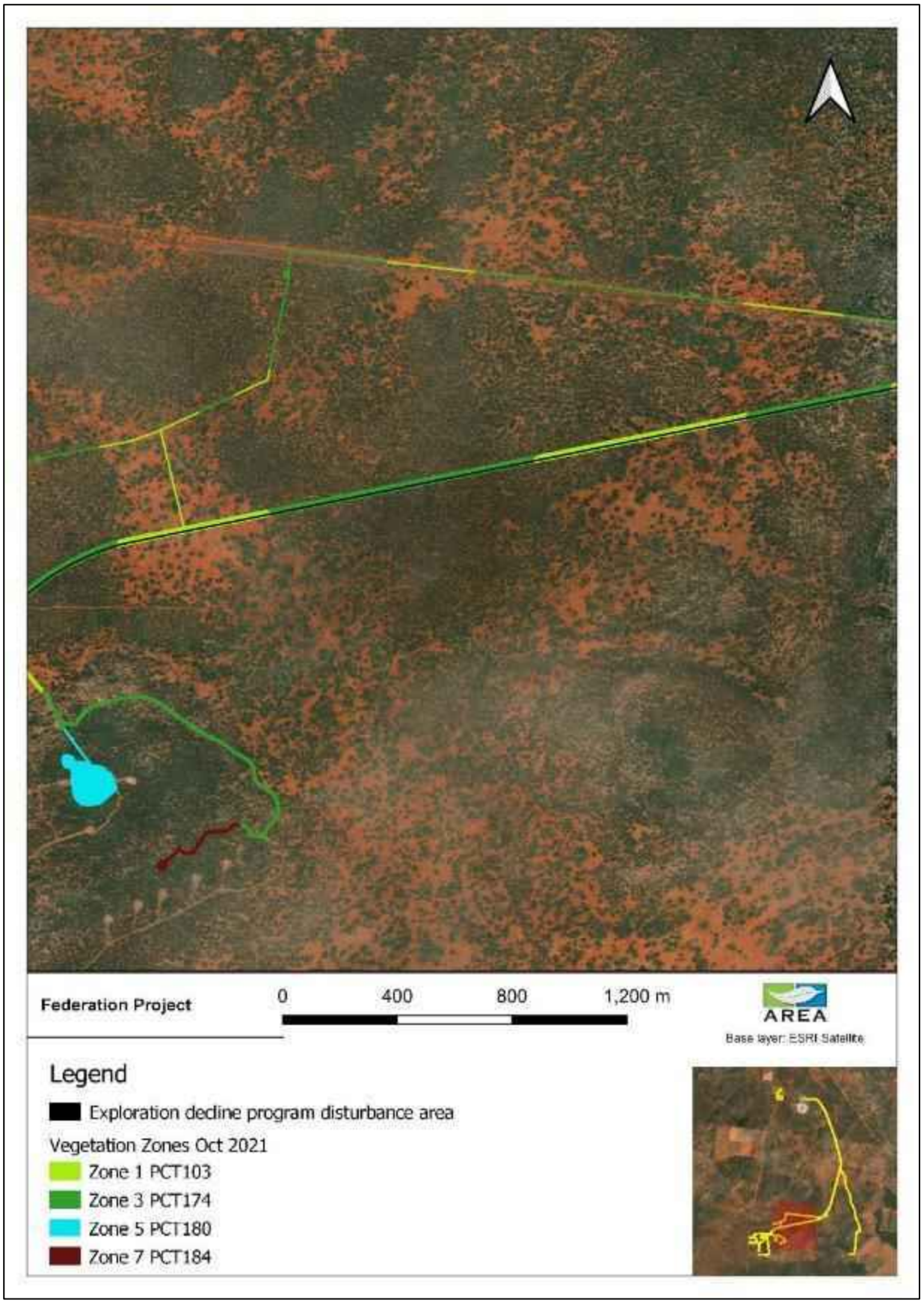
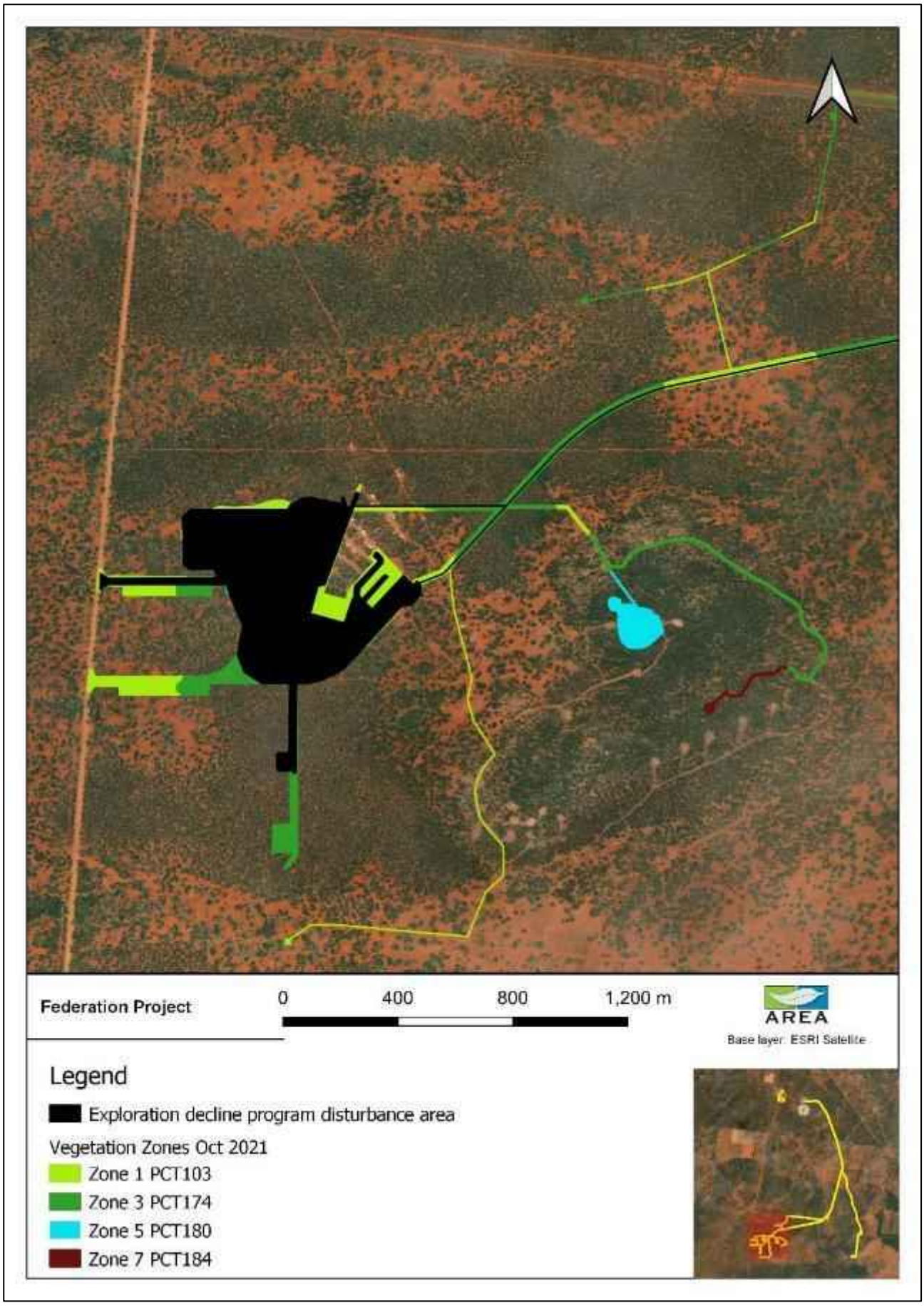


Figure 3-8: Vegetation zones (south)



3.4 Impact by Stage

As per the requirements of the EES department of DPIE, a sufficient number of BAM vegetation plots have been done to satisfy the plots requirement for each stage.

The area of each vegetation zone within each proposed stage of the Project, minimum BAM plot required, and the actual number of BAM plots done are shown in Table 3-3. Figures 3-9 to Figure 3-15 illustrate the impact to vegetation zones by each stage and the relevant BAM plots done for each stage. Once the stages were determined AREA undertook five additional plots to ensure this requirement was satisfied.

Table 3-3: Areas and BAM plot requirement by stage

	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Total Area (ha)
Stage 1 Area (ha)	19.07	0	10.89	2.95	0	0.67	0.45	0	**34.03**
Plots Required	3	0	3	2	0	1	1	-	
Stage 2 Area (ha)	7.37	0.32	0	0	0	0	0	1.05	**8.74**
Plots Required	3	1	0	0	0	0	0	-	
Stage 3 Area (ha)	4.22	0	1.79	0.91	0	0.19	0	0	**7.11**
Plots Required	2	0	1	1	0	1	0	-	
Stage 4a Area (ha)	1.32	0	0.77	0	0	0	0	0	**2.09**
Plots Required	1	0	1	0	0	0	0	-	
Stage 4b Area (ha)	1.5	0	1	0	0	0	0	0	**2.50**
Plots Required	1	0	1	0	0	0	0	-	
Stage 5 Area (ha)	0	0	0.01	0	2.35	0	0	0	**2.36**
Plots Required	0	0	1	0	2	0	0	-	
Total area of Zone (ha)	**33.48**	**0.32**	**14.46**	**3.86**	**2.35**	**0.86**	**0.45**	**1.05**	**56.83**
Minimum plot required	**4**	**1**	**3**	**2**	**2**	**1**	**1**		
Total Plots done to compensate for staging	**10**	**1**	**7**	**3**	**2**	**2**	**1**		

Figure 3-9: Stage 1 Federation Site, Services Corridor and Communications Tower (north)

Figure 3-10: Stage 1 Federation Site, Services Corridor and Communications Tower (south)

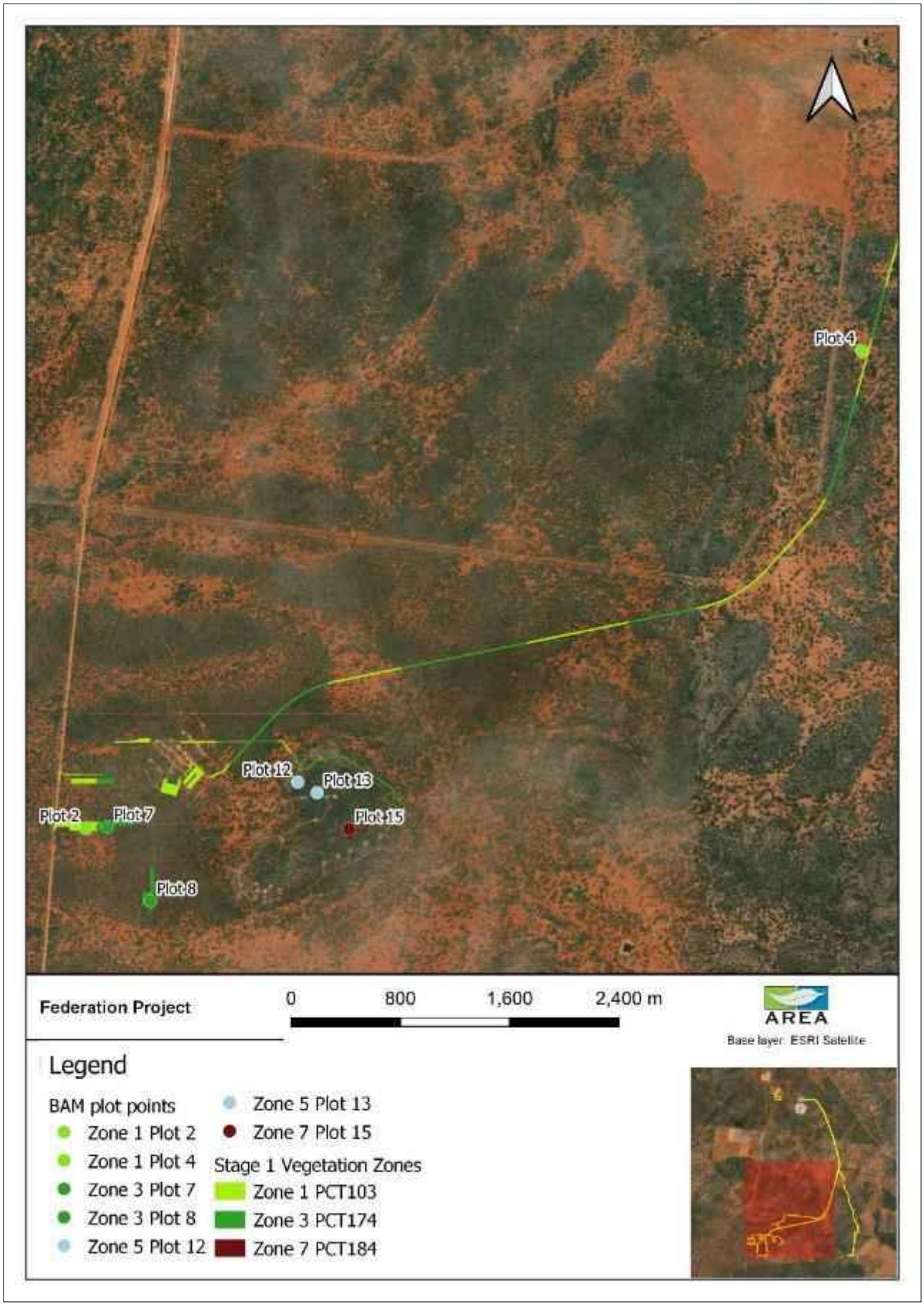


Figure 3-11: Stage 2 Solar Farm and Associated Powerline

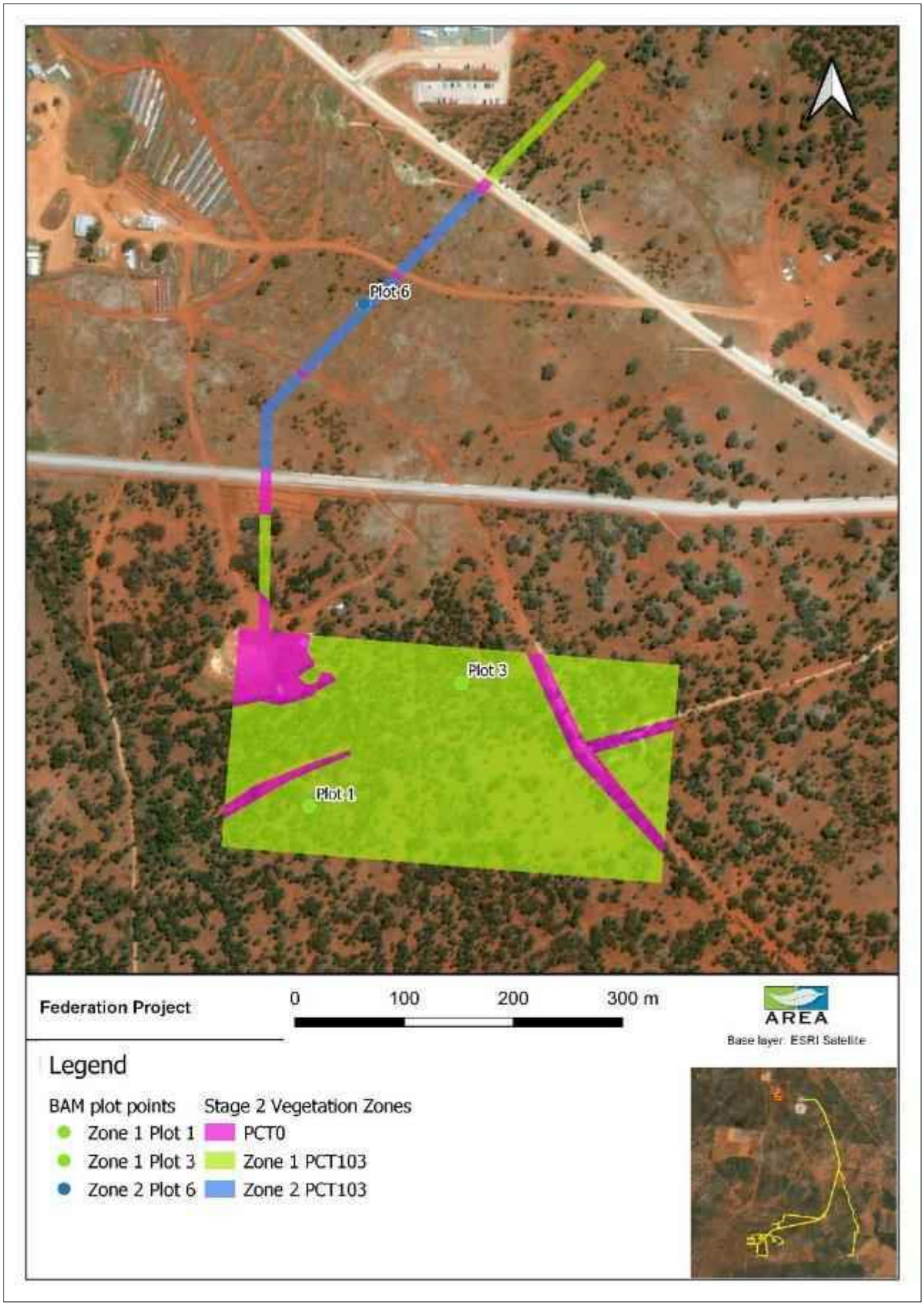


Figure 3-12: Stage 3 Potential Tailings Pipeline and Return Water Pipeline

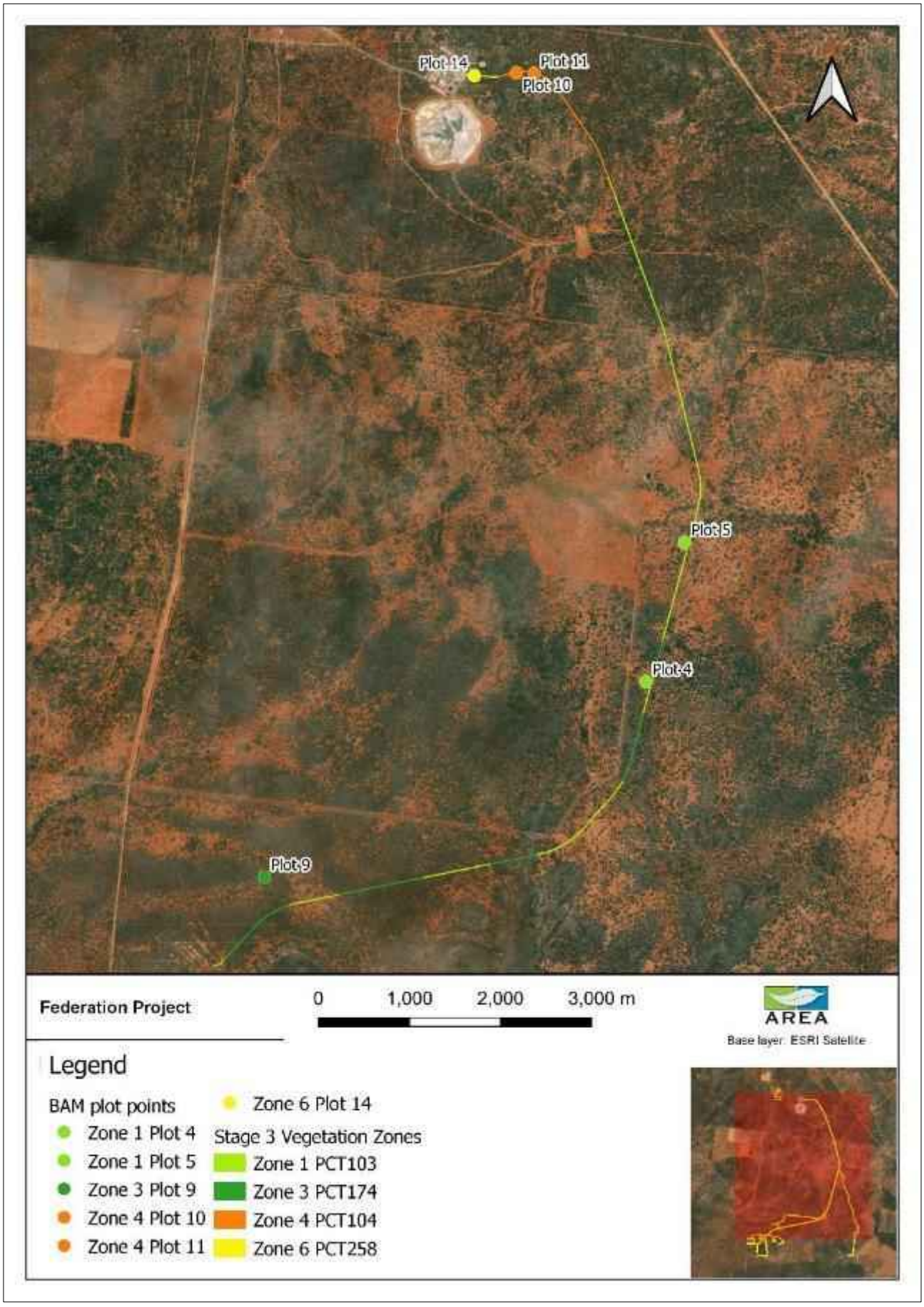


Figure 3-13: Stage 4a Bore and Pipelines, eastern alignment (locations indicative only)

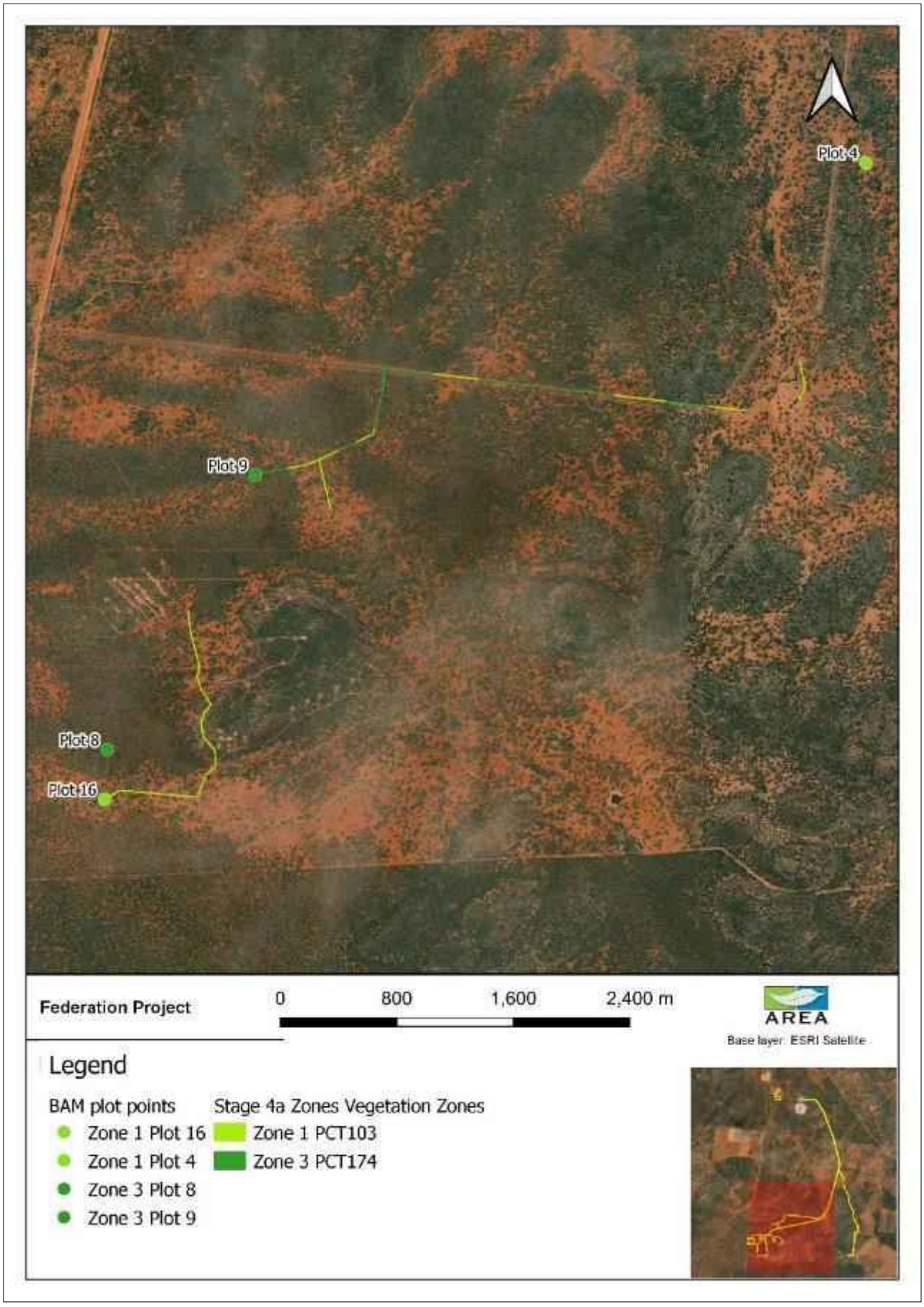


Figure 3-14: Stage 4b Bore and Pipelines, west and southern alignments (locations indicative only)

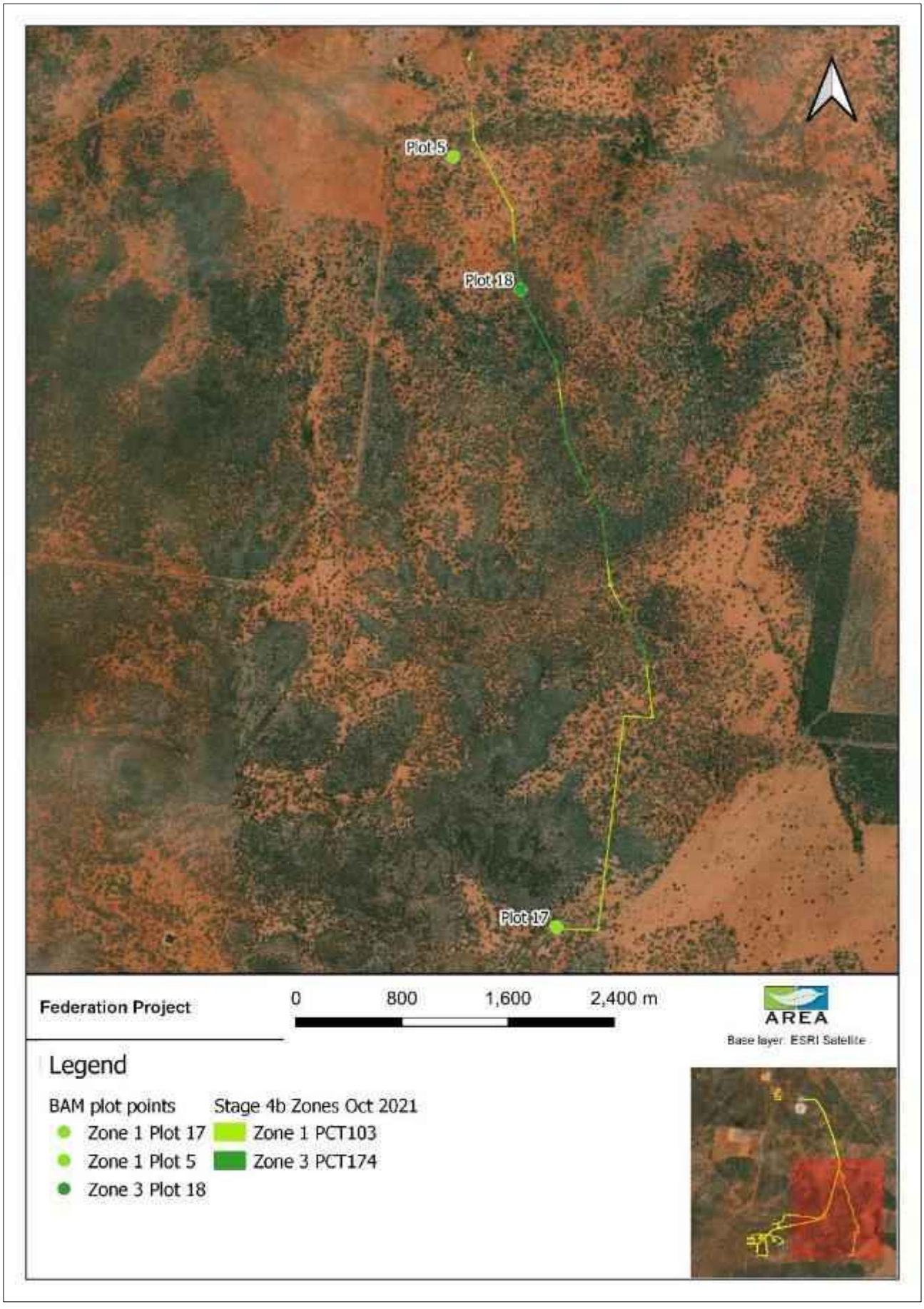
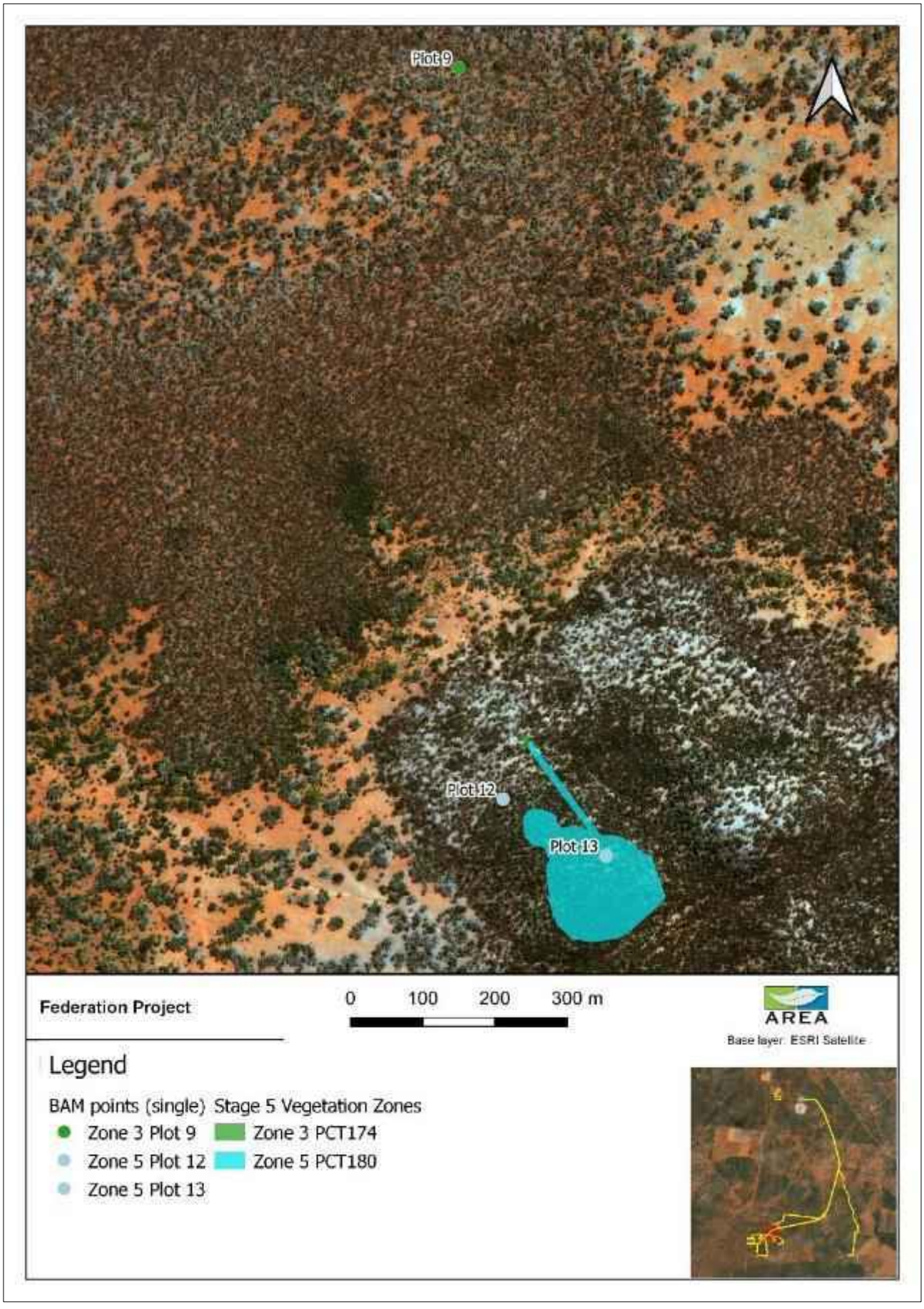


Figure 3-15: Stage 5 Quarry



3.4.1 PCTs in the Project disturbance area and their benchmarks

To compare plot sheet data collected in each PCT to its respective benchmark, AREA used the following rationale:

- The benchmark values for each PCT were obtained from the VIS Classification website on the BioNet data collection
- The species composition, structure and function scores collected on site and recorded in each the BAM plot assessed were used to compare to the benchmark for the PCT
- If more than one BAM plot was recorded the scores were averaged
- If the average score matched or above 25 per cent of the benchmark value for the PCT, then the attribute was within benchmark.

Vegetation plot data from each zone and how they compare to benchmarks is presented in Table 3-4 to Table 3-10.

Table 3-4: PCT103 Community condition benchmarks (Zone 1)

PCT103: *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*										
Vegetation Class	Western Peneplain Woodlands									
IBRA	Cobar Peneplain									
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 16**	**Plot 17**	**Plot Average**
Tree Richness	**3**	0.75	4	2	1	2	2	2	2	**2.1**
Shrub Richness	**7**	1.75	4	7	7	12	5	6	4	**6.4**
Grass and Grass Like Richness	**6**	1.5	6	5	8	7	6	5	5	**6.0**
Forb Richness	**9**	2.25	13	9	19	18	17	13	18	**15.3**
Fern Richness	**1**	0.25	1	0	1	0	0	0	0	**0.3**
Other Richness	**1**	0.25	0	1	0	0	0	0	0	**0.1**
Tree Cover	**18**	4.5	39	18	20	22	20.1	13	10.2	**20.3**
Shrub Cover	**11**	2.75	1.7	12	2.1	9.8	1.0	11.2	1	**5.5**
Grass and Grass Like Cover	**6**	1.5	5.6	1.3	9.9	2.6	4.3	25.3	61.4	**15.8**
Forb Cover	**3**	0.75	1.3	1.5	11.5	5.9	12.5	21.5	2.9	**8.2**
Fern Cover	**0**	0	0.1	0	0.1	0	0	0	0	**0.0**
Other Cover	**0**	0	0	0.1	0	0	0	0	0	**0.0**
Total length of fallen logs	**26**	6.5	5	32	9	7	0	38	29	**17.1**
Litter Cover	**30**	7.5	62.6	48	40	28.6	22.6	38.6	23	**37.6**
Number of Large Trees	**3**	0.75	4	3	6	2	1	3	4	**3.3**
Large Tree Threshold Size	**30**									
Benchmark Confidence:										
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High										

Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)

Table 3-5 : PCT103 (cleared) Community condition benchmarks (Zone 2)

PCT103 (cleared): *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*			
Vegetation Class	Western Peneplain Woodlands		
IBRA	Cobar Peneplain		
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 6**
Tree Richness	**3**	0.75	**1**
Shrub Richness	**7**	1.75	**8**
Grass and Grass Like Richness	**6**	1.5	**8**
Forb Richness	**9**	2.25	**8**
Fern Richness	**1**	0.25	**1**
Other Richness	**1**	0.25	**1**
Tree Cover	**18**	4.5	**2**
Shrub Cover	**11**	2.75	**5.4**
Grass and Grass Like Cover	**6**	1.5	**57.6**
Forb Cover	**3**	0.75	**7.5**
Fern Cover	**0**	0	**0.1**
Other Cover	**0**	0	**0.1**
Total length of fallen logs	**26**	6.5	**0**
Litter Cover	**30**	7.5	**5**
Number of Large Trees	**3**	0.75	**0**
Large Tree Threshold Size	**30**	**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**	
Benchmark Confidence:			
Composition: High Structure: Moderate Function: Logs: High Litter: High Large Trees: High			

Table 3-6: PCT174 Community condition benchmarks (Zone 3)

PCT174: *Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion*							
Vegetation Class		Sand Plain Mallee Woodlands					
IBRA		Cobar Peneplain					
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 7**	**Plot 8**	**Plot 9**	**Plot 18**	**Plot Average**
Tree Richness	**4**	1	3	4	4	3	**3.5**
Shrub Richness	**10**	2.5	13	7	13	4	**9.25**
Grass and Grass Like Richness	**4**	1	4	5	9	5	**5.75**
Forb Richness	**6**	1.5	8	8	4	12	**8**
Fern Richness	**0**	0	0	0	0	0	**0**
Other Richness	**1**	0.25	0	2	0	0	**0.5**
Tree Cover	**20**	5	18.5	18.2	27.5	35	**24.8**
Shrub Cover	**14**	3.5	16.3	4.8	15	0.6	**9.2**
Grass and Grass Like Cover	**4**	1	1.3	4.4	3.3	12.6	**5.4**
Forb Cover	**1**	0.25	1.2	16.6	2.3	8.6	**7.2**
Fern Cover	**0**	0	0	0	0	0	**0**
Other Cover	**0**	0	0	0.2	0	0	**0.05**
Total length of fallen logs	**41**	10.25	43	61	49	27	**45**
Litter Cover	**30**	7.5	53	69	61.6	38.4	**55.5**
Number of Large Trees	**3**	0.75	5	1	0	2	**2**
Large Tree Threshold Size	**30**		**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**				
Benchmark Confidence:							
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High							

Table 3-7: PCT:104 Community condition benchmarks (Zone 4)

PCT104: Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion					
Vegetation Class	Inland Rocky Hill Woodlands				
IBRA	Cobar Peneplain				
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 10**	**Plot 11**	**Plot average**
Tree Richness	**4**	1	3	2	**2.5**
Shrub Richness	**6**	1.5	9	9	**9**
Grass and Grass Like Richness	**5**	1.25	6	5	**5.5**
Forb Richness	**12**	3	7	3	**5**
Fern Richness	**1**	0.25	1	0	**0.5**
Other Richness	**1**	0.25	1	0	**0.5**
Tree Cover	**37**	9.25	26	35	**30.5**
Shrub Cover	**17**	4.25	2.1	3.6	**2.85**
Grass and Grass Like Cover	**9**	2.25	1.5	2.8	**2.15**
Forb Cover	**5**	1.25	2.5	0.7	**1.6**
Fern Cover	**1**	0.25	0.1	0	**0.05**
Other Cover	**0**	0	0.1	0	**0.05**
Total length of fallen logs	**41**	10.25	25	4	**14.5**
Litter Cover	**30**	7.5	39	61.6	**50.3**
Number of Large Trees	**3**	0.75	7	3	**5**
Large Tree Threshold Size	**30**	**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**			
Benchmark Confidence:					
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High					

Table 3-8: PCT 180 Community condition benchmarks (Zone 5)

PCT180: *Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion*					
Vegetation Class	Inland Rocky Hill Woodlands				
IBRA	Cobar Peneplain				
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 12**	**Plot 13**	**Plot average**
Tree Richness	**4**	1	3	3	**3**
Shrub Richness	**6**	1.5	0	1	**0.5**
Grass and Grass Like Richness	**5**	1.25	3	5	**4**
Forb Richness	**12**	3	9	9	**9**
Fern Richness	**1**	0.25	0	1	**0.5**
Other Richness	**1**	0.25	1	1	**1**
Tree Cover	**37**	9.25	43	32	**37.5**
Shrub Cover	**17**	4.25	0	0.1	**0.05**
Grass and Grass Like Cover	**9**	2.25	12.5	12.7	**12.6**
Forb Cover	**5**	1.25	2.9	2.6	**2.75**
Fern Cover	**1**	0.25	0	0.1	**0.05**
Other Cover	**0**	0	0.1	0.1	**0.1**
Total length of fallen logs	**41**	10.25	2	7	**4.5**
Litter Cover	**30**	7.5	44	21	**32.5**
Number of Large Trees	**3**	0.75	0	1	**0.5**
Large Tree Threshold Size	**30**	**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**			
Benchmark Confidence:					
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High					

Table 3-9: PCT 258 Community condition benchmarks (Zone 6)

PCT258: *Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion*			
Vegetation Class	Inland Rocky Hill Woodlands		
IBRA	Cobar Peneplain		
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 14**
Tree Richness	**4**	1	**3**
Shrub Richness	**6**	1.5	**4**
Grass and Grass Like Richness	**5**	1.25	**3**
Forb Richness	**12**	3	**14**
Fern Richness	**1**	0.25	**0**
Other Richness	**1**	0.25	**4**
Tree Cover	**37**	9.25	**61**
Shrub Cover	**17**	4.25	**4.3**
Grass and Grass Like Cover	**9**	2.25	**0.3**
Forb Cover	**5**	1.25	**2.8**
Fern Cover	**1**	0.25	**0**
Other Cover	**0**	0	**0.4**
Total length of fallen logs	**41**	10.25	**34**
Litter Cover	**30**	7.5	**66**
Number of Large Trees	**3**	0.75	**7**
Large Tree Threshold Size	**30**	**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**	
Benchmark Confidence:			
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High			

Table 3-10: PCT 184 Community condition benchmarks (Zone 7)

PCT184: *Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion*			
Vegetation Class	Inland Rocky Hill Woodlands		
IBRA	Cobar Peneplain		
Benchmark Calculation Level	**Benchmark value**	25% of BM	**Plot 15**
Tree Richness	**4**	1	**2**
Shrub Richness	**6**	1.5	**3**
Grass and Grass Like Richness	**5**	1.25	**1**
Forb Richness	**12**	3	**10**
Fern Richness	**1**	0.25	**0**
Other Richness	**1**	0.25	**0**
Tree Cover	**37**	9.25	**9**
Shrub Cover	**17**	4.25	**0.3**
Grass and Grass Like Cover	**9**	2.25	**5**
Forb Cover	**5**	1.25	**2.3**
Fern Cover	**1**	0.25	**0**
Other Cover	**0**	0	**0**
Total length of fallen logs	**41**	10.25	**9**
Litter Cover	**30**	7.5	**24**
Number of Large Trees	**3**	0.75	**3**
Large Tree Threshold Size	**30**	**Note: Green fill = within benchmark (i.e. at or more than 25% of the BM value)**	
Benchmark Confidence:			
Composition: High Structure: Moderate Function: Logs: High; Litter: High; Large Trees: High			

4 Threatened species

The following section addresses the potential presence of threatened flora and fauna species considered in the assessment of impact and targeted surveys.

4.1 Database searches

A default list of threatened species with potential to occur in the Project disturbance area was firstly identified using the assessment filtering tool in the Biodiversity Assessment Method Calculator (BAM-C) and was used to inform the field assessment and threatened species assessment. A background review was also conducted to confirm these, and possible additional, threatened species using the resources shown in Table 4-1.

Table 4-1: Wildlife databases used to identify potentially occurring threatened species

Database / resource	Search area	Date accessed
BAM credit calculator (BAM-C)	Cobar Peneplain IBRA > Subregion Nymagee Downs	July 2021
DPIE NSW Atlas of Wildlife (BioNet)	Approximately 10 X10 kilometres centred on the Project area	July 2021
MNES Protected Matters Search Tool (DEE)	One kilometre radius around the Project area	July 2021
DPIE Threatened Species Profile Database (TSPD)	IBRA subregion	July 2021

4.1.1 Predicted threatened species by IBRA subregion

A list of threatened species predicted to occur by the DPIE threatened species database search filtered by IBRA subregion are included in Appendix A. This list shows 66 threatened species, populations and ecological communities area predicted to occur in the Nymagee IBRA subregion, the same list was used to inform the field assessment.

4.1.2 BioNet records

A BioNet species record search was conducted for all listed species, including species listed under international bilateral agreements. Threatened species known to occur within 10 kilometres of the Project area based on recorded sightings recorded on the DPIE BioNet Species Sightings Database are shown in Table 4-2. Figure 4-1 illustrates BioNet sightings with 10 kilometres of the Project area, Figure 4-2 shows records within 1500 metres.

Table 4-2: BioNet Atlas threatened species records within 10 kilometres of the Project area

Scientific Name	Common Name	NSW Status	Comm Status
Bird			
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Cinclosoma castanotum	Chestnut Quail-thrush	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-
Pachycephala inornata	Gilbert's Whistler	V	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-

Scientific Name	Common Name	NSW Status	Comm Status
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-
Leipoa ocellata	Malleefowl	E	V
Certhionyx variegatus	Pied Honeyeater	V	-
Chthonicola sagittata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Polytelis swainsonii	Superb Parrot	V	V
Neophema pulchella	Turquoise Parrot	V	-
Epthianura albifrons	White-fronted Chat	V	-
Mammal			
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Vespadelus baverstocki	Inland Forest Bat	V	-
Antechinomys laniger	Kultarr	E	-
Chalinolobus picatus	Little Pied Bat	V	-

Figure 4-1: BioNet threatened species records within 10 kilometres of the Project area

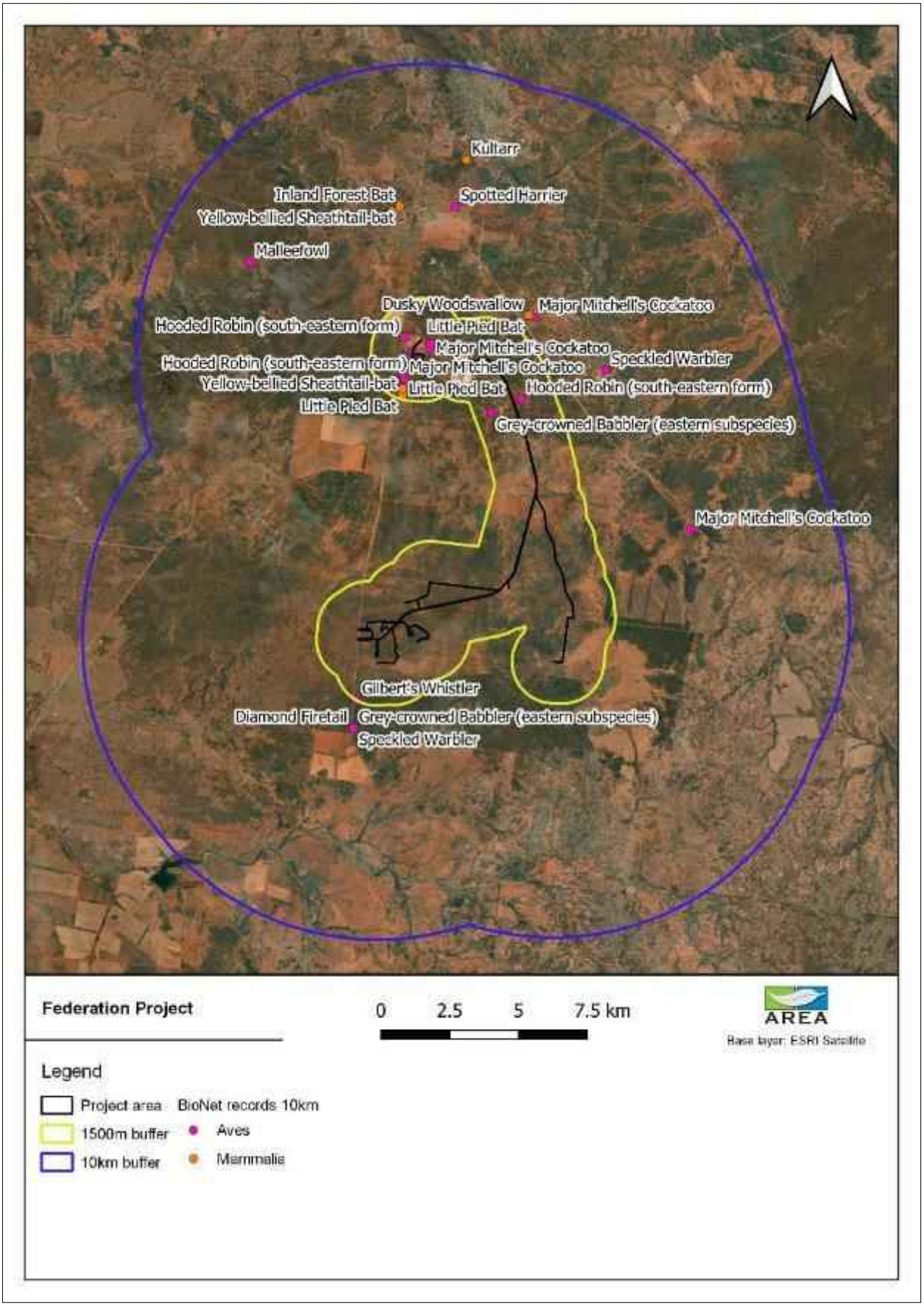
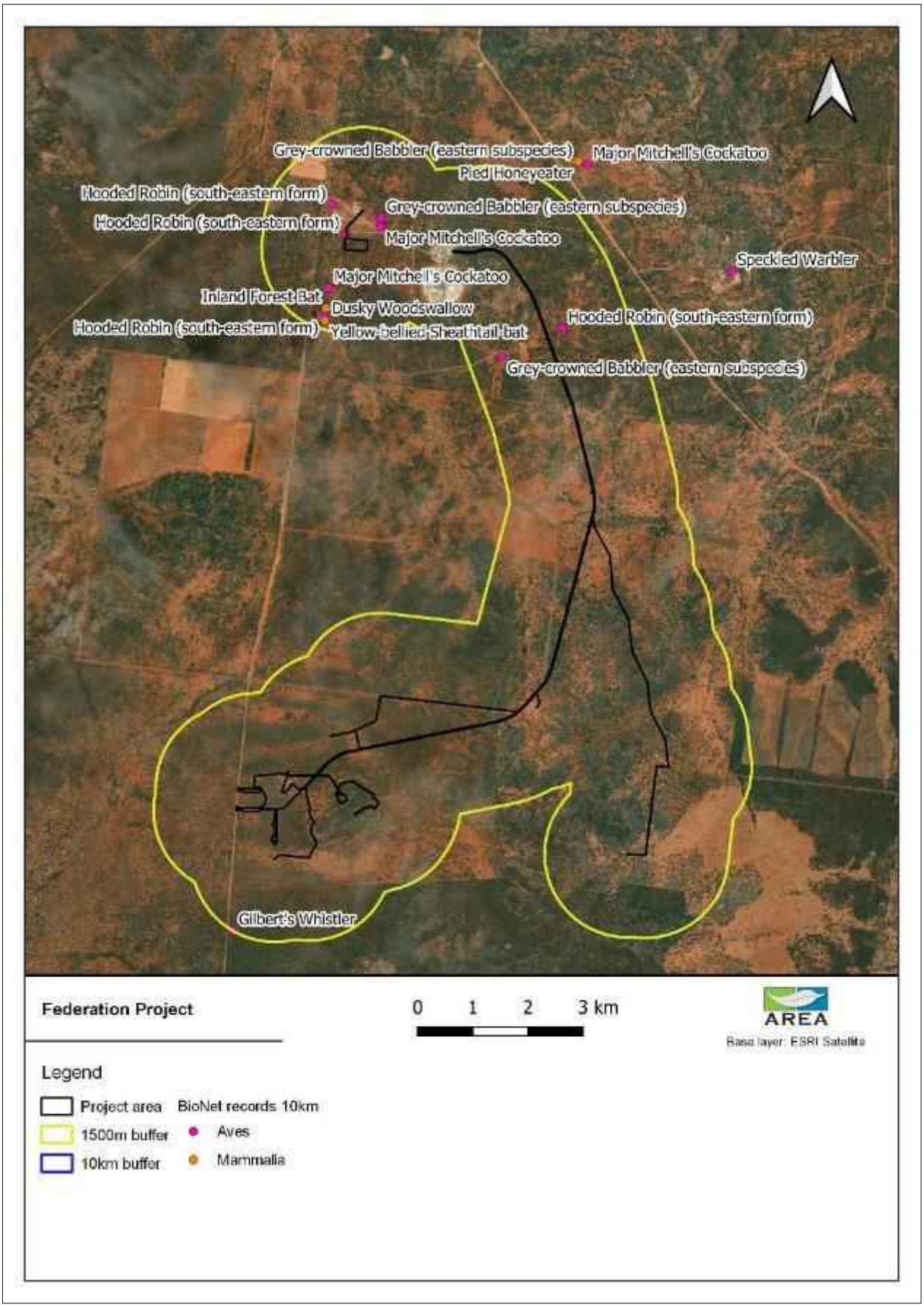


Figure 4-2: BioNet records within 1500 meters of Project area



4.1.3 Matters of National Environmental Significance (MNES)

The Commonwealth Protected Matters Search Tool was used to generate a report on Matters of National Environmental Significance predicted to occur within one-kilometre radius around the Project area. This report is included in Appendix A and is summarised in Table 4-3.

Table 4-3: MNES summary

MNES	Result	Is there an implication for this assessment?
World Heritage Properties	None	No
National Heritage Places	None	No
Wetlands of International Importance	3	No – all three are more than 500km upstream
Great Barrier Marine Park	None	No
Commonwealth Marine Area	None	No
Listed Threatened Ecological Communities	3	No – field assessment confirmed none of these communities occur in the Project disturbance area
Listed Threatened Species	16	No – assessed under NSW legislation or likelihood of presence considered (see Table 4-4)
Listed Migratory Species	7	No –the Federation Project is unlikely to impact these 7 bird species, see Section 4.1.4
Commonwealth Land	None	No
Commonwealth Heritage Places	None	No
Listed Marine Species	13	No - The Project will not impact these species
Whales and other Cetaceans	None	No
Critical Habitats	None	No
Australian Marine Parks	None	No
Commonwealth Reserves Terrestrial	None	No
State and Territory Reserves	1	Balowra State Conservation Area is within 1500 metres of the Project area, it will not be impacted by the Project.
Forest Regional Agreements	None	No
Invasive Species	10	No – species listed are either already present in the region or their presence will not be increased by this proposal, or they are unlikely to be introduced.
Nationally Important Wetlands	None	No
Key Ecological Features (Marine)	None	No

Likelihood of threatened species predicted in the Commonwealth Protected Matters report is considered in Table 4-4. In summary, each species is either unlikely to occur or is addressed under NSW legislation and is unlikely to be significantly impacted. This BDAR, by implementing the burden of proof through BAM (2020), confirms MNES species and ecosystems are unlikely to occur and will not be significantly impacted, therefore a Referral under the EPBC Act is not required. Despite this assessment concluding there are unlikely to be significant impacts to MNES, the proponent has elected to submit a Referral for the Project.

EPBC matters are therefore further addressed in a separate referral to be provided to the Commonwealth Government. Table 4-4 provides the results of the likelihood of occurrence of the 16 threatened species predicted in the Commonwealth Protected Matters report considered by the MNES Assessment Report[5]. Table 4-4 also considers the possible presence of one vulnerable

[5] The Federation Project SSD MNES Assessment Report can be provided electronically with approval by the proponent on request

EPBC listed bat species, Large-eared pied bat *Chalinolobus dwyeri* in the Project study, as this was potentially indicated by bat echolocation call analysis during field survey, so this species has been added to the list (a total of 17 species).

In the preparation of this BDAR, three EPBC listed species considered by the BAM-C were not highlighted by the MNES Protected Matters Report. These species have also been assessed for likelihood of occurrence in the Project study area, and likelihood of impact from the Project, see Table 4-5 below. These three species were determined not to require assessment of significance as they are unlikely to be in the Project disturbance area and they are unlikely to be impacted by the Project.

All but two predicted EPBC listed species are considered unlikely to occur in the Project area and therefore are unlikely to be impacted. Assessments of Significance have been undertaken in the *Federation Project SSD MNES Assessment Report* for two EPBC listed species with potential to be present and impacted by the proposal; Malleefowl *Leipoa ocellata* and Superb Parrot *Polytelis swainsonii*. These Assessments of Significance concluded there are unlikely to be significant impacts to these EPBC listed threatened species.

Table 4-4: Commonwealth Protected Matters report – predicted threatened species

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
Birds							
Australasian Bittern	*Botaurus poiciloptilus*	E	**Unlikely** The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over a muddy or peaty substrate. There is no suitable wetland habitat in or around the study area which is relatively arid and only contains a few ephemeral drainage lines and farm dams with no aquatic habitat. This species has not been recorded in the study area and in unlikely to occur and unlikely to be impacted.	N/A	No	E	No
Curlew Sandpiper	*Calidris ferruginea*	CE	**Unlikely** Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters Curlew Sandpipers forage on mudflats and nearby shallow water. This species is gregarious, often occurring in large flocks. There is no suitable wetland habitat in or around the study area which is relatively arid and only contains a few ephemeral drainage lines and farm dams with no aquatic habitat. This species has not been recorded in the study area and in unlikely to occur and unlikely to be impacted.	N/A	No	E	No
Grey Falcon	*Falco hypoleucos*	V	**Unlikely** The Grey Falcon is an elusive species endemic to mainland Australia and occurs at low densities across inland Australia. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter. The nests chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*), but falcons also nest in telecommunication towers.	N/A	No	E	Yes

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
			This species has not been recorded in or around the study area, no suitable tree-lined watercourses are present in the study area and no suitable nests were detected in the study area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.				
Painted Honeyeater	*Grantiella picta*	V	**Unlikely** The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema.* This species has not been recorded in or around the study area. No suitable habitat exists in the study area which are semi- arid woodlands with a shrubby formation and no suitable vegetation and mistletoe density. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	V	Yes
Swift Parrot	*Lathamus discolor*	CE	**Unlikely** The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. They occupy habitats across all tenures. Swift Parrots are usually seen in small parties of up to 30 birds, or occasionally in larger flocks (of several hundred birds) around sources of abundant food. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta,* Spotted Gum *Corymbia maculata,* Red Bloodwood *C. gummifera,* Forest Red Gum *E. tereticornis,* Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. This species has not been recorded in or around the study area. There is no favoured food trees in the study area and the study area is not mapped as an important habitat area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	E	No
Malleefowl	*Leipoa ocellata*	V	**Potential** There are historic records of this species in and around the study area and old mounds were detected; however no active mounds are present in the Project disturbance area and this species has not been detected in the study area in over 40 years. Active nests are a key indicator of presence. No population was detected in the study area.	Yes	No	E	Yes
Plains-wanderer	*Pedionomus torquatus*	CE	**Unlikely** Plains-wanderers inhabit sparse grasslands with c.50% bare ground, with most vegetation less than 5 cm in height and some widely spaced plants up to 30 cm high. Overgrazing causes the species to leave an area when grassland is reduced to a remnant less than 2–3 cm high with 60% or more bare ground. Habitat structure	N/A	No	E	No

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
			appears to play a more important role than plant species composition. Preferred habitat of the Plains-wanderer typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. The vast majority (>99%) of records of Plains-wanderers in NSW over the past 30 years come from an area of the western Riverina bounded by Hay and Narrandera on the Murrumbidgee River in the north, the Cobb Highway in the west, the Billabong Creek in the south, and Urana in the east. This species has not been recorded in or around the study area. There is no suitable grassy habitat structure and leaf litter in the study area which has been historically cleared and grazed. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.				
Night Parrot	*Pezoporus occidentalis*	E	**Unlikely** The Night Parrot was thought to be extinct but in 2013 it was rediscovered in Queensland (Pullen Pullen Reserve). The Night Parrot is known to occur within Spinifex grasslands in stony or sandy areas and samphire and chenopod associations on floodplains, salt lakes and clay pans. Suitable habitat is characterized by the presence of large and dense clumps of Spinifex, and it may prefer mature spinifex that is long and unburnt. This species has not been recorded in or around the study area. No suitable large and dense clumps of spinifex exist in the study area to provide suitable habitat. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	Extinct	No
Superb Parrot	*Polytelis swainsonii*	V	**Potential** The Superb Parrot mainly inhabits forests and woodlands dominated by eucalypts, especially River Red Gums (Eucalyptus camaldulensis) and box eucalypts such as Yellow Box (*Eucalyptus melliodora*) or Grey Box (*E. microcarpa*). The species also seasonally occurs in box-pine (*Callitris*) and Boree (*Acacia pendula*) woodlands. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Has been recorded within 1500 metres of the study area. Suitable foraging habitat may occur in the Project area; however preferred tree species are not present in the Project area and no population was detected in the study area.	Yes	No	V	Yes
Australian Painted Snipe	*Rostratula australis*	E	**Unlikely** The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or	N/A	No	E	No

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
			saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of *lignum Muehlenbeckia* or canegrass or sometimes tea-tree (Melaleuca). Australian Painted Snipe breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands (D. Rogers 2002, pers. comm.), provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover There is no suitable wetland habitat in or around the study area which is relatively arid and only contains a few ephemeral drainage lines and farm dams with no aquatic habitat. This species has not been recorded in the study area and in unlikely to occur and unlikely to be impacted.				
Mammals							
Corben's Long-eared Bat, South-eastern Long-eared Bat	*Nyctophilus corbeni*	V	**Unlikely** This microbat species has a scattered distribution mostly within the Murray-Darling Basin, but with some records outside of this area. It is more common in box, ironbark and cypress pine woodland on the western slopes and plains. Its stronghold seems to be the Pilliga Scrub. It roosts in tree hollows, crevices and under loose bark. It is a slow flying agile bat that hunts for non-flying prey, especially caterpillars and beetles Addressed under NSW legislation. This species has not been recorded in the study area and is therefore unlikely to be present and unlikely to be impacted by the Project.	N/A	No	V	Yes
Large-eared pied bat	Large-eared pied bat *Chalinolobus dwyeri*	V	**Unlikely** Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat. Records from south-east Queensland suggest that rainforest and moist eucalypt forest habitats on other geological substrates (rhyolite, trachyte and basalt) at high elevation are of similar importance to the species The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests. It also possibly roosts in the hollows of trees The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs (that need to be deep enough to allow juvenile bats to learn to fly safely inside) and with indentations in the roof (presumably to allow the capture of heat). These physical characteristics are not very common in the landscape and therefore a limiting factor. This species is	N/A	No	V	No

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
			threatened by disturbance to roosting areas by goats and clearing and isolation of forest and woodland habitats for agriculture or development. Only a few possible passes from this species were recorded in the study area in October 2020, however no definitive calls have been recorded so this cannot be considered a record of presence. The specifically required structure of primary nursery roosts is not present in the Project area which has been thoroughly surveyed. The study area has been historically disturbed by clearing and grazing and is unlikely to contain suitable habitat for this species. This species in unlikely to occur in the Project area and is unlikely to be impacted by the Project.				
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory	*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)*	V	**Unlikely** Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* species. Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. The distribution of this habitat is largely influenced by land elevation, annual temperature and rainfall patterns, soil types and the resultant soil moisture availability and fertility. Preferred food and shelter trees are naturally abundant on fertile clay soils. No Koala records exist on BioNet within 10km of the study area – the closest over 70 kilometres south. There is not a resident local population of koala present, this species has not been recorded in the study area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	V	Yes
Plants							
A spear-grass	*Austrostipa metatoris*	V	**Unlikely** *Austrostipa metatoris* grows in sandy mallee areas of the Murray Valley. Habitat includes sandhills, sand ridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils (DECC NSW, 2005a). Associated species include the trees and shrubs Bimble Box (*Eucalyptus populnea*), Gum Coolibah (*E. intertexta*), White Cypress Pine (*Callitris glaucophylla*), Belah (*Casuarina cristata*), Sweet Quandong (*Santalum acuminatum*), Sticky Hopbush (*Dodonaea viscosa*), *Hakea ivoryi*, and the grasses *Austrostipa drummondii* and *A. eremophila.* The main identified threats to A. metatoris are clearing of habitat grazing pressure by rabbits (Oryctolagus cuniculus), domestic stock and kangaroos; habitat degradation by rabbits and stock. This species has not been recorded within 50km of the study area. The Project area has a history of historic clearing and grazing. Survey effort meeting requirement of NSW and Commonwealth guidelines were followed to determine this species is not	N/A	No	V	No

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Significant impact?	NSW status	Included in BAM calcs?
			present in the Project area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.				
A spear-grass	*Austrostipa wakoolica*	E	**Unlikely** Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise. *Austrostipa wakoolica* probably does not tolerate disturbance, requiring sites protected from the impacts of herbivore grazing and rabbits. This species has not been recorded within 50km of the study area. The Project area has a history of historic clearing and grazing. Survey effort meeting requirement of NSW and Commonwealth guidelines were followed to determine this species is not present in the Project area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	E	Yes
Winged Peppercress	*Lepidium monoplocoides*	E	**Unlikely** Winged Pepper-cress occurs predominantly in mallee scrub in semi-arid areas (Leigh et al. 1984). Sites are seasonally moist to water-logged with heavy, fertile soils and a mean annual rainfall of around 300 to 500 mm. The predominant vegetation is usually an open-woodland dominated by *Allocasuarina leuhmannii* and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses (notably *Danthonia* spp. and *Stipa* spp.), but the seasonally waterlogged sites preferred by Winged Pepper-cress also support a number of moisture dependent herbs, such as *Marsilea* spp. (Nardoo) (Leigh & Briggs 1992). Also known from riparian woodland. Was not recorded during field surveys and has not been recorded within 50 km of the study area. No suitable moist or water-logged habitat present in the study area. This species in unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	E	No
Slender Darling-pea	*Swainsona murrayana*	V	**Unlikely** The Slender Darling-pea often grows in heavy soils, especially depressions, and is also found on grey and red to brown clay and clay-loam soils in *Atriplex vesicaria* (Bladder Saltbush) herbland, *Eucalyptus largiflorens* (Black Box) woodland and grassland communities and is frequently associated with *Maireana* species. Was not recorded during field surveys and has not been recorded within 200km of the study area. No suitable habitat is present. This species is unlikely to occur in the study area and is unlikely to be impacted by the Project.	N/A	No	V	No

Table 4-5: Additional EPBC listed species highlighted by the BAM-C

Common name	Scientific name	Comm. status	Potential to occur in the study area and/or be impacted by the Project?	Assessment of significance required?	Signif. impact?	NSW status	Included in BAM calcs?
Bird							
White-throated Needletail	*Hirundapus caudacutus*	V	**Unlikely** In Australia, the White-throated Needletail is almost exclusively aerial and rarely comes to rest. Was not recorded during field surveys and has not been recorded within 10km of the study area. No suitable habitat is present. This species is unlikely to occur in the study area and is unlikely to be impacted by the Project.	No	No	N/A	Yes
Plant							
Curley-bark Wattle	*Acacia curranii*	V	**Unlikely** Has not been recorded within 40km of the Project area but is known to occur at Yathong and Nombinnie Natures Reserves which lie approximately 80km south of the Project area. Grows in Acacia shrubland and mallee. Prefers acidic, skeletal soils in rocky habitats and occupies specialised habitats comprising rocky ridges and deeply weathered sandstone. No suitable habitat exists in the Project disturbance area, this species is unlikely to occur. AREA is extremely familiar with this species. AREA annually undertakes monitoring of *A. curranii* populations around Yathong for NSW NPWS and AREA's Managing Director, Phil Cameron, is considered a DPIE species expert for *Acacia curranii* AREA conducted surveys (including search transects and eighteen BAM plots) in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. No Curly-bark Wattle was recorded during these surveys. This species is unlikely to occur in the study area and is unlikely to be impacted by the Project.	No	No	V	Yes
Commersonia procumbens	*Commersonia procumbens*	V	**Unlikely** *Commersonia procumbens* has not been recorded within 20km of the study area. Grows in sandy sites, often along roadsides. Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and Callitris area. The habitat constraint, Pilliga Sandstone, is not present in the Project area. No suitable habitat exists in the Project area. AREA is extremely familiar with this species around Dubbo and AREA's Managing Director (who participated in field surveys), Phil Cameron, is considered a DPIE species expert for *Commersonia procumbens.* AREA conducted surveys (including search transects and eighteen BAM plots) in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. No *Commersonia procumbens* was recorded during these surveys. This species is unlikely to occur in the study area and is unlikely to be impacted by the Project.	No	No	V	Yes

One species of Commonwealth listed fauna has been recorded on BioNet within 1500 metres of the Project disturbance area: Superb Parrot *Polytelis swainsonii*. This species was not recorded during survey and is already included in BAM calculations

4.1.4 Migratory species

Seven migratory species listed under the EPBC Act may potentially occur within the Project area (EPBC Act Protected Matters Report). None were recorded during the surveys following relevant guidance material. These migratory species are not expected to occur or be impacted by the Project. There is no 'real chance' direct or indirect impacts would occur to migratory birds, therefore no significant impact to migratory birds would occur. As a result, a referral under the EPBC Act is not required. Despite this assessment concluding there are unlikely to be significant impacts to MNES, the proponent has elected to submit a Referral for the Project, see previous Section.

4.2 Field survey

4.2.1 Survey for habitat constraints and microhabitat

The vegetation in the Project disturbance area can provide habitat for a wide range of terrestrial fauna. Trees were inspected for hollows; fallen logs, rocks, crevices and shrubby habitat were observed, and the area was checked for infrastructure which may provide artificial habitat for microbats and other fauna species. Multiple farm dams exist within 1500 metres of the Project disturbance area, however these lack aquatic vegetation and habitat. Large trees, some with hollows, are present in or adjacent to the Project disturbance area.

4.2.2 Targeted threatened species survey

AREA ecologists undertook threatened species survey specifically for this proposal over five days 12 to 16 July 2021. Field assessments followed guidance materials listed in Section 1.8 of this BDAR. Survey focussed on targeted assessment which could occur at the time, but additional consideration was given to threatened species which may be present in other more suitable seasons for their detection.

The targeted threatened species assessment focused on listed species highlighted by the BAM-C and the EPBC Act Protected Matters Report following all survey requirement identified on the BAM-C and BioNet data collection. Threatened species searches were undertaken as per the threatened species survey guidelines.

The following survey effort was completed in July 2021:

- bat ultrasonic recorder (SM) and a Song Meter SM4BAT-FS bioacoustics recorder in place for four nights
- call playback and spotlighting over three nights
- threatened search transects throughout the Project disturbance area
- diurnal observation of hollows in and around the Project disturbance area
- bird searches
- opportunistic observation.

Additional threatened species surveys (search transects) were undertaken in October 2021 to completely cover off on survey effort required.

Data collected from AREA's previous BDAR for the exploration decline program REF has also been used to inform this EIS BDAR. To identify environmental constraints for the exploration decline program, the following survey effort was completed in June (winter), October (spring) 2020 and January 2021:

- call playback and spotlighting over six nights
- targeted bat ultrasonic assessments (2 x SM2+ and 1 x SM4) and a Song Meter SM4BAT-FS ultrasonic recorder in place for six nights in June 2020, 7 nights in October 2020
- 50 Type A Elliot traps in place for a total of 350 trap nights (eight days/seven nights)
- five cage traps for a total of 35 trap nights (seven nights)
- 14 camera traps positioned over baited lures containing rolled oats, peanut butter and honey in place for eight days/seven nights (98 trap nights)
- threatened species search transects throughout the Project area
- mapping and observation of hollows in and around the Project area
- opportunistic observation.

Monitoring points / trap sites used during the 2020 and 2021 surveys are shown on Figure 4-3. Figure 4-4 shows transects walked by the assessors. AREA has been assessing the area in and around the Project disturbance area since 2018 and within 10 kilometres since 2010, so local experience, previous survey of the region and preliminary reporting as well as information held on government databases and archives were also used to inform the assessment (see Section 1.8.3). Survey effort to inform the BDAR prepared for Hera Mine Modification 5 in February 2019 is particularly relevant to the Project. Three Figures taken from 'Hera Mine Modification 5 Biodiversity Assessment Report' prepared by AREA in February 2019 included as Appendix I illustrate the survey effort for Modification 5 which is relevant to the Project.

Figure 4-3: Fauna monitoring points

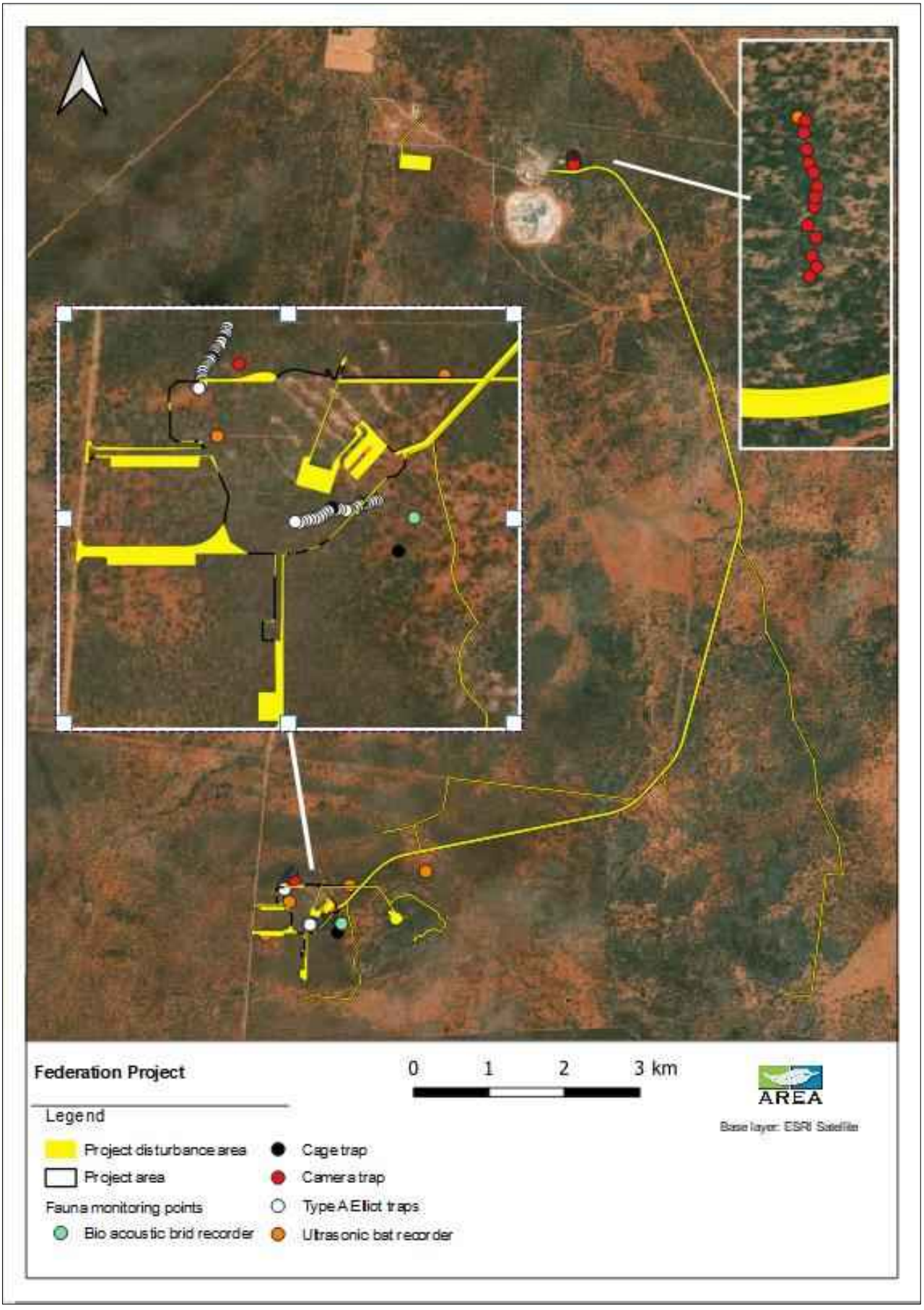
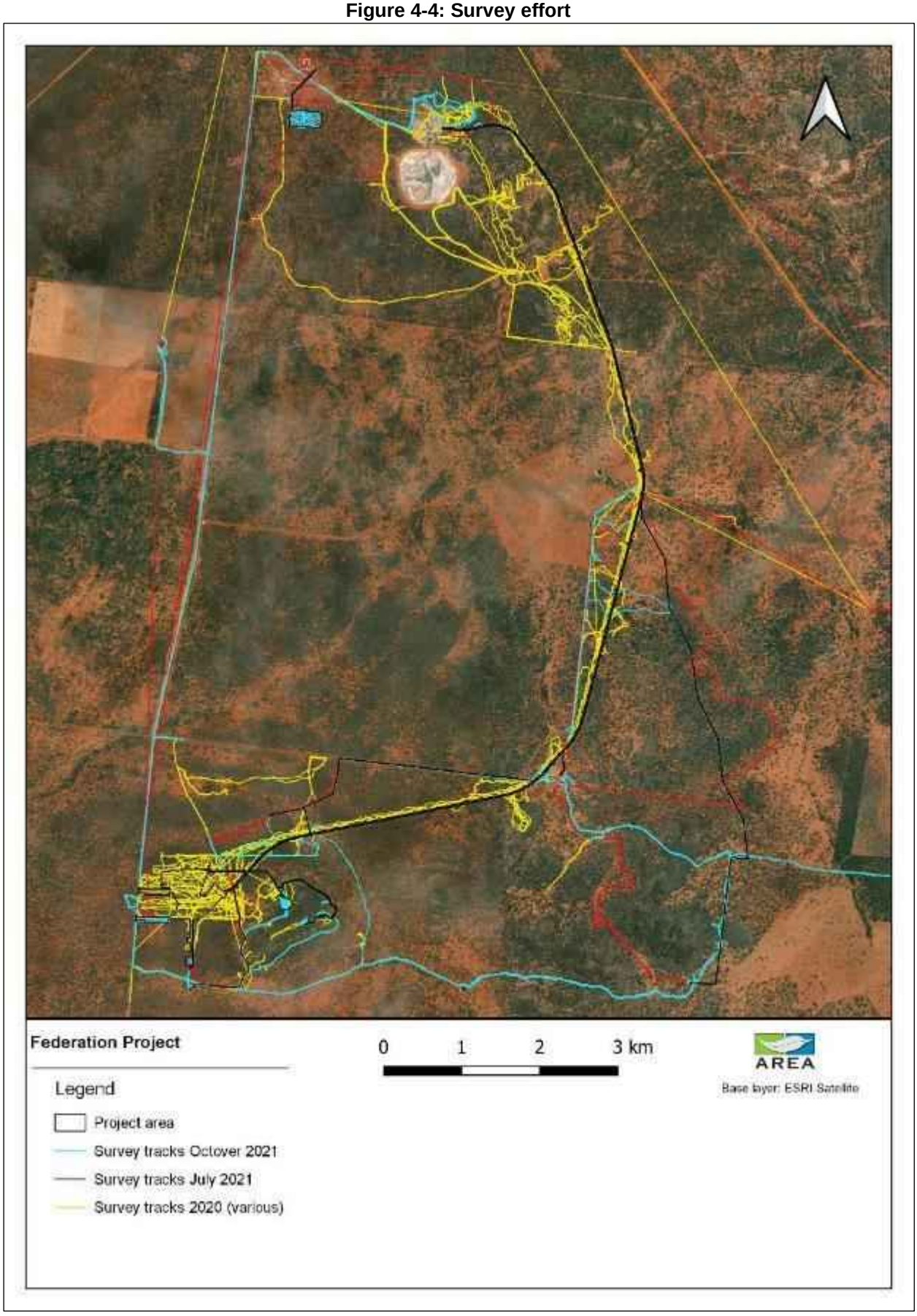


Figure 4-4: Survey effort



4.2.3 Threatened fauna species survey results

No threatened species were recorded in the Project disturbance area during field survey in July 2021 or October 2021. Three threatened fauna species listed under the BC Act (not EPBC listed) known to occur adjacent to the Project disturbance area were sighted outside the Project disturbance area. An individual Hooded Robin (south-eastern form) *Melanodryas cucullata cucullate* was observed in habitat west of the Project disturbance area (where there is a known local population); Major Mitchell's Cockatoo *Lophochroa leadbeateri* was observed flying southwest over the Project disturbance area on two occasions and Grey-crowned babblers *Pomatostomus temporalis temporalis* were observed in the southeast of the Project disturbance area. All three species are commonly recorded in the area and are included in BAM calculations as

Three threatened bat species listed under the BC Act (not EPBC listed) were confidently recorded in and around the Project area using ultrasonic bat recorders (Section 4.2.4) in 2020 and 2021. These species are discussed further in the following sections.

4.2.4 Insectivorous Bat and Bioacoustics Survey

The assessment of bats followed '*Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method 2018*.

Bat echolocation calls, as per DPIE guidelines, were recorded over seven nights in June 2020 (Federation Site), seven nights of bat surveys were conducted at Hera in October 2020 and four nights in July 2021. These calls were assessed by AREA's bat expert Dr Heidi Kolkert, see full reports in Appendix D. The presence of three threatened bat species was indicated by bat echolocation call analysis in 2021 (Table 4-6), four (three confidently and one possibly) threatened species were recorded in 2020 (Table 4-7).

Table 4-6: Bat threatened species recorded in the Project disturbance area in 2021

Scientific name	Common Name	Bat recordings July 2021			
		12/07/2021	13/07/2021	14/07/2021	15/07/2021
Chalinolobus picatus #	Little pied bat		x		
Miniopterus orianae oceanensis #	Eastern bentwing bat	x	x		x
Saccolaimus flaviventris #	Yellow-bellied sheathtail bat		P		

x species identified in the Project disturbance area
P potential record of species
species listed under the Biodiversity Conservation Act 2016
* species listed under the Environment Protection and Biodiversity Act

Table 4-7: Bat threatened species positively recorded in and around the Project area in 2020

Scientific name	Common Name	Bat recording session 1 Winter								Bat recording session 2 Spring						
		12/06/2020	13/06/2020	14/06/2020	15/06/2020	16/06/2020	17/06/2020	18/06/2020	19/06/2020	19/10/2020	20/10/2020	21/10/2020	22/01/2020	23/10/2020	24/10/2020	25/10/2020
Chalinolobus picatus #	Little pied bat								x	x				P	x	x
Miniopterus orianae oceanensis #	Eastern bentwing bat			x	x			x		x	x	x	x	x	x	x
Saccolaimus flaviventris #	Yellow-bellied sheathtail bat								x	x	x	x	x	x		x
Bat calls not positively identified to species																
Chalinolobus dwyeri #*	Large-eared pied bat												1P			

x species identified in the Project disturbance area
P potential record of species
species listed under the Biodiversity Conservation Act 2016
* species listed under the Environment Protection and Biodiversity Act

These species are discussed below:

- Eastern Bent-winged Bat *Miniopterus schreibersii oceanensis* was confidently identified by call in 2020 and possibly identified in 2021. This species is a cave dwelling bat species and has recently been renamed to *Miniopterus orianae oceanensis* or the Large Bent-winged Bat, from *Miniopterus schreibersii subsp. oceanensis* or the eastern bent-wing bat. This species was manually added into the BAM-C.
    - This species was also recorded feeding on Hera Mine during annual monitoring in 2013, 2017, 2018 and 2019
- Yellow-bellied sheathtailed bat *Saccolaimus flaviventris* has already been taken into consideration as a predicted species in the BAM-C. It has been recorded within 10 kilometres as a BioNet record from previous annual monitoring activities.
    - This species was recorded on Hera Mine during the initial EIS and annual monitoring in 2010, 2013 to 2017 and 2019 and 2020
- Little pied bat *Chalinolobus picatus* has already been taken into consideration as a predicted species in the BAM-C. This species roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.
- Large-eared pied bat *Chalinolobus dwyeri* was potentially recorded in 2020, but only a few possible passes. No positive or potential calls were recorded in 2021. The specifically required structure of primary nursery roosts is not present in the Project area which has been thoroughly surveyed. As the call has not been positively identified as present in the Project disturbance area by a subject matter expert it is not considered as a record of presence. See also Table 4-4.

Acoustic calls were collected at the Project disturbance area from 12 July 2021 to 15 July 2021. Spectrograms (a visual representation of the spectrum of frequencies of each acoustic call) was manually scanned by Dr Kolkert to specifically detect calls from the Barking Owl and Masked Owl using Kaleidoscope Viewer (Version 5.2.1). Further inspection of the spectrograms (when a possible species was detected) was undertaken using Audacity (Version 3.0.2). No threatened

species were detected. The Bioacoustics recorder is new technology which was not available during the 2020 surveys.

4.2.5 Threatened flora species survey results

No threatened flora species were identified in the Project disturbance area.

During spring surveys in October 2021, specifically undertaken to detect threatened flora during the recommended survey period, n=10-15 greenhood orchids were observed in an area approximately 500m^2 within Stage 5 of the Project. The plants were highest point in the landform where the proposed quarry is located, Figure 4-5.

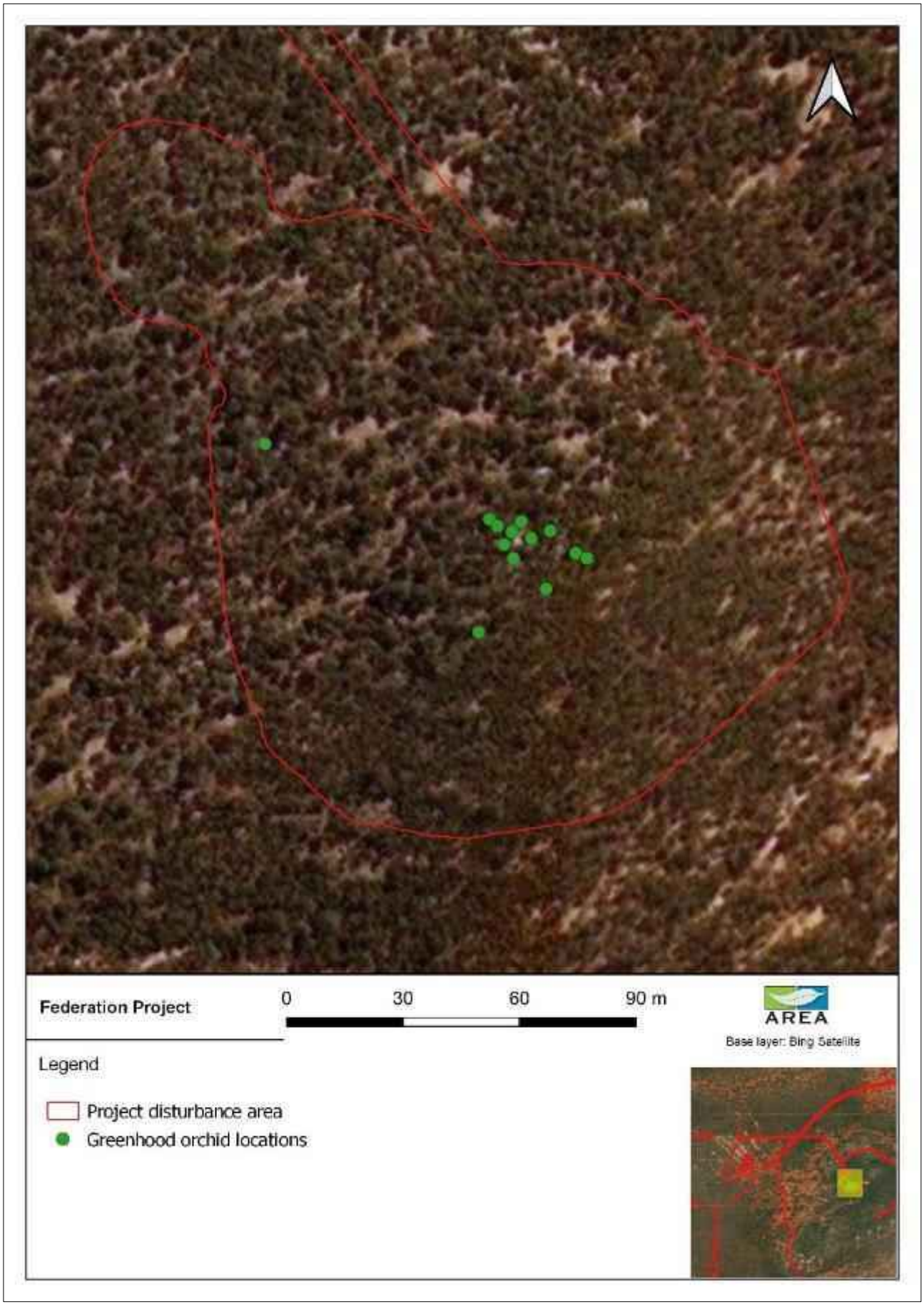
Greenhood orchids are difficult to identify accurately, see Table 4-8 for photos of the plant located in the Project disturbance area and three greenhood orchid species it could potentially be. One physical sample as well as lots of photos were collected and a preliminary identification was made by AREA, suspecting it is not a threatened species. However, as there was doubt for identification, AREA sought expert advice from the Royal Botanic Gardens Sydney (see Appendix F). Botanists confirmed the orchid found in the Project disturbance area was not Cobar Greenhood, it was positively identified as *Pterostylis boormanii* Borman's Rustyhood (not listed).

Table 4-8: Greenhood orchid specimens located in Project disturbance area and similar greenhood orchid species

Orchid name	Photo
Orchid located in the Project disturbance area	 

Orchid name	Photo
Pterostylis cobarensis Cobar Greenhood (Vulnerable BC Act)	
Pterostylis boormanii Borman's Rustyhood (Not listed)	
Pterostylis lingua Thick-lipped Rustyhood (Not listed)	

Figure 4-5: Borman's Rustyhood orchids (not listed) located in the Project disturbance area



4.3 Predicted species

Predicted species (ecosystem credit species) are predicted to occur based on their known presence or predicted presence in the IBRA subregion, the known association with PCTs and the size and condition of the vegetation patches on the Project disturbance area, as determined by the BAM-C. Predicted species may be excluded from this list where they require particular habitat or geographic features (as prescribed by the BAM-C) which are not present.

Predicted species are assumed by the BAM-C to occur and be affected by the Project. Offset of the impact to these species is included in the ecosystem credit calculations.

4.3.1 List of ecosystem credit species derived

The BAM-C assessment tool identified 35 threatened species reliably predicted to use habitat present in the Project disturbance area, see Table 4-9.

Table 4-9: Ecosystem credit species list

Species	Habitat constraints	Geographic limitations	Sensitivity to gain class	BC Act listing	EPBC Act Listing
Antechinomys laniger Kultarr	--	--	High Sensitivity to Potential Gain	Endangered	Not Listed
Artamus cyanopterus Dusky Woodswallow	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Calyptorhynchus lathami *Glossy Black-Cockatoo (Foraging)*	Presence of *Allocasuarina* and *Casuarina* species.	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Certhionyx variegatus Pied Honeyeater	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Chalinolobus picatus Little Pied Bat	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Chthonicola sagittata Speckled Warbler	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Cinclosoma castanotum Chestnut Quail-thrush	-	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Circus assimilis Spotted Harrier	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Daphoenositta chrysoptera Varied Sittella	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Delma australis Marble-faced Delma	Triodia habitat	--	Moderate Sensitivity to Potential Gain	Endangered	Not Listed
Falco hypoleucos Grey Falcon	--	--	Moderate Sensitivity to Potential Gain	Endangered	Vulnerable
Falco subniger Black Falcon	-	-	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Grantiella picta Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	--	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Hamirostra melanosternon Black-breasted Buzzard (Foraging)		--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hieraaetus morphnoides Little Eagle (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hirundapus caudacutus White-throated	-	-	High Sensitivity to Potential Gain	Not Listed	Vulnerable

Species	Habitat constraints	Geographic limitations	Sensitivity to gain class	BC Act listing	EPBC Act Listing
Needletail					
Hylacola cautus Shy Heathwren	-	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Leipoa ocellata Malleefowl	--	--	High Sensitivity to Potential Gain	Endangered	Vulnerable
Lophochroa leadbeateri Major Mitchell's Cockatoo (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Lophoictinia isura Square-tailed Kite (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Melanodryas cucullata Hooded Robin (south-eastern form)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Melithreptus gularis gularis Black-chinned Honeyeater (eastern subspecies)	-	-	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Neophema pulchella Turquoise Parrot	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ningaui yvonneae Southern Ningaui	-	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Ninox connivens Barking Owl (Foraging)	-	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Nyctophilus corbeni Corben's Long-eared Bat	-	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Pachycephala inornata Gilbert's Whistler	-	-	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Phascolarctos cinereus Koala (Foraging)	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
Polytelis swainsonii Superb Parrot (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Stagonopleura guttata Diamond Firetail	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Tiliqua occipitalis Western Blue-tongued Lizard	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed
Tyto novaehollandiae Masked Owl (foraging)			High Sensitivity to Potential Gain	Vulnerable	Not Listed
Vespadelus baverstocki Inland Forest Bat	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed

Three threatened species were detected during bat surveys (see previous section). Little Pied Bat *Chalinolobus picatus* and Yellow-bellied sheathtail bat *Saccolaimus flaviventris* were already predicted to occur by the BAM-C. Eastern bentwing bat *Miniopterus orianae oceanensis* was not predicted to occur so this species was added as to the BAM-C as a predicted species (Table 4-10) because of field survey, bringing the total to 36.

Table 4-10: Species added as ecosystem credit species based on field survey results

Scientific Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	BC Act listing	EPBC Act Listing
Miniopterus schreibersii oceanensis Eastern Bent-winged Bat (Foraging)	-	-	High Sensitivity to Potential Gain	Vulnerable	Not Listed

4.3.2 Justification for exclusion of predicted species

The following two species (Table 4-11) can be excluded because the required habitat constraints are not present. Ecosystem credits apply to the remaining 34 species.

Table 4-11: Excluded predicted species (predicted species)

Scientific Name	Common Name	Habitat constraints	Justification for exclusion
Calyptorhynchus lathami	Glossy Black Cockatoo	Presence of *Allocasuarina* and *casuarina* species	*Allocasuarina* and *Casuarina* species are not present in the Project area. The targeted searches followed Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004) did not detect this species.
Grantiella picta	Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	Mistletoes are not present at a density of greater than five mistletoes per hectare. The targeted searches followed Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004) did not detect this species.

The BAM states 'No surveys are required' to confirm presence of the remaining 34 predicted ecosystem species. Offset of the impact to these species is included in the ecosystem credit calculations.

4.4 Candidate species

Candidate species (species credit species) are those that cannot be reliably predicted from the habitat surrogates and their presence is to be assessed through habitat assessment and targeted surveys.

When candidate species have habitat constraints within the Project disturbance area, they require targeted surveys. When a candidate species is known to occur or assumed to occur, they require offsetting. The full list of 19 candidate species/populations generated by the BAM-C is provided in Table 4-12.

Table 4-12: Candidate species list (full list)

Species	Habitat constraints	Months of Survey	Sensitivity to gain class	BC status	EPBC status.
Acacia curranii Curley-bark Wattle	Rock areas; Rocky slopes and ridges, or within 100m of break or slope	All months	High Sensitivity to Potential Gain	V	V
Ardeotis australis Australian Bustard	-	All months	High Sensitivity to Potential Gain	E	N/A
Austrostipa wakoolica A spear-grass	Alluvial plains and plains	Oct, Nov, Dec	Moderate Sensitivity to Potential Gain	E	E
Burhinus grallarius Bush Stone-curlew	Fallen/standing dead timber including logs	All months	High Sensitivity to Potential Gain	E	N/A
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Hollow bearing trees; Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground	Apr, May, Jun, Jul, Aug	High Sensitivity to Potential Gain	V	N/A
Calyptorhynchus lathami - E population Glossy Black-Cockatoo, Riverina population	Cobar LGA	All months	High Sensitivity to Potential Gain	E Population	N/A
Commersonia procumbens	Pilliga sandstone	All months except Jun and Jul	High Sensitivity to Potential Gain	V	V
Diuris tricolor Pine Donkey Orchid	--	Sept and Oct	Moderate Sensitivity to Potential Gain	V	N/A
Grevillea ilicifolia subsp. ilicifolia Holly-leaf Grevillea	--	All months	High Sensitivity to Potential Gain	CE	N/A
Hamirostra melansternon Black-breasted Buzzard (Breeding)	Waterbodies; Land within 40m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts	Sept, Oct, Nov	Moderate Sensitivity to Potential Gain	V	N/A
Hieraaetus morphnoides Little Eagle (Breeding)	Nest trees, live (occasionally dead) large old trees within vegetation	Aug, Sept, Oct	Moderate Sensitivity to Potential Gain	V	N/A
Lophochroa leadbeateri Major Mitchell's Cockatoo (Breeding)	Hollow bearing trees; Living or dead tree with hollows greater than 10cm diameter Paddock trees with hollows greater than 10 cm diameter	Sept, Oct, Nov, Dec	High Sensitivity to Potential Gain	V	N/A
Lophoictinia isura Square-tailed Kite (Breeding)	Nest trees	Sept, Oct, Nov, Dec, Jan	Moderate Sensitivity to Potential Gain	V	N/A
Monotaxis macrophylla Large-leafed Monotaxis	-	Jan, Feb, Aug, Sept, Oct, Nov, Dec	High Sensitivity to Potential Gain	E	N/A
Ninox connivens Barking Owl (Breeding)	Hollow bearing trees; Living or dead trees with	May, Jun, Jul, Aug, Sept, Oct, Nov, Dec	High Sensitivity to Potential Gain	V	N/A

Species	Habitat constraints	Months of Survey	Sensitivity to gain class	BC status	EPBC status.
	hollows greater than 20cm diameter and greater than 4m above the ground				
Phascolarctos cinereus Koala (Breeding)	Areas identified via survey as important habitat	All months	High Sensitivity to Potential Gain	V	V
Polytelis swainsonii Superb Parrot (Breeding)	Hollow bearing trees. Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5cm diameter greater than 4m above ground or trees with a DBH of greater than 30cm	Sept, Oct, Nov	High Sensitivity to Potential Gain	V	V
Pterostylis cobarensis Greenhood Orchid	--	Oct	Moderate Sensitivity to Potential Gain	V	N/A
Tyto novaehollandiae Masked Owl (Breeding)	Hollow bearing trees. Living or dead trees with hollows greater than 20cm diameter	May, Jun, Jul, Aug	High Sensitivity to Potential Gain	V	N/A

The following bat species (Table 4-13) was added as a candidate species based on survey (see Section 4.2.4), therefore there is a total of 20 candidate species requiring consideration.

Table 4-13: Added candidate species

Species	Common Name	Habitat constraints	Months of survey	Sensitivity to gain class	BC status	EPBC status
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	Caves; Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding; roost observations	Jan, Feb, Dec	Very High Sensitivity to Potential Gain	Vulnerable	Not listed

4.4.1 Justification for exclusion and inclusion of candidate species

The list of 20 candidate species identified in the previous section was assessed to identify if habitat constraints for each species are present; if habitat constraints are **not** present the species can be excluded from further survey. Six of the 20 identified species credit species were excluded from further assessment (Table 4-14). Fourteen candidate species require further assessment.

Table 4-14: Justification of exclusion of candidate species credit species

Species	Habitat constraints	Justification for exclusion
Austrostipa wakoolica A spear-grass	Alluvial plains and plains	Excluded based on habitat constraint: Project disturbance area is not located on an alluvial plain, or plain.
Commersonia procumbens	Pilliga sandstone	Excluded based on habitat constraint: Pilliga sandstone not present. AREA Principal Consultant is a DPIE nominated expert for this species and participated in the 2020 and 2021 assessments.

Species	Habitat constraints	Justification for exclusion
Hamirostra melansternon Black-breasted Buzzard (Breeding)	Waterbodies; Land within 40m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts	Excluded based on habitat constraints: No suitable waterbodies are present and the Project disturbance area is not within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts.
Hieraaetus morphnoides Little Eagle (Breeding)	Nest trees, live (occasionally dead) large old trees within vegetation	Excluded based on habitat constraints: Due to historical clearing Project disturbance area does not contain large old trees within vegetation. No large stick nests are present, and no Little Eagle individuals observed.
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Caves; Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding; roost observations	Excluded based on habitat constraints: Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding are not present in the Project disturbance area ; there were no roost observations in the Project disturbance area .
Phascolarctos cinereus Koala (Breeding)	Areas identified via survey as important habitat	Excluded based on habitat constraint: Project disturbnace area is unlikely to be identified as important habitat. No Koala records exist on BioNet within 10km of the Project disturbance area . There is not a resident local population of koala present.

4.4.2 Description of targeted threatened species surveys

All fourteen candidate species identified as needing targeted survey were able to be excluded from the BAM-C because field assessment determined they are:

- not present or
- unlikely to be present or
- unlikely to use the suitable habitat in the Project disturbance area.

This is justified in Table 4-15.

Table 4-15: Species excluded by additional survey

Species	Months of survey	Survey effort
Acacia curranii Curley-bark Wattle	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys (including search transects and eighteen BAM plots) in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects were conducted across the Project area in all surveys (during the BAM recommended survey period). No Curly-bark Wattle was recorded during these surveys
Ardeotis australis Australian Bustard	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects were conducted across the Project area in all surveys (during the BAM recommended survey period). This species was not recorded.
Burhinus grallarius Bush Stone-curlew	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects and were conducted in and around the Project area in all surveys (during the BAM recommended survey period). This species was not recorded.
Calyptorhynchus lathami Glossy Black-	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020,

Species	Months of survey	Survey effort
Cockatoo (Breeding)		October 2020, January 2021, July 2021 and October 2021. Search transects and were conducted in and around the Project area in all surveys (during the BAM recommended survey period). During all surveys signs of breeding and trees were considered for nest tree / hollow suitability ((i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees and may be near-vertical or vertical.). No birds, evidence of nesting or suitable nest trees were located. This species was not recorded.
Calyptorhynchus lathami - E population Glossy Black-Cockatoo, Riverina population	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects were conducted in and around the Project area in all surveys (during the BAM recommended survey period). During all surveys signs of breeding and trees were considered for nest tree / hollow suitability ((i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees and may be near-vertical or vertical.). No birds, evidence of nesting or suitable nest trees were located. This species was not recorded.
Diuris tricolor Pine Donkey Orchid	Sept and Oct	Field assessment followed *Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method 2020*. AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. AREA Principal Consultant is a DPIE nominated expert for this species and participated in assessment for the species on the Project area and neighbouring properties and did not record it. This species was not recorded during survey.
Grevillea ilicifolia subsp. ilicifolia Holly-leaf Grevillea	All months	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys (including search transects and numerous BAM plots) in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. No Holly-leaf Grevillea was recorded during these surveys.
Lophochroa leadbeateri Major Mitchell's Cockatoo (Breeding)	Sept, Oct, Nov, Dec	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021 during which signs of breeding and trees were considered for nest tree suitability. Hollows in and around the Project area were observed and no Major Mitchell's Cockatoos were recorded using the hollows. Survey was within the BAM recommended survey period. This species was observed adjacent to the Project area in Oct 2020 and 2021 but was not recorded utilising habitat in the Project area.
Lophoictinia isura Square-tailed Kite (Breeding)	Sept, Oct, Nov, Dec, Jan	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects were conducted in and around the Project area in all surveys (during the BAM recommended survey period) during which signs of breeding and trees were considered for nest tree suitability. No individuals of this species, evidence of nesting or suitable nest trees were located. This species was not recorded.
Monotaxis macrophylla Large-leafed Monotaxis	Jan, Feb, Aug, Sept, Oct, Nov, Dec	Field assessment followed Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004. AREA conducted surveys (including search transects and numerous BAM plots) in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Survey for this species is to be within 6 months of disturbance. The Project area has a history of historical and current disturbances, and this species has never been detected. No Large-leafed Monotaxis was recorded during these surveys.

Species	Months of survey	Survey effort
Ninox connivens Barking Owl (Breeding)	May, Jun, Jul, Aug, Sept, Oct, Nov, Dec	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Search transects were conducted in and around the Project area in all surveys (during the BAM recommended survey period) during which signs of breeding and trees were considered for nest tree suitability. No individuals of this species, evidence of nesting or suitable nest trees were located. This species was not recorded.
Polytelis swainsonii Superb Parrot (Breeding)	Sept, Oct, Nov	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021, July 2021 and October 2021. Hollows in and around the Project area were observed during the BAM recommended survey period. No Superb Parrots were recorded. No evidence of nesting Superb Parrots was recorded.
Pterostylis cobarensis Greenhood Orchid (Cobar Greenhood)	Oct	Field assessment followed *Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method 2020*. Search transects occurred in October 2020 and October 2021 during the required survey period. A greenhood orchid species was found in the Project disturbance area in October 2021, however Royal Botanic Gardens Sydney botanists confirmed the orchid found in the Project disturbance area was not Cobar Greenhood, it was positively identified as *Pterostylis boormanii* Borman's Rustyhood. This species was not recorded.
Tyto novaehollandiae Masked Owl (Breeding)	May, Jun, Jul, Aug	Field assessment followed *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft November 2004.* AREA conducted surveys in and around the Project area in November 2018, July 2019, June 2020, October 2020, January 2021 July 2021 and October 2021. Search transects were conducted in and around the Project area in all surveys (during the BAM recommended survey period). This species was not recorded.

4.4.3 Species credit species

Targeted surveys for all species credit species identified in Table 4-15 were undertaken in accordance with the relevant survey guidelines and none were identified. No species credit species are, or are assumed to be, present and therefore do not generate credits under the BAM.

This result was consistent with the results of surveys AREA has undertaken previously for other Aurelia projects including Hera Mine Modification 5 and 6, Hera mining accommodation village expansion, and annual monitoring results undertaken on the Hera Mine and associated properties since 2010.

4.5 State Environmental Planning Policy

The State Environmental Planning Policy (Koala Habitat Protection) 2021 came into effect 17 March 2021. Cobar LGA is not listed under Schedule 1 of this SEPP; therefore it is not relevant to this proposal.

Secondary food trees exist in the study area, but Koala are unlikely to occur in the study area and no further assessment or test of significance is required.

5 Assessment of impacts

5.1 Serious and irreversible impacts

The BAM-C Biodiversity Credit Report provides a column indicating Candidate SAIIs. A review of this report demonstrates no candidate species assessed in this BDAR are identified as SAIIs (Appendix E).

5.2 Potential Direct Impacts

Direct impacts are a direct result of Project activities. Direct impacts predicted to occur by the Project are considered in the following sections and recommended mitigation measures are outlined in Section 5.6.

5.2.1 Vegetation Clearance and Habitat Connectivity

Vegetation present in the Project disturbance area could provide suitable habitat for a range of threatened species. Hollow bearing trees are present in the Project disturbance area and will be impacted, as well as some areas of rocky habitat. As such, direct impact to habitat for threatened species could occur during vegetation clearance for construction. Potential impact to threatened fauna habitat has been minimised by avoidance of impact to native vegetation as far as possible, see Section 5.5.

The Project disturbance area is well connected to native vegetation from all directions, however there are no officially mapped wildlife corridors in the vicinity. The area has been previously disturbed from historic clearing and agricultural activities, and clearing is approved for the exploration decline program. All vegetation around the Project area will be retained and limited agricultural practices (similar to current low impact feral goat grazing) will occur so there will be abundant surrounding vegetation and habitat.

5.2.2 Injury to Wildlife and Vehicle Strike

Injury to wildlife is possible during vegetation clearing for the construction phase of this proposal. Contact with wildlife and potential habitat (e.g., trees with hollows, fallen logs etc.) will be avoided wherever possible. A local wildlife rescue organisation (e.g., WIRES or a local veterinarian) will be contacted in the event wildlife requires rescue or removal. Mitigation measures designed to reduce an injury and mortality of fauna are provided in Section 5.6.

The Project will lead to increased potential for vehicle strike to occur on access roads. Potential impact will be minimised as far as possible by mine site speed limits and compulsory staff inductions.

5.2.3 Groundwater Dependent Ecosystems (GDE's)

The risk assessment guidelines for groundwater dependent ecosystems (Serov et al. 2012) available online at http://www.water.nsw.gov.au/water-management/water-availability/risk-assessment/groundwater-dependent-ecosystems.

These guidelines were reviewed which determined changes to GDEs during the implementation of this Project are unlikely. A Groundwater Assessment undertaken by GHD for the Federation

Project (GHD Pty Ltd, 2021) concluded it unlikely vegetative communities in the Project area are GDEs given the deep water levels identified at the study area (approximately 45 to 90 metres below ground level). Groundwater in the study area is too deep to support GDEs therefore there will be no impact to groundwater dependent vegetation.

5.2.4 Surface Water

A water management system will be implemented to prevent release of contaminated water, manage sediment affected water, and divert clean water around mining activities and infrastructure. There will be no change in flood behaviour or impacts of flooding on mine site infrastructure. Linear infrastructure crossings will be designed and constructed to minimise impacts.

5.2.5 Aquatic habitat impacts

Aquatic habitats differ from terrestrial habitats and are more susceptible to degradation and loss, so potential impacts need to be carefully managed.

There are several unnamed ephemeral tributaries and topographic drainage lines (hydrolines) which intersect Project linear infrastructure, but not the Federation Site or Hera Mine. Dams and hydrolines in the study area lack aquatic habitat which would attract insects and amphibian species; however the Project will directly impact some drainage lines during construction through excavation, vegetation removal and other construction activities. Construction is recommended to be undertaken in dry conditions where possible.

Mitigation actions listed in Section 5.6 would be followed to reduce impact to waterways. Once construction is complete, restoration of the aquatic environment to pre-construction condition would occur.

5.2.6 Exposed soil and stockpiles

Soils would be disturbed where vegetation removal and construction will occur. Disturbed soils have the potential to move off the study area and impact waterways if not appropriately managed.

Stockpiles also have the potential to negatively impact the environment if not appropriately managed. Erosion and sediment control measures are described in Section 5.6.

5.2.7 Subsidence

Beck Engineering (BE) has conducted a surface subsidence assessment for proposed underground metalliferous mining at the Federation Project (the Project) (Beck Engineering, 2021). A simulation of the proposed Federation underground mining plan was conducted using a non-linear, strain-softening, discontinuum finite element numerical model. The numerical simulation of mine-scale subsidence for the entire duration of the mine plan indicates that total cumulative 3D surface displacements above the mining footprint will be within the range of 1-2 cm. This includes both horizontal and vertical components of displacement. A small zone of the surface located to the northwest of the stoping footprint is affected by displacements of up to 3 cm. This indicates that mining-induced surface subsidence displacements of the same magnitude as those numerically forecast at the Federation mine fall into the ‘negligible impact category (i.e. < 0.25 metres). Therefore, subsidence will not result in impacts to biodiversity.

5.3 Potential Indirect Impacts

Indirect impacts are these which are not a direct result of the Project, often produced away from or as a result of a complex impact pathway. They can be hard to predict and difficult to manage. Indirect impacts are considered in the following sections. Recommended mitigation measures are outlined in Section 5.6.

5.3.1 Introduction and spread of disease and pathogens

In NSW, there are infectious pathogens with potential to impact on biodiversity. Any activities involving the movement of soil and equipment over large areas are a potential risk for spread and infection. The pathogens and diseases below are listed as key threatening processes under the BC Act. These three pathogens are considered a negligible risk to the study area due to the low rainfall of the area.

Phytophthora (*Phytophthora cinnamomi*): Phytophthora is soil-borne fungus causing tree death (dieback). It attacks the roots of a wide range of native plant species. Spores can be dispersed over relatively large distances by surface and sub-surface water flows. Infected soil/root material may be dispersed by vehicles (e.g. earth moving equipment).

Infection by Psittacine Circoviral (beak and feather): Psittacine Circoviral (beak and feather) Disease (PCD) affects parrots and their allies (psittacines) and is often fatal. No other faunal species or groups are known to be susceptible to PCD (Murdoch University 1997). It is caused by a relatively simple virus which infects and kills the cells of the feather and beak, as well as cells of the immune system, leaving birds vulnerable to bacterial and other infections (Murdoch University 1997). The distribution of the disease and the factors involved in its spread are not well understood. The virus multiplies in the liver and can be transmitted orally or in faeces or feathers.

Chytrid fungus (*Batrachocytrium dendrobatidis*): Chytrid fungus is a fatal infectious disease affecting amphibians worldwide. It is a water-borne fungus which may be spread because of handling frogs or through cross contamination of water bodies by vehicles and workers.

There is a low to negligible likelihood for the potential risk of pathogens and disease in the Project disturbance area from proposed activities given its location and dry climate, and they have not been detected on site. A Pathogen and/or Disease Management Plan is not required. Mitigation measures for these diseases have been provided in Section 5.6.

5.3.2 Introduction and spread of weeds and pests

An increase in the movement of people, vehicles, machinery, vegetation waste and soil during and following construction and mine operations will potentially alter the current exotic flora in the Project area and increase the prevalence of weeds elsewhere.

Disturbed areas, such as those in which earthwork are to be carried out, will be particularly susceptible to weed establishment. Mitigation measures will be required to minimise the risk of introduction and spread of weeds. Table 5-2 summarises these safeguards.

The Project is unlikely to result in the spread of new pests. Ensuring machinery and vehicles are clean prior to entering the Project area will assist in reducing the risk of invasion and spread of pests.

5.3.3 Edge Effects and Fragmentation

The construction of the Project will cause disturbance by reducing habitat quality in adjacent areas. This is related to the greater potential for edge effects, habitat fragmentation and barrier effects due to the high perimeter to area ratio of linear developments. Edge effects typically take the form of weed invasion, increased light levels, increased wind speeds, and greater temperature fluctuations.

The Project is in an area currently subject to existing edge effects from agricultural activity, the existing roadways and other development. Overall, connectivity will not be significantly reduced by the Project, nor fragmentation significantly increased as remaining vegetation will be no less connected to surrounding vegetation.

5.3.4 Dust, Noise and Vibration

Construction and operational activities will result in localised dust, noise and vibration impacts which may result in fauna temporarily avoiding habitats next to the activities.

There is likely to be night-time working and artificial lighting may result in impact to nocturnal fauna. Nocturnal species such as possums and microbats may avoid the habitat adjacent to the Project area as temporary ‘daylight’ conditions would be created. Many Project areas will not be lit at night, for example linear infrastructure corridors.

5.4 Prescribed impacts

The prescribed impacts which may be associated with the Project are discussed below.

Table 5-1: Prescribed impacts relevant to the Project disturbance area

Feature	Present	Description of feature characteristics and location	Potential impact	Threatened species or community using or dependent on feature	Section of the BAR where prescribed impact is addressed
Karst, caves, crevices, cliffs or other geologically significant feature	☒ Yes / ☐ No	No karsts, caves, crevices, cliffs or other geologically significant features are present in the Project disturbance area however the Project will impact some rocky habitat.	Disturbance to habitat for rock or crevice dependent species.	No candidate species identified	See mitigation measures, Section 5.6
Rocks	☒ Yes / ☐ No	The Project will impact some rocky habitat.	Disturbance to habitat for rock dependent species.	No candidate species identified	See mitigation measures, Section 5.6
Human-made structure	☐ Yes / ☒ No	N/A	No human-made structures will be impacted	N/A	N/A
Non-native vegetation	☐ Yes / ☒ No	N/A	There are some weeds in the Project disturbance area but no significant areas of non-native vegetation will be impacted	N/A	N/A
Habitat Connectivity	☒ Yes / ☐ No	N/A	The Project disturbance area is well connected to native vegetation from all directions, there are no corridors which will be impacted	N/A	N/A
Hydrological process sustaining/interacting with rivers, streams or wetlands	☒ Yes / ☐ No	Minor waterways/hydrolines intersecting the Project disturbance area	The Project will result in changes to surface drainage and topography through excavation and extraction of materials. The EIS will include details of proposed erosion and sediment controls as well as addressing the anticipated impact of floods.	N/A	N/A
Wind farm development	☐ Yes / ☒ No	N/A	No wind farm proposed on the Project area	N/A	N/A
Vehicle Strike	☒ Yes / ☐ No	The Federation Project will result in increased vehicle movements in the area	Potential for vehicle strike to occur on access roads.	No candidate species identified	See mitigation measures, Section 5.6

5.5 Avoid and minimise impact

As the Project involves underground mining, impact associated with large open cut mining areas are avoided.

The proponent has aimed to avoid and minimise impact to the environment as far as possible. Opportunities to minimise impact to native vegetation has been achieved by:

- modifying earlier versions of the Project area by placing roads, tracks and ancillary infrastructure on areas cleared under previous approvals
- consulting with field ecologists to minimise the impact of the water pipeline and bore network which has been realigned to avoid ephemeral drainage lines not detectable by more coarser mapping initially used to inform the design and have also been realigned to use previously cleared roads and fence lines where possible. These actions significantly minimised impact to native vegetation
- condensing the Project area into the smallest area possible without compromising the functionality or its purpose
- haulage of ore and tailings between the Federation Site and Hera Mine using a public road, thereby avoiding vegetation clearance associated with a private haul road on private land through remnant native vegetation
- utilising previously cleared surface infrastructure areas for the exploration decline program to the maximum extent possible to minimise additional clearance attributable to the Project
- utilising existing infrastructure at the Hera Mine to minimise a need for extra for new replicate infrastructure
- locating the new process plant at Hera Mine within the existing approved disturbance footprint
- locating the proposed solar farm in a historically cleared and disturbed area in which White Cypress Pine regrowth is the predominant species in the mid and upper stratum (this species is known to significantly suppress biodiversity) and is located close to the existing mine accommodation village infrastructure, so it utilises existing tracks and roads, and the powerline route is as short at possible which will reduce impact.

Staging the development into separate components will also mean the impact will be minimised by allowing fauna to vacate if present and will avoid unnecessary clearing if a stage does not go ahead.

5.6 Mitigation and management of impacts

A list of recommended mitigation measures is summarised in Table 5-2. These are designed to provide guidance on recommended measures to further avoid and mitigate impact to biodiversity.

Table 5-2: Recommended mitigation measures

Impact	Mitigation measures	Timing/duration	Comment
General	Ensure all staff working on the Project are inducted on: 1. Site environmental procedures (i.e. vegetation management, sediment and erosion control, protective fencing, weeds, hygiene protocols, ethical procedures for handling fauna displaced on the site) 2. What to do in case of environmental emergency (chemical spills, fire, injured fauna) 3. Key contacts in case of environmental emergency 4. How to reduce the risk of vehicle strike to fauna.	Pre-construction, construction, operation	All personnel would be inducted to be aware any stand of native vegetation outside the authorised disturbance has legislative consequences if deliberately or accidentally impacted without approval. Evidence of all personnel receiving an induction would be kept on file.
Removal of native vegetation including: • hollow bearing trees • threatened species habitat • other habitat features	Native vegetation removal will be minimised as far as possible using the following measures: • Utilise existing disturbed and cleared areas for compound, parking and stockpiling to ensure there is not additional impact to vegetation. • Before starting work, a physical vegetation clearing boundary at the approved clearing limit is to be identified and effectively communicated to personnel. The delineation of such a boundary may include the use of temporary fencing or parawebbing and marked as 'No-Go Zones'. Regular inspections should be undertaken to ensure all retained vegetation/fauna habitat is clearly marked and that fencing is in place, where appropriate • Vegetation within the Project disturbance area would be removed in such a manner so as to avoid damage to surrounding vegetation. Groundcover disturbance should be kept to a minimum where possible. • Some vegetation to be removed would be mulched on-site and re-used to stabilise disturbed areas where possible.	Planning stage, pre-construction and during construction	Up to 55.78 hectares of native vegetation will be removed. Rehabilitation will occur post mining.
	• A preclearing inspection should be undertaken by a qualified ecologist prior to the removal of vegetation. An ecologist or spotter/catcher should be present for the removal of hollow-bearing trees, logs or stags which could contain native fauna. • Avoid clearing native vegetation in Spring, when possible. Any fallen timber, dead wood and bush rock encountered on site would be left in situ where possible or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	Pre-construction and during construction	
	Implement staged habitat removal to allow fauna to vacate if present so vegetation will be retained in the buffer area until future stages commence. Respond to (e.g. rescue, relocate only if required) fauna detected during the clearing process.	During construction	
	Where tree removal is required, large trees, or part thereof, with hollows can be left in the remnant vegetation where possible to provide habitat or used in the waterway to create snags. Nest-boxes or creating tree hollows through pruning existing trees (in a 1:1 fashion) should be installed in suitable, retained trees to compensate for the loss of large hollows (>20cm) because of the Project.	During and post construction	

Impact	Mitigation measures	Timing/duration	Comment
	The Project has a finite life and post mining disturbed areas will be rehabilitated. The result will be a stable environment that is conducive to the establishment of vegetation characteristic to the area that is similar to the pre-mining vegetation composition.	Rehabilitation post mining	
Revegetation and Rehabilitation	Minor landscaping may be required. Where this occurs, there are two options 1) either allow the area to naturally regenerate or 2) to plant species. Natural regeneration in arid areas is typically more successful than planting vegetation. If planting is chosen, then all species planted for any purpose should be consistent with those Plant Community Types described in this report. Shrubby vegetation layers can be planted on the Project boundaries to screen and provide habitat.	During and post construction	Rehabilitation will occur post mining.
Fragmentation of habitat connectivity	Connectivity impacts will be mitigated post mining through rehabilitation.	During construction and operation	Rehabilitation will occur post mining.
Fauna management	• Personnel will avoid handling wildlife, especially snakes. Fauna handling should only be done by a licenced fauna ecologist or wildlife carer. • In the case of injured fauna contact a nominated animal rescue agency / wildlife car group or veterinarian if an animal is injured as per the proponent's fauna handling and rescue procedure (or see Appendix G).	During construction and operation	A Biodiversity Management Plan (BMP) for the Federation Project will further detail management of biodiversity at the site.
Vehicle Strike	• Low speed limits in place on mine site roads. • Install warning signs of known wildlife crossings. • Reporting requirements for any incidents of vehicle strikes. • Ensure staff are inducted on how to reduce risk to fauna from vehicle strike.	During construction and operation	See above
Changes to hydrology	• A water management system will be implemented to prevent release of contaminated water, manage sediment affected water, divert clean water around mining activities and infrastructure. • The Project will have insignificant impacts on the hydrology of water courses. The Project is not a risk of experiencing flooding due to its location within the landscape.	Planning stage, during operation	Water management is addressed in detail in the Project's surface water impact assessment (GHD Pty Ltd, 2021).
Aquatic impacts	• Follow relevant legislation guidelines regarding impact to waterways • Identify and mitigate potential risks to water quality (e.g. sediment from construction, importation of clean fill). Rehabilitation of waterways will occur post mining. • Construction to occur during dry periods only. • Do not refuel, store or decant chemicals within 50m of a waterway.	During construction and operation	No residual impact is expected if requirements in relevant guidelines are met. Rehabilitation will occur post mining.

Soil Management and Stockpiles	• Provide sediment and erosion controls to manage exposed soil surfaces and stockpiles to prevent sediment discharge into vegetation and fauna habitat.
	• Clearly identify stockpile and storage locations and provide erosion and sediment controls around stockpiles.
	• Stockpile and compound sites would be located using the following criteria:
	  • At least 40 m away from the nearest waterway
	  • On relatively level ground
	  • Outside the one in 10 year Average Recurrence Interval (ARI) floodplain.
	  • Stockpiling materials and equipment and parking vehicles would be avoided within the dripline (extent of foliage cover) of any tree.
		During construction and operation	Rehabilitation will occur post mining.

Impact	Mitigation measures	Timing/duration	Comment
Subsidence	Subsidence monitoring will be included in regular environmental monitoring activities.	During construction and operation	Mining-induced surface subsidence displacements of the same magnitude as those numerically forecast at the Federation mine fall into the Negligible Impact category. No residual impact is anticipated.
Invasion and spread of weeds	• Any priority weeds in the Project area should be sprayed and managed as far as possible. Application of a native grass mix or sterile exotic grass mix in areas disturbed by the Project post construction will assist in bank stabilisation and preventing further invasion and spread of weeds. • Construction machinery (bulldozers, excavators, trucks, loaders and graders) should be cleaned using a high-pressure washer (or other suitable device) before entering and exiting work sites. • Weed-free fill should be used for on-site earthwork. • All chemicals should be used in accordance with the requirements on the label. Any person carrying out herbicide application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	During construction and operation	No residual impact is expected
Invasion and spread of pests, pathogens and disease	• All food scraps and rubbish are to be appropriately disposed of in sealed receptacles to prevent providing forage habitats for foxes, rats, dogs and cats. • Any roadkill in close proximity to or caused by the Project is to be relocated away from the site to prevent bird species which eat carrion from being injured by traffic. • Pathogens such as *Phytophthora cinnamomi* will be managed by implementing precaution such as washing down equipment prior to commencing the Project. • Handling of frogs encountered during construction will be done only if necessary, and always in accordance with safe frog handling procedures to prevent the spread of Chytridiomycosis (Amphibian Chytrid Fungus Disease). See fact sheets such as available at • https://www.environment.gov.au/system/files/resources/279bf387-09e0-433f-8973-3e18158febb6/files/c-disease_1.pdf	During construction and operation	No residual impact is expected
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing.	During construction	No residual impact is expected
Noise, light and vibration	Noise, dust vibration and artificial light impacts will be minimised by strategic project planning to reduce the creation of noise, light, dust and vibration impacts	Detailed design and during construction	No residual impact is expected

Impact	Mitigation measures	Timing/duration	Comment
New or evolving impacts	Adaptive management is recommended to be able to respond to changing circumstances.	Ongoing	Monitor impacts and review efficiency of mitigation measures regularly.

6 Biodiversity credit summary

Biodiversity offsetting is triggered by this proposal.

The offsetting requirement for the Federation Project State Significant Development has been determined by the BAM-C.

Vegetation integrity scores for the PCTs in the Project disturbance area are shown in Table 6-1.

Biodiversity offsetting requirements for impact to PCT103, PCT104, PCT174, PCT180, PCT258 and PCT184 is provided on Tables 6-2 and 6-3.

The BAM-C Credit Summary Report is provided in Appendix E

6.1 Vegetation scores

Table 6-1: Current vegetation integrity scores

Zone	PCT	BAM item number	Area (ha)	Composition condition score	Structure condition score	Function condition score	Vegetation integrity (VI) score
1	103 (dense)	1	33.48	90.8	77.6	95.2	**87.5**
2	103 (open)	2	0.32	92	33.2	15.8	**36.4**
3	174	3	14.46	97.5	81	94.5	**90.7**
4	104	4	3.86	70.8	53.7	86.3	**68.9**
5	180	5	2.35	72.7	66.8	41.2	**58.5**
6	258	6	0.86	88	58.4	99.3	**79.9**
7	184	7	0.45	61.8	19	38.7	**35.7**

6.2 Credits required

Table 6-2: Ecosystem credit summary from BAMC

Note: area figures are rounded up in the BAMC at this stage of the calculation

Zone	BAM item number	Matter requiring offsetting	Change is vegetation integrity	Area	Sensitivity to Potential Gain	Number of credits
1	1	PCT103	85.2	33.48	High sensitivity to potential gain	1282
2	2	PCT103_cleared	36.4	0.32	High sensitivity to potential gain	5
3	3	PCT174	94.7	14.46	High sensitivity to potential gain	574
4	4	PCT104	68.8	3.86	High sensitivity to potential gain	100
5	5	PCT180	58.8	2.35	High sensitivity to potential gain	52
6	6	PCT258	79.9	0.86	High sensitivity to potential gain	26
7	7	PCT184	35.7	0.45	High sensitivity to potential gain	6
					Total	**2045**

Table 6-3: Ecosystem credit summary (number and class of biodiversity credits to be retired)

Note: area figures are rounded up in the BAMC at this stage of the calculation

Zone	PCT	TEC	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1 and 2	103 Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Zone 3 and 4 combined)	Not a TEC	33.8	1282	5	**1287**
3	174 Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion (Zone 1)	Not a TEC	14.5	574	0	**574**
4	104 Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion (Zone 2)	Not a TEC	3.9	100	0	**100**
5	180 Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	Not a TEC	2.4	0	52	**52**
6	258 Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion	Not a TEC	0.9	26	0	**26**
7	184 Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion	Not a TEC	0.5	0	6	**6**

6.3 Credit classes

Credit classes allocated to the Project are outlined below in Table 6-4 to Table 6-9.

6.3.1 Ecosystem credit classes

Table 6-4: Credit classes for PCT103 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Western Peneplain Woodlands This includes PCT's: 103, 135, 145	Western Peneplain Woodlands - ⩾ 50% - < 70% cleared group	Zone 1 103_good	Yes	1282	Nymagee , Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.
Western Peneplain Woodlands This includes PCT's: 103, 135, 145	Western Peneplain Woodlands - ⩾ 50% - < 70% cleared group	Zone 2 103_cleared	No	5	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Table 6-5: Credit classes for PCT174 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Sand Plain Mallee Woodlands This includes PCT's: 142, 173, 174, 190, 193, 355, 474	Sand Plain Mallee Woodlands >=50% and <70%	Zone 3 174_good	Yes	574	Nymagee, Barnato Downs, Bogan Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Table 6-6: Credit classes for PCT104 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands - < 50% cleared group	Zone 4 104_good	Yes	100	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Table 6-7: Credit classes for PCT180 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	Zone 5 180_good	No	52	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Table 6-8: Credit classes for PCT258 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	Zone 6 258_good	Yes	26	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Table 6-9: Credit classes for PCT184 Like-for-like options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	Zone 7 184_good	No	6	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

Species credit classes

There are no species credits generated by the Project.

7 Credit requirement per stage

As discussed in Section 1.3, the Federation Project has been separated in different components (or stages). The BDAR will consider the impacts of each stage separately, so the proponent is only liable for offsets if a stage occurs.

Proposed stages are as follows:

- Stage 1: Federation Site, Services Corridor and Communications Tower
- Stage 2: Solar Farm and Associated Powerline
- Stage 3: Potential Tailings Pipeline and Return Water Pipeline
- Stage 4a: Bore and Pipelines, eastern alignment (locations indicative only)
- Stage 4b: Bore and Pipelines, west and southern alignments (locations indicative only)
- Stage 5: Quarry

The total offsetting requirement for all stages has been determined. The offsetting requirement for each stage has then been calculated by working out the area of each native vegetation plant community type (PCT) impacted by each stage and converting that area to a percentage of the total impact to each PCT by the whole Federation Project proposal. The percentage for each stage has then been applied to the total offsetting requirement, resulting in an allocation of the offsetting requirement of each stage.

Credit required summary is as follows

Stage	Total Credits Required
1	1265
2	287
3	262
4a	81
4b	97
5	53
Total	**2045**

Credit breakdown per stage and PCT are shown below:

Stage 1

Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	19.07	0	10.89	2.95	0	0.67	0.45	0	**34.03ha**
Percentage of zone in this stage	57%	0%	75%	76%	0%	78%	100%	-	**-**
Credits required	730	0	433	76	0	20	6	-	**1265**

Stage 2

Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	7.37	0.32	0	0	0	0	0	1.05	**8.74ha**
Percentage of zone in this stage	22%	100%	0%	0%	0%	0%	0%	-	**-**
Credits required	282	5	0	0	0	0	0	-	**287**

Stage 3

Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	4.22	0	1.79	0.91	0	0.19	0	0	**7.11ha**
Percentage of zone in this stage	13%	0%	12%	24%	0%	22%	0%	-	**-**
Credits required	162	0	71	24	0	6	0	-	**262**

Stage 4a

Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	1.32	0	0.77	0	0	0	0	0	**2.09ha**
Percentage of zone in this stage	3.9%	0%	5%	0%	0%	0%	0%	-	**-**
Credits required	51	0	31	0	0	0	0	-	**81**

Stage 4b

Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	1.5	0	1	0	0	0	0	0	**2.50ha**
Percentage of zone in this stage	4.5%	0%	7%	0%	0%	0%	0%	-	**-**
Credits required	57	0	40	0	0	0	0	-	**97**

Stage 5

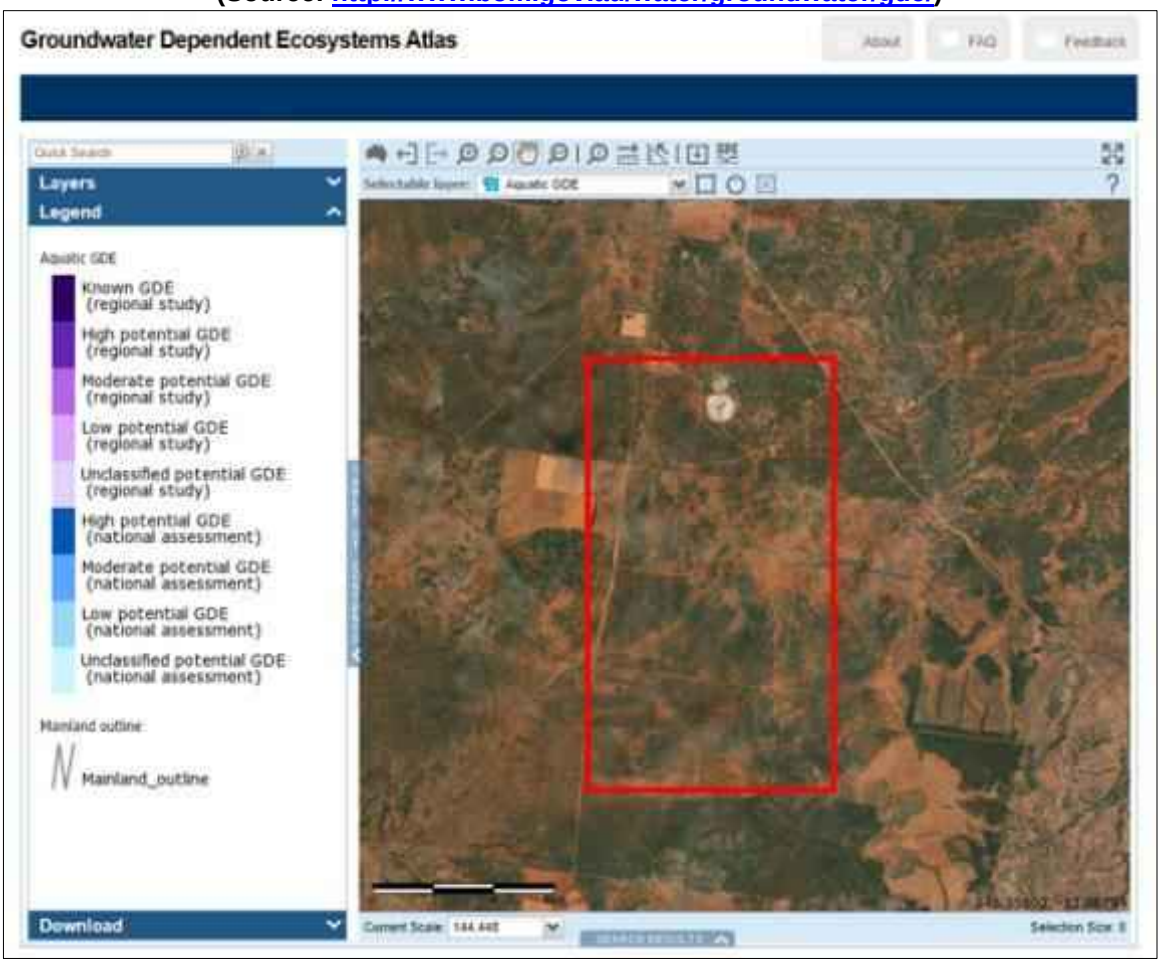
Stage 1	Zone 1 PCT 103	Zone 2 PCT 103 (cleared)	Zone 3 PCT 174	Zone 4 PCT 104	Zone 5 PCT 180	Zone 6 PCT 258	Zone 7 PCT 184	PCT 0	Totals
Hectares in stage	0	0	0.01	0	2.35	0	0	0	**2.36ha**
Percentage of zone in this stage	0%	0%	0.07%	0%	100%	0%	0%	-	**-**
Credits required	0	0	1	0	52	0	0	-	**53**

It is understood a requirement of BAM (2020) is the credit liability will need to be recalculated for each stage immediately before the offsetting liability is to be honoured, therefore the obligation for each stage may differ.

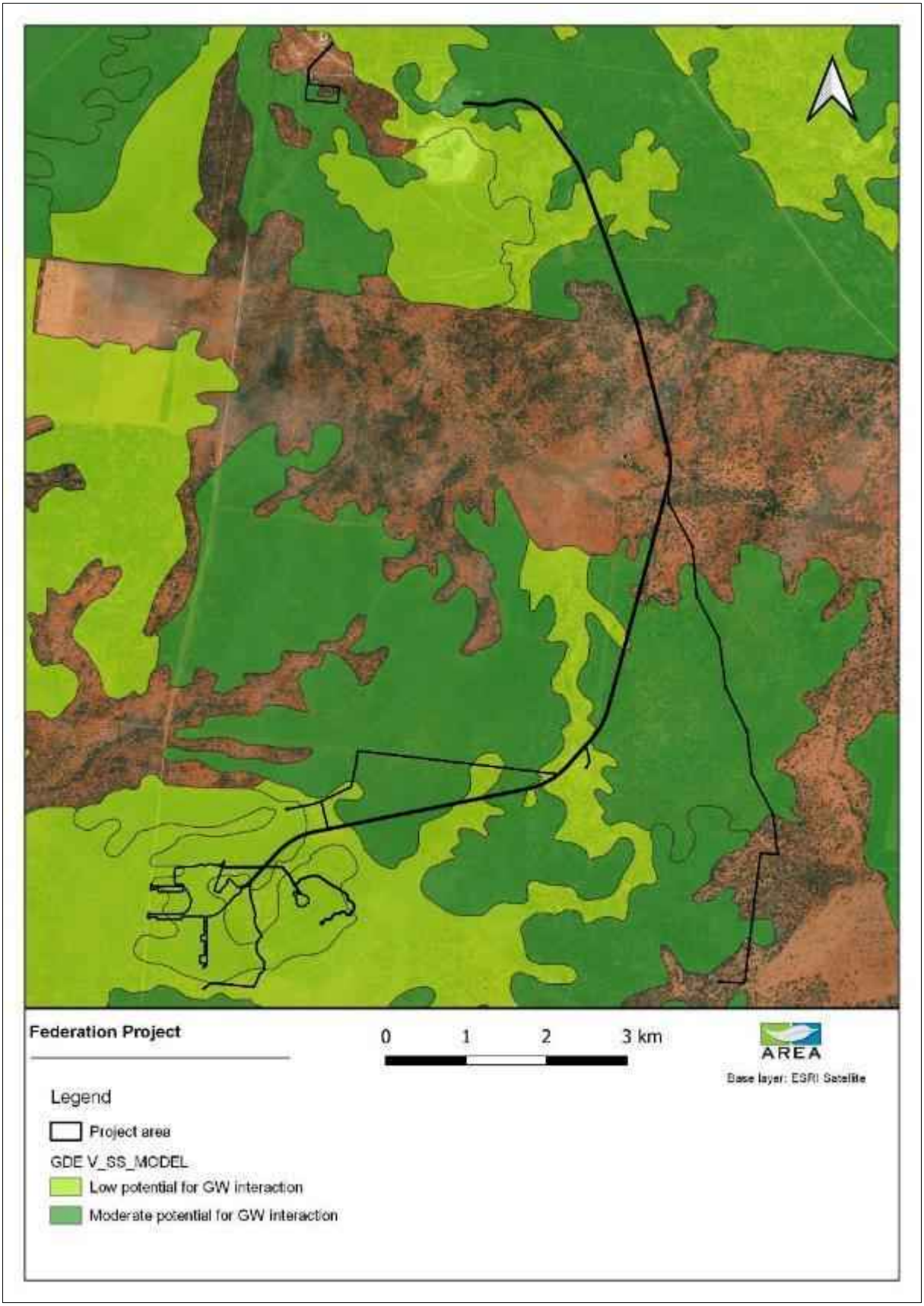
Appendix A – Database search results

Groundwater Dependent Ecosystems

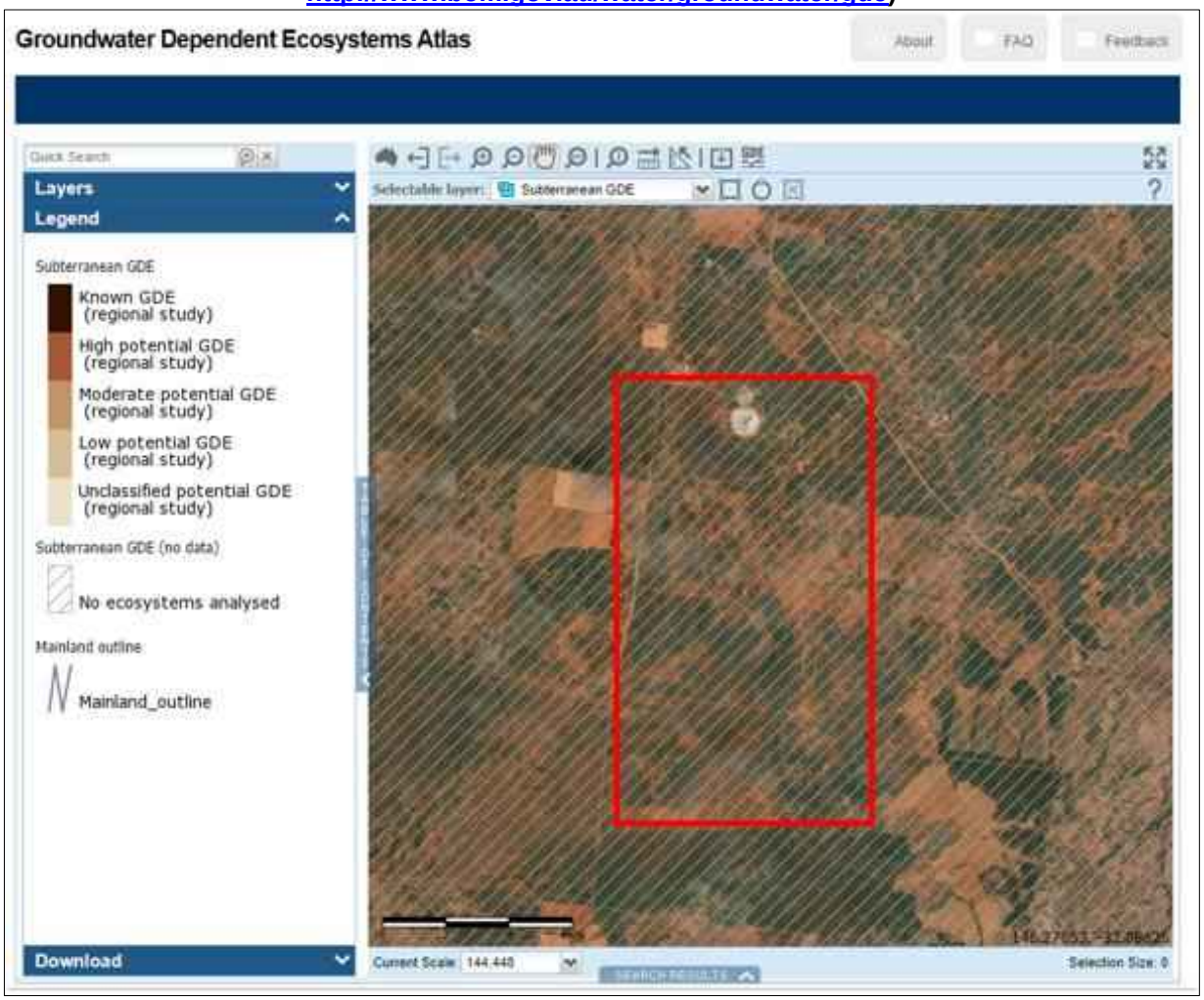
Aquatic GDE (Red polygon represents approximate location of the study area)
(Source: http://www.bom.gov.au/water/groundwater/gde/)



Terrestrial GDE



Subterranean GDE (red polygon represent approximate location of the study area) (Source: http://www.bom.gov.au/water/groundwater/gde)



IBRA search results

IBRA Threatened Species Search: IBRA subregion Nymagee Downs

Scientific name	Common name	NSW status	Commonwealth status	Occurrence
Amphibian				
Crinia sloanei	Sloane's Froglet	Vulnerable	Endangered	Predicted
Bird				
Ardeotis australis	Australian Bustard	Endangered		Predicted
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable		Known
Botaurus poiciloptilus	Australasian Bittern	Endangered	Endangered	Predicted
Burhinus grallarius	Bush Stone-curlew	Endangered		Predicted
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable		Known
Calyptorhynchus lathami - endangered population	Glossy Black-Cockatoo, Riverina population	Endangered Population		Known
Certhionyx variegatus	Pied Honeyeater	Vulnerable		Known
Chthonicola sagittata	Speckled Warbler	Vulnerable		Known
Cinclosoma castanotum	Chestnut Quail-thrush	Vulnerable		Known
Circus assimilis	Spotted Harrier	Vulnerable		Known
Daphoenositta chrysoptera	Varied Sittella	Vulnerable		Known
Drymodes brunneopygia	Southern Scrub-robin	Vulnerable		Known
Epthianura albifrons	White-fronted Chat	Vulnerable		Known
Falco hypoleucos	Grey Falcon	Endangered		Known
Falco subniger	Black Falcon	Vulnerable		Known
Grantiella picta	Painted Honeyeater	Vulnerable	Vulnerable	Known
Grus rubicunda	Brolga	Vulnerable		Known
Hamirostra melanosternon	Black-breasted Buzzard	Vulnerable		Known
Hieraaetus morphnoides	Little Eagle	Vulnerable		Known
Hirundapus caudacutus	White-throated Needletail	Not listed	Vulnerable	Known
Hylacola cautus	Shy Heathwren	Vulnerable		Known
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	Known
Leipoa ocellata	Malleefowl	Endangered	Vulnerable	Known
Limosa limosa	Black-tailed Godwit	Vulnerable		Predicted
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Vulnerable		Known
Lophoictinia isura	Square-tailed Kite	Vulnerable		Predicted
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable		Known
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable		Predicted
Neophema pulchella	Turquoise Parrot	Vulnerable		Known
Ninox connivens	Barking Owl	Vulnerable		Known
Oxyura australis	Blue-billed Duck	Vulnerable		Predicted
Pachycephala inornata	Gilbert's Whistler	Vulnerable		Known
Pachycephala rufogularis	Red-lored Whistler	Critically Endangered	Vulnerable	Known
Petroica phoenicea	Flame Robin	Vulnerable		Predicted
Polytelis swainsonii	Superb Parrot	Vulnerable	Vulnerable	Known
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable		Known
Pyrrholaemus brunneus	Redthroat	Vulnerable		Predicted
Rostratula australis	Australian Painted Snipe	Endangered	Endangered	Predicted
Stagonopleura guttata	Diamond Firetail	Vulnerable		Known

Scientific name	Common name	NSW status	Commonwealth status	Occurrence
Stictonetta naevosa	Freckled Duck	Vulnerable		Predicted
Tyto novaehollandiae	Masked Owl	Vulnerable		Predicted
Mammal				
Antechinomys laniger	Kultarr	Endangered		Known
Chalinolobus picatus	Little Pied Bat	Vulnerable		Known
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered	Predicted
Ningaui yvonneae	Southern Ningaui	Vulnerable		Known
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Vulnerable	Known
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable	Known
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable		Known
Sminthopsis macroura	Stripe-faced Dunnart	Vulnerable		Predicted
Vespadelus baverstocki	Inland Forest Bat	Vulnerable		Known
Plant				
Acacia curranii	Curly-bark Wattle	Vulnerable	Vulnerable	Known
Atriplex infrequens	A saltbush	Vulnerable	Vulnerable	Predicted
Austrostipa wakoolica	A spear-grass	Endangered	Endangered	Known
Commersonia procumbens	Commersonia procumbens	Vulnerable	Vulnerable	Known
Diuris tricolor	Pine Donkey Orchid	Vulnerable		Known
Eleocharis obicis	Spike-Rush	Vulnerable	Vulnerable	Known
Grevillea ilicifolia subsp. ilicifolia	Holly-leaf Grevillea	Critically Endangered		Known
Lepidium monoplocoides	Winged Peppercress	Endangered	Endangered	Known
Monotaxis macrophylla	Large-leafed Monotaxis	Endangered		Predicted
Pterostylis cobarensis	Greenhood Orchid	Vulnerable		Known
Swainsona sericea	Silky Swainson-pea	Vulnerable		Predicted
Reptile				
Delma australis	Marble-faced Delma	Endangered		Known
Tiliqua occipitalis	Western Blue-tongued Lizard	Vulnerable		Predicted
Threatened Ecological Community				
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions		Endangered Ecological Community	Endangered	Known
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions		Endangered Ecological Community	Endangered	Known

EPBC Act Protected Matters Report

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

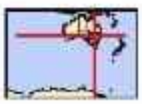
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 19/08/21 10:06:30

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 1.5Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	16
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Barrock station wetland complex	500 - 600km upstream
Riverland	500 - 600km upstream
The coorong, and lakes alexandrina and albert wetland	700 - 800km upstream

Listed Threatened Ecological Communities		[Resource Information]
For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.		
Name	Status	Type of Presence
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community may occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Extinct within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Mammals		
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Austrostipa metatoris [66704]	Vulnerable	Species or species habitat may occur within area
Austrostipa wakoolica [66623]	Endangered	Species or species habitat may occur within area
Lepidium monoplocoides Winged Pepper-cress [9190]	Endangered	Species or species habitat may occur within area
Swainsona murrayana Slender Darling-pea, Slender Swainson, Murray Swainson-pea [6765]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Balowra	NSW

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.102831 146.283278,-32.102831 146.282592,-32.100505 146.377349,-32.239418 146.389022,-32.239418 146.286085,-32.102831 146.283278

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B – BAM plot sheets

Numbers 1-8 on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	Date: 12/07	Survey name: Aurelia EIS (1 Jul)		Plot identifier	Plot 1
Recorders	D.Sturman G Bible	IBRA region		Veg zone ID	
Datum	Coordinate system: Projected / Geographic	MGA zone	X coordinate: 435280	Y coordinate	6446791
Location description					
Plot dimensions		Orientation of midline from 0 m point: 116		Photo #	

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field.

Composition (400 m² plot)		Sum values	Structure (400 m² plot)		Sum values (%) (may sum to >100%)	Function (1000 m² plot) Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species (richness) in each growth form group (not individual plants within each growth form)	Trees (TG)	4	Sum of foliage cover of native plant species by growth form group	Trees (TG)	39	80 + cm	0
	Shrubs (SG)	4		Shrubs (SG)	1.7	50 – 79 cm	0
	Grasses etc. (GG)	6		Grasses etc. (GG)	5.6	30 – 49 cm	4
	Forbs (FG)	13		Forbs (FG)	1.3	20 – 29 cm	14
	Ferns (EG)	1		Ferns (EG)	0.1	10 – 19 cm	25
	Other (OG)	0		Other (OG)	0	5 – 9 cm	9
						Tree regeneration <5 cm	✓
			Total high threat weed cover		0	Length of fallen logs	5
						Hollow bearing trees	0

Vegetation integrity - function cont. (five 1 m² plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	98 95 0 85 35	2 5 20 2 15	0 0 80 2 30	0 0 0 0 0
Average of the 5 subplots	62.6	12.8	22.4	0

These attributes require consideration of site observations and may be completed after field work.

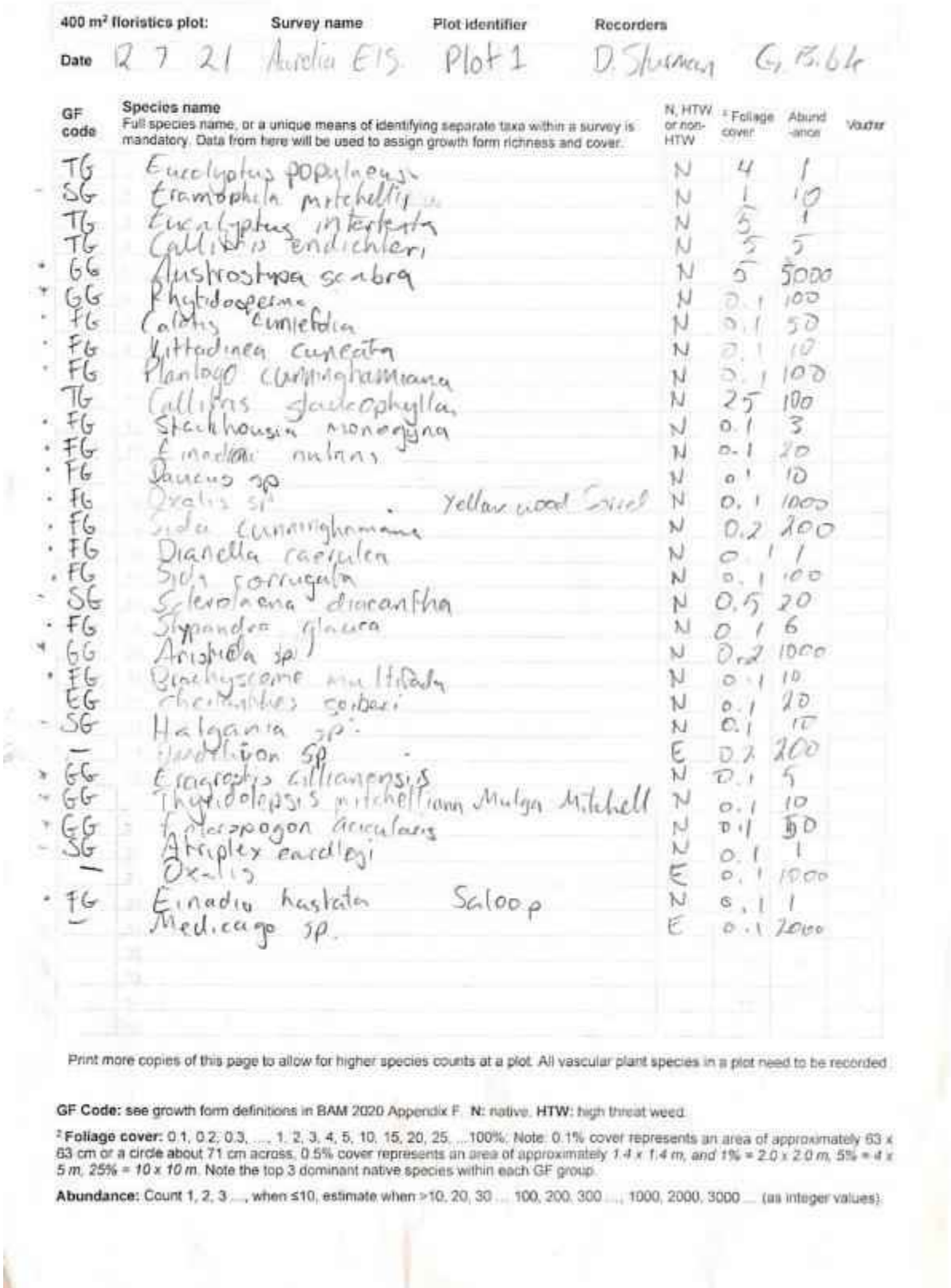
Vegetation class	Western Peneplain Woodlands	Large tree benchmark size	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)	103	EEC	Tick	Confidence	H/ M/ L

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (id. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Brief site description or other items: Representative of PCT 103 w/ E. intertexta dominant

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)



400 m² floristics plot: Survey name: Aurelia EIS Plot identifier: Plot 1 Recorders: D. Sherman G. B. Mc

Date: 12 7 21

GF code	Species name (Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.)	N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Eucalyptus populnea ssp.	N	4	1	
SG	Eremophila mitchellii	N	1	10	
TG	Eucalyptus intertexta	N	5	1	
TG	Callitris endlicheri	N	5	5	
GG	Austrostipa scabra	N	5	5000	
GG	Rhytidosperma	N	0.1	100	
FG	Calotis cuneifolia	N	0.1	50	
FG	Wittadinea cuneata	N	0.1	10	
FG	Plantago cunninghamiana	N	0.1	100	
TG	Callitris glaucophylla	N	25	100	
FG	Stackhousia monogyna	N	0.1	3	
FG	Einadia nutans	N	0.1	20	
FG	Daucus sp	N	0.1	10	
FG	Oxalis sp. Yellow wood Sorrel	N	0.1	1000	
FG	Sida cunninghamii	N	0.2	200	
FG	Dianella caerulea	N	0.1	1	
FG	Sida corrugata	N	0.1	100	
SG	Sclerolaena diacantha	N	0.5	20	
FG	Stypandra glauca	N	0.1	6	
GG	Aristida sp	N	0.2	1000	
FG	Brachyscome multifida	N	0.1	10	
EG	Chenopodium sorbax	N	0.1	20	
SG	Halgania sp.	N	0.1	10	
—	Vachellia sp.	E	0.2	200	
GG	Eragrostis gilliamensis	N	0.1	5	
GG	Thyridolepis mitchelliana Mulga Mitchell	N	0.1	10	
GG	Aristida ramosa	N	0.1	50	
SG	Atriplex eardleyi	N	0.1	1	
—	Oxalis	E	0.1	1000	
FG	Einadia hastata Saloop	N	0.1	1	
—	Medicago sp.	E	0.1	2000	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native. **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%. Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across. 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	**Date** 13/7/21	**Survey name**	Aurelia EIS (4 Jul)	**Plot identifier** Plot 2
Recorders	J Sturmer G. Bible		**IBRA region**		**Veg zone ID**
[1]**Datum**	**Coordinate system**	○ Projected ○ Geographic	**MGA zone**	[1]**X coordinate** 433470	[1]**Y coordinate** 6436567
Location description					
[1] **Plot dimensions**				[1] **Orientation of midline from 0 m point** 278°	**Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate systems), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	2	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	18	80 + cm	2
	Shrubs (SG)	7		Shrubs (SG)	12	50 – 79 cm	1
	Grasses etc. (GG)	5		Grasses etc (GG)	1.3	30 – 49 cm	—
	Forbs (FG)	9		Forbs (FG)	1.5	20 – 29 cm	2
	Ferns (EG)	—		Ferns (EG)	—	10 – 19 cm	12
	Other (OG)	1		Other (OG)	0.1	5 – 9 cm	16
						[4]Tree regeneration <5 cm	✓
			Total high threat weed cover		0	[5]Length of fallen logs	32
						[6]Hollow bearing trees	3

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	40 65 15 20 90	60 25 75 65 5	15 10 10 15 0	0 0 0 0 0
Average of the 5 subplots	48	42	10	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class [3]**Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) 103 EEC Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for Bioplot systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (d. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Brief site description or other notes

Representative of PCT 103 w/ dominant E. interfesa

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 13 7 21	Aurelia EIS	Plot 2	D.Sturmen G. Eble

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[1] Foliage cover	Abundance	Voucher
TG	Eucalyptus intertextus	N	6	2	
SG	Senna artemisioides (sp 1)	N	10	26	
TG	Callitris glaucophylla	N	12	17	
SG	Eremophila Turpentine	N	0.5	2	
GG	Enteropogon acicularis	N	0.5	1000	
FG	Calotis cuneifolia	N	0.5	100	
SG	Geijera parviflora	N	1	1	
SG	Acacia colletioides	N	0.1	1	
SG	Sclerolaena diacantha	N	0.1	50	
GG	Aristida jerichoensis	N	0.5	1000	
FG	Sida corrugata	N	0.1	50	
FG	Vittadinia cuneata	N	0.2	200	
GG	Thyridolepis mitchelliana	N	0.1	500	
FG	Einadia nutans	N	0.1	7	
FG	Brachyscome ?multifida (cut leaf grey)	N	0.1	2000	
GG	Austrostipa scabra	N	0.1	1000	
GG	Aristida jerichoensis	N	0.1	1000	
FG	Scaevola humilus	N	0.1	30	
SG	Ptilotus sessilifolius	N	0.2	500	
OG	Glycine sp. Narrow leaved	N	0.1	1	
FG	Dianella caerulea	N	0.1	1	
SG	Sclerolaena eriacantha ~~Cotton balls~~ / Silky Glabrous	N	0.1	1	
FG	Sida cunninghamii	N	0.1	6	
FG	Goodenia sp	N	0.2	1000	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed

[1] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10: 20, 30 ... 100, 200, 300 ... 1000, 2000, 3000 ... (as integer values)

Numbers [1-3] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 6/7/21 **Survey name** Aurelia EIS (2021) **Plot identifier** Plot 3

Recorders D. Shannon G. Bibbe **IBRA region** **Veg zone ID**

[1]Datum **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** **[1]X coordinate** 435419 **[1]Y coordinate** 6446904

Location description

[1] Plot dimensions **[1] Orientation of midline from 0 m point** 146 **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 55 (Coastal NSW), 56 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation Integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [5]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species (richness) in each growth form group (not individual plants within each growth form)	Trees (TG)	1	Sum of [2] foliage cover of native plant species by growth form group	Trees (TG)	20	80 + cm	—
	Shrubs (SG)	7		Shrubs (SG)	2.1	50 – 79 cm	1
	Grasses etc. (GG)	8		Grasses etc. (GG)	9.9	30 – 49 cm	5
	Forbs (FG)	19		Forbs (FG)	11.5	20 – 29 cm	8
	Ferns (EG)	1		Ferns (EG)	0.1	10 – 19 cm	5
	Other (OG)	0		Other (OG)	0	5 – 9 cm	8
			Total high threat weed cover		—	[4]Tree regeneration <5 cm	✓
						[5]Length of fallen logs	9m
						[6]Hollow bearing trees	0

Vegetation integrity - function cont. (five 1 m² plots)	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	50 35 50 40 25	0 0 5 5 20	0 40 20 10 10	0 0 0 0 0
Average of the 5 subplots	40	8	16	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class **[8]Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) EEC Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / Civil removal		
Grazing (st. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Brief site description or other notes

Representative of Cypress dominated PCT 103

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

SHEET 2 of 2

400 m² floristics plot: | Survey name | Plot identifier | Recorders

Date 16 7 21 | Arcelia EIS | Plot 3 | D Sherman G Reid

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	Foliage cover	Abundance	Voucher
TG	Callitris glaucophylla		QD	40	
GG	Austrostipa scabra		5	5000	
FG	Calotis cuneifolia		2	1000	
FG	Vittadinia cuneata		1	500	
FG	Dianthus sp.		0.1	200	
FG	Nicotiana sp.		0.1	50	
—	Erodium malacoides	E	2	1000	
GG	Mn. Rhytidosperma		1	500	
FG	Sida corrugata		0.2	50	
FG	Geranium solanderi		1	300	
SG	Maireana erichyloenoides		0.1	20	
GG	Panicum JP		2	5500	
FG	Calotis hispidula		5	1000	
—	Pattersons curse looking weed		1	500	
EG	Cheilanthes austrotenuifolia		0.1	20	
SG	Cassinia laevis Tall Gorb		1.5	500	
FG	Dichondra repens		0.1	200	
GG	Hypochaeris radicata	E	0.2	1000	
GG	Aspidium sp		0.1	300	
—	Oxalis		0.1	1000	
GG	Aristida ramosa		0.1	100	
—	Arctotheca sp.	E	0.5	1000	
FG	Stackhousia monogyna		0.1	100	
GG	Lachnagrostis filiformis		1	500	
FG	Calotis lappulacea		1	200	
FG	Erodium botrys		0.1	7	
FG	Solanum coactiliferum		0.1	3	
SG	Maireana excavata		0.1	4	
SG	Sclerolaena diacantha Jelly bean		0.1	11	
SG	Sclerolaena bicornis		0.1	6	
FG	Dianella caerulea		0.1	1	
FG	Boerhavia dominii		0.1	1	
FG	Goodenia sp.		0.1	100	
—	Galium murale	E	0.1	1000	
—	Salvia verbenaca	E	0.8	30	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3 ..., 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%. Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and* 1% = *2.0 x 2.0 m*, 5% = *4 x 5 m*, 25% = *10 x 10 m*. Note the top 3 dominant native species within each GF group

Abundance: Count 1, 2, 3 ... when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ... 1000, 2000, 3000 ... (as integer values)

SHEET 2 of 2

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 16 7 21	Nevia EIS	Plot 3	DS + GB

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abund-ance	Voucher
GG	Aristida jerichoensis	N	2	1000	
SG	Geijera parviflora	N	0.1	1	
SG	Salsola tragus	N	0.1	10	
FG	Vittadinia gracilis	N	0.2	10	
—	Medicago sp	E	0.1	1000	
FG	Goodenia pinnatifida	N	0.1	3	
FG	Ptilotus sp	N	1	100	
GG	Eragrostis cilianensis	N	0.2	500	
FG	Arabidella sp	N	0.1	50	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values)

BAM Plot – Field Survey Form			Site Sheet no: Prel. Plot 10		
		Survey Name	Plot Identifier	Recorders	
Date	21/10/20	Federation Pipe	Plot 4	Dave Stillman, Addy Watson	
Zone 55	Datum	IBRA region	Photo #		Zone ID
Easting 439148	Northing 6440062	Plot Dimensions	20 x 20 in 20 x 50	Orientation of midline from the 0 m point. 100	Magnetic °
Likely Vegetation Class					Confidence H M L
Plant Community Type				EEC:	Confidence H M L

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	12
	Grasses etc.	7
	Forbs	18
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	22
	Shrubs	9.8
	Grasses etc.	2.6
	Forbs	5.9
	Ferns	0
	Other	0
High Threat Weed cover %		0

BAM Attribute (20 x 50 m plot) dbh	Stem Classes and Hollows Euc*	Non Euc	Hollows?
80 + cm	1		1
50 – 79 cm	1		
30 – 49 cm			Hollows 20cm+
20 – 29 cm			0
10 – 19 cm		✓	
5 – 9 cm		✓	
< 5 cm			This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)			total 7

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	75	55	5	5	3	10	40	90	40	82	0	0	1	5	10	0	0	0	0	0
Average of the 5 subplots	28.6					52.2					2.2					0				

Plot Disturbance	Severity code	Age code
Clearing (inc logging)		
Cultivation (inc pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		

Free Text Section for brief site description	Leaf Litter and end point GPS ID	Easting	Northing
Site selected to be representative of zone PCT103	End point	439195	6440040

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe   Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017   Printed 19 October 2020

TG	2	22
SG	12	4.8
GG	7	2.6
FG	17	6.9

400 m² plot: Sheet _ of _

Date	Survey Name.	Plot Identifier	Recorders
21/10/2020	Federation P.PO	Plot 4	A Watson D [illegible]

ID	BAM Code	GF Code	Full species name mandatory, or a unique means of identifying unknown taxa within a survey	N, E or HTE	Cover	Abund	Stratum		
1	FG		Helichrysum bracteatum Golden everlasting	N	1	100	G	-	0.6
2	FG		Chrysocephalum apiculatum	N	1	200	G	-	0.3
3	TG		Eucalyptus intertexta	N	20	2	U	-	26
4	SG		Geijera parviflora	N	5	2	M	-	4
5	TG		Callitris glaucophylla	N	2	3	U	-	6
6	FG		Calotis hispidula	N	1	100	G	-	0.7
7	SG	c	Maireana excavata Bottle fissure	N	0.5	100	M	-	0.1
8	GG		Austrostipa scabra	N	1	500	G	-	0.6
9	FG		Wahlenbergia	N	0.1	20	G	-	0.3
10	FG		Sida corrugata	N	0.2	100	G	-	0.1
11	FG		Goodenia pusilliflora Small flower	N	0.1	100	G	-	0.1
12	SG	c	Sclerolaena muricata Black roly poly	N	0.2	100	M	-	0.1
13	GG		Thyridolepis mitchelliana Mulga Mitchell	N	0.1	100	G	-	0.3
14	FG		[illegible] cunninghamiana	N	0.1	20	G	-	0.1
15	SG	c	Sclerolaena divaricata Pale poverty	N	0.1	100	G	-	0.3
16	GG	g	Enteropogon acicularis	N	1	300	G	-	0.2
17	SG	c	Maireana enchylaenoides	N	1	100	M	-	0.3
18	FG		Euphorbia dallachyana	N	1	5	G	-	0.1
19	FG		Helipterum floribundum White paper daisy	N	0	110	G	-	0.3
20	SG	c	Sclerolaena bicornis	N	0.2	20	M	-	0.1
21	FG		Vittadinia cuneata	N	0.1	20	G	-	0.2
22	FG		Ptilotus [illegible] Common [illegible]	N	0.5	100	G	-	0.3
23	GG		Eragrostis leptostachya	N	0.1	10	G	-	0.2
24	GG		Aristida jerichoensis	N	0.2	100	G	-	0.3
25	GG		Rytidosperma setacea	N	0.1	50	G	-	0.1
26	SG	s	Dodonaea cuneata	N	1	5	M	-	0.7
27	GG		Austrostipa sp. (variable)	N	0.1	10	G	-	0.2
28	SG		Eremophila glabra Tar bush	N	1	7	M	-	1.5
29	SG	c	Maireana decalvans Black cottonbush	N	0.1	10	M	-	0.1
30	FG		Acaena novae-zelandiae	N	0.1	20	G	-	0.1
31	SG	c	Rhagodia gaudichaudii Cottony saltbush	N	0.1	3	M	-	0.1
32	—		Chondrilla juncea Skeletonweed	E	0.1	4	G	-	0.4
33	SG	c	Einadia nutans	N	0.1	10	M	-	0.2
34	FG		Solanum cinereum Narrawa burr	N	0.1	1	G	-	0.1
35	FG		Eschscholzia lerens [illegible]	N	0.1	200	G	-	0.1
36				N					
37	FG		Glycine tabacina	N	0.1	2	G	-	0.5
38	—		Salvia verbenaca Wild sage	E	0.2	100	G	-	0.1
39	SG	s	Eremophila duttonii Harlequin fuchsia	N	0.5	2	M	-	0.8
40	FG	c	Harmsiodoxa blennodioides Hairy podless	N	0.1	100	G	-	0.1

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, E: exotic, HTE: high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Oriana.h

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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FG F	Calotis lappulaceae	N	0.1	100	G	- 0.1
FG	Goodenia	N	0	100	G	- 0.1
—	Cirsium vulgare	E	0.1	50	G	- 0.1
—	Centaurea melitensis	E	0.1	20	G	- 0.1

BAM Plot – Field Survey Form

Site Sheet no: Prev. Plot 11

Survey Name	Plot Identifier	Recorders
Federation	Plot 5	Mildy Watson Caleb Green

Date	Zone	Datum	IBRA region	Photo #	Zone ID
21/10/22	55	GDA			

Easting	Northing	Plot Dimensions	Orientation of midline from the 0 m point	Magnetic °
439580	6441649	20 x 20 in 20 x 50	175	

		Confidence
Likely Vegetation Class*		H M L
Plant Community Type	PCT 103 EEC:	H M L

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	5
	Grasses etc.	6
	Forbs	17
	Ferns	–
	Other	–
Sum of Cover of native vascular plants by growth form group	Trees	20.1
	Shrubs	1.0
	Grasses etc.	4.3
	Forbs	12.5
	Ferns	–
	Other	–
High Threat Weed cover %		0.2

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		
dbh	Euc*	Non Euc	Hollows†
80 + cm			0
50 – 79 cm	1		
30 – 49 cm			Hollows 20cm+
20 – 29 cm	2		0
10 – 19 cm	✓		
5 – 9 cm	✓	✓	
< 5 cm	✓	✓	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, ≥50 cm in length)	–		total 0

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	95	5	5	1	5	0	80	70	60	70	0	10	5	30	20	0	0	0	0	0
Average of the 5 subplots	22.2					56					12					0				

Plot Disturbance	Severity code	Age code
Clearing (inc logging)		
Cultivation (inc pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Representative of PCT 103

Leaf Litter end point GPS

ID	Easting	Northing
End point	439595	6441595

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 19 October 2020

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 21/10/20	Federation	11	Addy Watson Griffin Green

ID	BAM Code	GF Code	Full species name mandatory or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers	N, E or HTE	Cover	Abund	[illegible]	[illegible]	[illegible]
1	TG	t	Eucalyptus populnea	N	20	35	u	—	15
2	SG	s	Eremophila glabra	N	0.1	2	m	—	0.8
3	FG	f	Helichrysum brachyoelum	N	0.5	1000	G	—	0.4
4	—		Salvia verbenaca Sage	E	0.2	200	G	—	0.2
5	—		Carthamus lanatus	HTE	0.2	100	G	—	0.6
6	—		Echium plantagineum	E	10	2000	G	—	0.6
7	—		Centaurea melitensis Maltese cockspur	E	0.1	100	G	—	0.2
8	FG	f	Wahlenbergia sp	N	0.1	100	G	—	0.2
9	—		Medicago sp	E	10	1000	G	—	0.1
10	FG	f	Dichondra repens	N	0.1	200	G	—	0.1
11	FG	f	Crinium flaccidum darling lilly	N	0.1	30	G	—	0.3
12	SG	s	Eremophila gaudichaudiana	N	0.2	4	G	—	0.8
13	FG	f	Stackhousia	N	0.1	20	G	—	0.2
14	GG	g	Rytidosperma sp	N	2	500	G	—	0.1
15	FG	f	Sida corrugata	N	0.1	100	G	—	0.1
16	FG	f	Glycine tabacina	N	0.1	10	G	—	0.1
17	FG	f	Calotis lappulacea	N	10	1000	G	—	0.2
18	SG	s	Sclerolaena soft leaf	N	0.1	50	G	—	0.1
19	FG	f	Scaevola aemula Fanflower	N	0.1	100	G	—	0.1
20	GG	g	Thyridolepsis mitchelliana	N	1	1000	G	—	0.2
21	FG	f	Cheilanthes	N	0.1	50	G	—	0.1
22	GG	g	Enteropogon acicularis	N	1	200	G	—	0.1
23	FG	f	Goodenia glabra	N	0.1	20	G	—	0.1
24	FG	f	Helipterum floribunda	N	0.1	10	G	—	0.2
25	FG	f	Erodium crinitum	N	0.5	60	G	—	0.5
26	FG	f	Calotis Burr daisy	N	0.1	5	G	—	0.2
27	FG	f	Helipterum jessenii Daisy Sunray	N	0.2	30	G	—	0.1
28	FG	f	Ptilotus macrocephalus	N	0.1	5	G	—	0.3
29	TG	t	Callitris glaucophylla	N	0.1	1	u	—	0.1
30	—		Hypochaeris radicata Flatweed	E	0.1	100	G	—	0.2
31	SG	s	Geijera parviflora	N	0.1	1	m	—	0.7
32	FG	f	Vittadinia cuneata	N	0.1	30	G	—	0.2
33	GG	g	Austrostipa scabra	N	0.1	20	G	—	0.6
34	GG	g	Elymus scabra	N	0.1	5	G	—	0.5
35	SG	s	Eremophila longifolia	N	0.5	35	m	—	4
36	GG	g	Aristida (ramosa?)	N	0.1	10	G	—	0.2
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); *Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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	Count	Cover
TG	2	20.1
SG	5	1.0
GG	6	4.3
FG	17	17.5

Numbers [1-6] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of	**Date** 14/7/21	**Survey name** NRETA EIS (7 Jul)	**Plot identifier**	Plot 6	
Recorders GB + DS		**IBRA region**		**Veg zone ID**	
[1]**Datum**	**Coordinate system** ☐ Projected ☐ Geographic	**MGA zone**	[1]**X coordinate** 435329	[1]**Y coordinate** 6447250	
Location description					
[1]**Plot dimensions**		[1]**Orientation of midline from 0 m point** 232		**Photo #**	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field.

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	[2]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	1	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	2	80 + cm	0
	Shrubs (SG)	8		Shrubs (SG)	5.4	50 – 79 cm	0
	Grasses etc. (GG)	8		Grasses etc. (GG)	57.6	30 – 49 cm	0
	Forbs (FG)	8		Forbs (FG)	7.5	20 – 29 cm	0
	Ferns (EG)	1		Ferns (EG)	0.1	10 – 19 cm	0
	Other (OG)	1		Other (OG)	0.1	5 – 9 cm	0
						*Tree regeneration <5 cm	✓
			Total high threat weed cover			[5]Length of fallen logs	0
						[6]Hollow bearing trees	—

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	5 5 5 5 5	40 15 5 30 30	0 30 8 30 30	0 0 0 0 0
Average of the 5 subplots	5	24	19.6	0

These attributes require consideration of site observations and may be completed after field work.

Vegetation class	[8]**Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT) 103		**EEC** Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (d. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Brief site description or other notes

Representative of PCT 103 - cleared zone

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Age: N=recent (<3yrs), M=mod recent (3-10yrs), O=old (>10yrs)

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 14 7 21	Aurelia EIS	Plot 6	Dave Shuttar G. Bibb

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Callitris glaucophylla	N	2	6	
EG	Thyridolepis mitchelliana	N	1	1000	
GG	Austrostipa scabra	N	25	10000	
GG	Aristida jerichoensis	N	20	8000	
FG	Geranium solanderi	N	5	2000	•
• SG	Maireana excavata	N	0.1	100	
GG	Eragrostis cilianensis	N	0.5	200	
FG	Sida corrugata	N	0.1	200	•
GG	Rhynchosperma sp.	N	0.1	200	
FG	Solanum coactiliferum	N	0.1	7	•
—	~~Asteraceae sp.~~ Hypochaeris radicata	E	1	300	
• SG	Osteocarpum acroptilum Water weed	N	8	3000	
FG	Wahlenbergia gracilenta	N	.	10	•
• SG	Maireana decalvans	N	1	200	
* OG	Convolvulus sp.	N	0.1	40	
FG	Rhodanthe floribunda Paper Daisy	N	0.1	10	•
—	Erodium malacoides	E	5	4000	
• SG	Sclerolaena diacantha Jelly bean	N	1	100	
—	Paspalidium sp	E	0.1	100	
—	Medicago sp	E	0.1	1000	
FG	Boerhavia dominii	N	0.1	10	•
EG	Cheilanthes austrotenuifolia	N	0.1	30	
• SG	Sclerolaena muricata Black roly poly	N	0.1	100	
—	Weed sp Rosette	E	1	1000	
FG	Euphorbia drummondii	N	0.1	2	•
—	Galium murale Small Bedstraw	E	0.1	500	
GG	Austrostipa aristiglumis	N	2	1000	
FG	Calotis cuneifolia	N	1	1000	•
• SG	Atriplex pseudocampanulata	N	1	15	
GG	Chloris truncata	N	1	1000	
• SG	Abutilon otocarpum Desert lantern	N	0.1	3	
• SG	Eremophila sp.	N	0.1	1	
EG	Tachnagrostis filiformis	N	2	1000	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 14/7/21 **Survey name** AURELIA EIS (5 Jul) **Plot identifier** Plot 7

Recorders GB + DS **IBRA region** **Veg zone ID**

[1]Datum **Coordinate system** ○ Projected ○ Geographic **MGA zone** **[1]X coordinate** 433627 **[1]Y coordinate** 6436577

Location description

[1]Plot dimensions **[1]Orientation of midline from 0 m point** 243 **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographical coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	3	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	18.5	80 + cm	0
	Shrubs (SG)	13		Shrubs (SG)	16.3	50 – 79 cm	0
	Grasses etc. (GG)	4		Grasses etc. (GG)	1.3	30 – 49 cm	5
	Forbs (FG)	8		Forbs (FG)	1.2	20 – 29 cm	15
	Ferns (EG)	0		Ferns (EG)	0	10 – 19 cm	6
	Other (OG)	0		Other (OG)	0	5 – 9 cm	2
						*Tree regeneration <5 cm	✓
			Total high threat weed cover		–	[3]Length of fallen logs	43
						*Hollow bearing trees	(5)

Vegetation integrity - function cont. (five 1 m² plots)	[1]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	90 95 20 15 65 5 2 30 60 95 0 20 20 50 0 0 30 20 0 5			
Average of the 5 subplots	53	24.4	8	20

These attributes require consideration of site observations and may be completed after field work

Vegetation class **[4]Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

EEC Tick Confidence H/ M/ L

Plant community type (PCT) 174

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern	Microrelief
Lithology		Soil surface texture		Soil colour	Soil depth
Slope		Aspect		Site drainage	Distance to nearest water and type

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (inc. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=slight, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Representative of PCT 174 - Mallee

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot: Survey name: AUSTRALIA Plot identifier: Plot 7 Recorders: GB + JS

Date: 14 7 21

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Eucalyptus intertexta		N	8	7	
TG	Eucalyptus socialis		N	10	9	
TG	Callitris glaucophylla		N	0.5	3	
SG	~~Hakea florida~~ Acacia colletoides		N	1	3	
GG	Austrostipa scabra		N	1	2000	
FG	Callotis cuneifolia		N	0.5	1000	•
SG	Atriplex semibaccata		N	0.1	20	
FG	Goodenia sp.		N	0.1	500	•
SG	Micromyrtus striata		N	0.5	50	
SG	Sclerolaena diacantha	Jelly bush	N	0.2	200	
FG	Sida cunninghamii		N	0.1	100	•
FG	Vittadinia cuneata		N	0.1	200	•
FG	Bracyscome multifida		N	0.1	50	•
GG	Enteropogon acicularis		N	0.1	500	
GG	Aristida jerichoensis		N	0.1	100	
SG	Senjea pervifolia		N	1	2	
FG	Oxalis perennans		N	0.1	500	•
SG	Eremophila glabra ?		N	0.5	1	
SG	Senna artemisioides (subsp zygophylla ?)		N	12	50	
SG	Atriplex eardleyi		N	0.1	<10	
SG	Ptilotus sp.		N	0.1	30	
GG	Panicum sp.		N	0.1	<10	
FG	Stackhousia sp		N	0.1	50	•
FG	Nicotiana sp		N	0.1	1	•
—	Galium murale		E	0.1	50	
SG	Sclerolaena divaricata	Pale poverty bush	N	0.1	1	
SG	Eremophila sturtii		N	0.5	2	
SG	Maireana decalvans	Black cotton bush	N	0.1	3	
SG	Acacia deanii		N	0.8	1	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across. 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 .... when ≤10, estimate when >10, 20, 30 .... 100, 200, 300 .... 1000, 2000, 3000 .... (as integer values)

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 14/9/21 **Survey name** AURELIA EIS (6JV1) **Plot identifier** Plot 8 JVL

Recorders GA + DS **IBRA region** **Veg zone ID**

[1]**Datum** **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** [1]**X coordinate** 433940 [1]**Y coordinate** 6676036

Location description

[1]**Plot dimensions** **[1]Orientation of midline from 0 m point** 351 **Photo #**

Datum: AGD66, WGS84, ODA84, GDA2020 or Other (specify) MGA Zone (for Projected coordinate system only) 55 (Coastal NSW), 56 (Central NSW) or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system); Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools, it is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	4	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	18.2	80 + cm	0
	Shrubs (SG)	7		Shrubs (SG)	4.8	50 – 79 cm	0
	Grasses etc (GG)	5		Grasses etc (GG)	4.4	30 – 49 cm	1
	Forbs (FG)	8		Forbs (FG)	16.6	20 – 29 cm	19
	Ferns (EG)	0		Ferns (EG)	0	10 – 19 cm	22
	Other (OG)	2		Other (OG)	0.2	5 – 9 cm	23
						[4]Tree regeneration <5 cm	✓
			Total high threat weed cover		0	[5]Length of fallen logs	10.2 61
						[6]Hollow bearing trees	

Vegetation integrity - function cont. (five 1 m²) **plots)**

	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	85 60 75 60 40 10 35 0 35 30 5 0 0 5 25 0 0 0 0			
Average of the 5 subplots	69	22	7	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class **[8]Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) 174 **EEC** Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet assessment flora survey purposes

Morphological type		Landform element		Landform pattern	Microrelief
Lithology		Soil surface texture		Soil colour	Soil depth
Slope		Aspect		Site drainage	Distance to nearest water and type

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (cf. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: Present (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Representative of PCT 174 matrix

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 14/7/21	Aurelia EIS	Plot 8 [illegible]	GB + DS

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover	N, HTW or non-HTW	² Foliage cover	Abundance	Voucher
TG	Eucalyptus socialis	N	15	22	
TG	Eucalyptus viridis	N	2	3	
SG	Microstrobus striata	N	2	100	
SG	Acacia colletoides	N	2	5	
GG	Lepidium [illegible]	N	0.1	100	
FG	Brachyscome — Desert cactus	N	15	30	
SG	Olearia microphylla	N	0.1	30	
SG	Leptospermum sp	N	0.1	1	
GG	[illegible] sp — Corkscrew	N	0.1	10	
GG	Enteropogon acicularis	N	0.1	100	
TG	Callitris glaucophylla	N	0.2	2	
FG	Goodenia sp	N	0.1	200	
OG	Rhyncharrhena linearis	N	0.1	2	
FG	Goodenia sp 2	N	0.1	50	
GG	Austrostipa scabra	N	0.1	200	
SG	Eremophila glabra	N	0.2	4	
FG	Vittadinia cuneata	N	0.1	200	
FG	Ptilotus sp	N	0.1	6	
SG	Sclerolaena divaricata — Poverty bush	N	0.1	1	
FG	Sida cunninghamii	N	0.1	50	
OG	Abutilon otocarpum — Desert lantern	N	0.1	2	
SG	Dodonaea viscosa	N	0.1	1	
FG	Forb sp 3 — Hollyleaf [illegible]	N	0.1	100	✓
FG	Nicotiana sp	N	1	100	✓
GG	Triodia scariosa — Porcupine grass	N	1	9	
TG	Eucalyptus intertexta	N	0.1	1	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native. **HTW:** high threat weed.

²**Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m*, and 1% = *2.0 x 2.0 m*, 5% = *4 x 5 m*, 25% = *10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10. 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of	**Date** 5/7/21	**Survey name** Averia EIS (11JV)		**Plot identifier** Plot 9	
Recorders GB + AD		**IBRA region**		**Veg zone ID**	
[1]**Datum**	**Coordinate system** □ Projected □ Geographic	**MGA zone**	[1]**X coordinate** 434959	[1]**Y coordinate** 6437918	
Location description (descriptive notes to locate site without grid reference)					
[1]**Plot dimensions** For composition & structure (400m²): 20 m x 20 m; For function (1000m²): 20 m x 50 m			[1]**Orientation of midline from 0 m point** 175°	**Photo #**	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate system only): 50 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3] Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species (**richness**) in each growth form group (not individual plants within each growth form)	Trees (TG)	4	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	27.5	80 + cm	Count
	Shrubs (SG)	13		Shrubs (SG)	15	50 – 79 cm	Count (best practice tick if large tree benchmark size ≥50 cm, count)
	Grasses etc. (GG)	9		Grasses etc. (GG)	3.3	30 – 49 cm	Count (best practice tick if large tree benchmark size ≥ 30 cm, count)
	Forbs (FG)	4		Forbs (FG)	2.3	20 – 29 cm	5 Count (best practice tick if large tree benchmark size ≥ 20 cm, count)
	Ferns (EG)	—		Ferns (EG)	—	10 – 19 cm	15 Count (best practice tick)
	Other (OG)	—		Other (OG)	—	5 – 9 cm	20 Count (best practice tick)
						[4]Tree regeneration <5 cm	Tick ✓
			Total high threat weed cover		0 %	[5]Length of fallen logs	Tally space 49 m
						[6]Hollow bearing trees	Tick —

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	8 70 80 85 70 40 10 5 5 10	40 30 10 0 1	1 2 0 5 1	
Average of the 5 subplots	61.6	14	14.2	1.8

These attributes require consideration of site observations and may be completed after field work.

Vegetation class		[8]**Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)			**EEC** Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (inf. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Brief site description or other notes

Representative of PCT 174 - swallee

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 18 7 21	ARELLA QLS	PLOT 9	GB

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Callitris glaucophylla	N	12.5	40	
TG	Eucalyptus socialis	N	5	10	
FB	Brachyscome sp	N	1	2000	
SG	Micromyrtus striata	N	0.2	400	
SG	Senna artemisioides (round leaf)	N	1	16	
FB	Ptilotus sp	N	0.1	20	
GE	Thyridolepis mitchelli	N	0.1	50	
GG	Lomandra filiformis	N	0.2	25	
GG	Eragrostis cilianensis	N	0.1	75	
GG	Austrostipa scabra	N	0.5	500	
GG	Rytidosperma sp	N	2	200	
FB	Dedis forrestiana	N	1	1000	
FB	Vittadinia cuneata	N	0.1	50	
SG	Geijera parviflora	N	2	25	
GG	Cyperus	N	0.1	1	
GG	Pteropogon aciculare	N	0.1	25	
FB	Paspalidium sp	N	0.1	50	
SG	Maireana enchylaenoides	N	0.1	100	
SG	Eremophila glabra (one bush)	N	0.1	1	
GG	Lomandra sp (wiry)	N	0.1	25	
TG	Eucalyptus dinosa	N	5	10	
SG	Maireana excavata	N	0.1	25	
SG	Atriplex semibaccata	N	0.1	10	
SG	Atriplex eardleyi	N	0.1	10	
SG	Olearia microphylla (spiney grey)	N	0.1	5	
SG	Scleroloena diacantha	N	0.1	25	
SG	Olearia pimeleoides (flat leaf)	N	0.1	1	
SG	Bossiaea walkeri (cactus pea)	N	1	1	
SG	Santalum acuminatum (Quandong)	N	10	5	
TG	Eucalyptus intertexta	N	5	2	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values)

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	**Date**	15/7/21	**Survey name**	Amelia EIS (8 Jul)	**Plot identifier**	Plot 10
Recorders	D. Sherman GB.blc			**IBRA region**		**Veg zone ID**	
[1]**Datum**		**Coordinate system**	□ Projected □ Geographic	**MGA zone**	[1]**X coordinate** 437728	[1]**Y coordinate**	6446749
Location description							
[1]**Plot dimensions**					[1]**Orientation of midline from 0 m point**	344	**Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3] Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	3	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	26	80 + cm	1
	Shrubs (SG)	9		Shrubs (SG)	2.1	50 – 79 cm	1
	Grasses etc. (GG)	6		Grasses etc (GG)	1.5	30 – 49 cm	5
	Forbs (FG)	7		Forbs (FG)	2.5	20 – 29 cm	12
	Ferns (EG)	1		Ferns (EG)	0.1	10 – 19 cm	16
	Other (OG)	1		Other (OG)	0.1	5 – 9 cm	22
						[4]Tree regeneration <5 cm	✓
			Total high threat weed cover		—	[5]Length of fallen logs	25
						[6]Hollow bearing trees	(4)

Vegetation integrity - function cont. (five 1 m²) plots)	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	75 35 50 20 15 0 20 0 5 5	0 50 10 10 5	0 0 0 0 0	
Average of the 5 subplots	39	6	15	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class	Inland Rocky Hill	[8]**Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)	104		**EEC** Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (cf. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Representative of PCT 104 - Rocky hill

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 15 7 21	Aurelia EIS	Plot 10	G. Bible D. [illegible]

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	² Foliage cover	Abund -ance	Voucher
TG	Eucalyptus populnea	N	1	1	
TG	Eucalyptus intertexta	N	10	3	
TG	Callitris glaucophylla	N	15	60	
SG	Maireana enchylaenoides (Wingles)	N	0.1	30	
SG	Einadia hastata (Saltbush)	N	0.5	20	
SG	Sclerolaena diacantha (Jelly Burr)	N	0.5	50	
GG	Austrostipa scabra	N	1	5?	
FG	Brachyscome multifida	N	0.1	20	•
FG	Einadia nutans	N	1	100	•
SG	Pittosporum angustifolium	N	0.5	1	
SG	Sclerolaena bicornis	N	0.1	50	
OG	Convolvulus erubescens	N	0.1	100	
FG	Calotis cuneifolia	N	1	500	•
GG	Eragrostis cilianensis	N	0.1	20	
SG	Chenopodium desertorum	N	0.1	3	
SG	Sclerolaena divaricata (Pale poverty)	N	0.1	7	
SG	Sclerolaena decalvans (Black cottonbush)	N	0.1	10	
GG	Enteropogon acicularis	N	0.1	20	
FG	Sida corrugata	N	0.1	50	•
SG	Atriplex semibaccata	N	0.1	2	
—	Salvia verbenaca	E	0.1	50	
FG	Wahlenbergia? / Vittadinia cuneata	N	0.1	2	•
EG	Phyllanthus? / Phyllotospermum sp	N	0.1	20	
* EG	Cheilanthes austrotenuifolia	N	0.1	2	
GG	Aristida strigosa? / Aristida [illegible]	N	0.1	3	
—	Dandelion sp.	E	0.1	100	
FG	Calotis hispidula Bogan Flea	N	0.1	100	•
GG	Thyridolepis mitchelliana	N	0.1	1	
FG	Chrysocephalum pseudevax?	N	0.1	1	•
N	Chenopodium sp	N	0.1	4	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

² **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-3] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 15/7/21 **Survey name** Aurelia EIS (9 July) **Plot identifier** Plot 11

Recorders D. Thurman G Gibbs **IBRA region** **Veg zone ID**

[1]**Datum** **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** [1]**X coordinate** 437922 [1]**Y coordinate** 6446740

Location description

[1]**Plot dimensions** **[1] Orientation of midline from 0 m point** 293 **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system); Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	2	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	35	80 + cm	—
	Shrubs (SG)	9		Shrubs (SG)	3.6	50 – 79 cm	—
	Grasses etc (GG)	5		Grasses etc (GG)	2.8	30 – 49 cm	III (3)
	Forbs (FG)	3		Forbs (FG)	0.7	20 – 29 cm	HHT HHT HHT HHT III (23)
	Ferns (EG)	0		Ferns (EG)	0	10 – 19 cm	HHT HHT HHT HHT HHT (200 Correx 200 m²)
	Other (OG)	0		Other (OG)	0	5 – 9 cm	HHT ✓ (about 100 m²) (100)
			Total high threat weed cover		—	[1]*Tree regeneration <5 cm	
						[1]Length of fallen logs	4 4
						[1]Hollow bearing trees	✓ (2)

Vegetation integrity - function cont. (five 1 m²) **plots)**	[1]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	98 45 70 25 70	0 20 5 10 5	0 25 0 5 10	0 0 0 0 0
Average of the 5 subplots	61.6	8	8	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class [1]**Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) 104 EEC Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (id. rabbit/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Brief site description or other notes

Representative of PCT 104

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² floristics plot:

Date	Survey name	Plot identifier	Recorders
15 7 21	Aurelia EIS	Plot 11	D. Shuman G. Bibby

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	² Foliage cover	Abund-ance	Voucher
TG	Eucalyptus intertexta	N	15	5	
TG	Callitris glaucophylla	N	20	50	
GG	Austrostipa scabra	N	3	1000	
SG	Sclerolaena diacantha (Jelly bur)	N	2	500	
SG	Sclerolaena bicornis	N	0.5	100	
SG	Eremophila sturtii	N	0.5	2	
FG	Vittadinia cuneata	N	0.1	100	
FG	Einadia nutans	N	0.5	200	
GG	Enteropogon acicularis	N	0.1	<100	
GG	Rhytidosperma sp	N	0.1	<100	
GG	Aristida jerichoensis	N	0.5	500	
FG	Calotis hispidula	N	0.1	100	
GG	Eragrostis sp.	N	0.1	50	
—	Galium murale	E	0.1	200	
SG	Chenopodium sp.	N	0.1	4	
SG	Maireana enchylaenoides (Wingless)	N	0.1	1	
SG	Pittosporum angustifolium	N	0.1	1	
SG	Sclerolaena muricata (Black rolypoly)	N	0.1	5	
—	Weed sp 3 (Plantago sp)	E	0.1	1	
SG	Atriplex eardleyi	N	0.1	1	
SG	Solanum ferocissimum (Upright thin leaf)	N	0.1	6	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

² **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

BAM Plot – Field Survey Form

Site Sheet no: Fairy Plot 18

Survey Name	Plot Identifier	Recorders
Federation	Plot 12	[illegible]

Date	Zone	Datum	IBRA region	Photo #	Zone ID
24/10/20	55				

Easting	Northing	Plot Dimensions	Orientation of midline from the 0 m point	
435020	6436906	20 x 20 m 20 x 50	206	Magnetic °

		Confidence
Likely Vegetation Class		H M L
Plant Community Type	PCT 180? EEC:	Confidence H M L

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	0
	Grasses etc.	3
	Forbs	9
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	43
	Shrubs	0
	Grasses etc.	12.5
	Forbs	3.9
	Ferns	0
	Other	0.1
High Threat Weed cover %		0

BAM Attribute (20 x 50 m plot) dbh	Stem Classes and Hollows: Euc*	Non Euc	Hollows*
80 + cm			0
50 – 79 cm			
30 – 49 cm			Hollows 20cm+
20 – 29 cm		IIII III	0
10 – 19 cm	✓	✓	
5 – 9 cm		✓	
< 5 cm	✓	✓	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)			total 2

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	60 20 70 60 10	10 20 15 30 20	0 5 2 2 1	30 60 10 10 80
Average of the 5 subplots	44			

Plot Disturbance	Severity code	Age code
Clearing (inc logging)		
Cultivation (inc pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Leaf Litter end point GPS	ID	Easting	Northing
	End point	435000	6456858

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 19 October 2020

400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 24/10/20	Federation	Plot 12	Addy Watson Gibbs Green

ID	BAM Code	GF Code	Full species name mandatory, or a unique name of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers	N, E or HTE	Cover	Abund	[illegible]	[illegible]	[illegible]
1	TG	t	Eucalyptus viridis	N	2	5	U	—	8
2	TG	t	Callitris glaucophylla	N	40	30	U	—	8
3	GG	g	Austrostipa scabra	N	10	1000	G	—	0.4
4	FG	f	Oxalis sp.	N	0.1	20	G	—	0.1
5	FG	f	Sida cunninghamii	N	0.2	200	G	—	0.1
6	FG	f	Calotis cuneifolia	N	2	1000	G	—	0.2
7	FG	f	Dysphania	N	0.1	100	G	—	0.1
8	GG	g	Rytidosperma sp.	N	2	200	G	—	0.2
9	FG	f	Wahlenbergia	N	0.1	100	G	—	0.2
10	GG	g	Thyridolepis mitchelliana	N	0.5	200	G	—	0.2
11	FG	f	Fimbo sp	N	0.1	5	G	—	0.1
12	FG	f	Goodenia pusillifolia	N	0.1	20	G	—	0.2
13	FG	f	Plantago cunninghamii	N	0.1	5	G	—	0.1
14	OG		Gergaloo?	N	0.1	1	G	—	0.1
15	FG	f	Chrysocephalum apiculatum	N	0.1	5	G	—	0.1
16	TG	t	Eucalyptus morrisii	N	1	2	U	—	4
17									
18									
19									
20									
21									
22									
23			Count / Cover						
24		TG	3 / 42						
25		SG	0 / 0						
26		GG	3 / 12.5						
27		FG	9 / 2.9						
28		EG	0 / 0						
29		OG	1 / 0.1						
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017 Printed 19 October 2020

Numbers [1-9] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 21/5/21 **Survey name** Federation **Plot identifier** Plot 13 (Plot 3 on 21)

Recorders Geo Reed, Phil Cameron **IBRA region** Cobar Peneplain **Veg zone ID**

[1]**Datum** **Coordinate system** ☐ Projected ☐ Geographic **MGA zone** 55 [1]**X coordinate** 435161 [1]**Y coordinate** 6436829

Location description Quarry

[1]**Plot dimensions** 20 x 20 / 20 x 50 **[1]Orientation of midline from 0 m point** 15 **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate system only): 55 (Coastal NSW), 56 (Central NSW) or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	3	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	
	Shrubs (SG)	1		Shrubs (SG)	
	Grasses etc (GG)	5		Grasses etc (GG)	
	Forbs (FG)	9		Forbs (FG)	
	Ferns (EG)	1		Ferns (EG)	
	Other (OG)	1		Other (OG)	
			Total high threat weed cover		—

Function (1000 m² plot) [3]Tree stem size class (DBH)	Sum values (%) (may sum to >100%)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
80 + cm	32	Count: —
50 – 79 cm	0.1	Count: —
30 – 49 cm	12.7	Count: 1
20 – 29 cm	2.6	Count: 26
10 – 19 cm	0.1	Count: 45
5 – 9 cm	0.1	Count: 15
[4]Tree regeneration <5 cm		Tick: No
[5]Length of fallen logs	—	Log length: Total: 7 m
[6]Hollow bearing trees		Tick: No

Vegetation integrity - function cont. (five 1 m² **plots**)	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	5 2 10 50 40	5 5 20 20 20	5 0 0 0 10	75 90 70 50 30
Average of the 5 subplots	21	14.6	3	59

These attributes require consideration of site observations and may be completed after field work

Vegetation class **[8]Large tree benchmark size** 20/ 30/ 50/ 80 DBH Confidence H/ M/ L

Plant community type (PCT) 180 EEC Tick Confidence H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)	0	–
Cultivation (inc. pasture)	0	–
Soil erosion	0	–
Firewood / CWD removal	0	–
Grazing (cf. native/stock)	2	R
Fire damage	0	–
Storm damage	0	–
Weediness	0	–
Other	0	–

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<5yrs), M=not recent (5-10yrs), O=old (>10yrs)

Brief site description or other notes

Selected to be representative of veg zone 9 in development footprint

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 2 10 2021	Federation Oct 21	Plot 3 Oct 2021	GP PJC

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Callitris glaucophylla	White Cypress pine	N	30	45	
TG	Eucalyptus morrisii	mallee	N	1	1	
TG	Eucalyptus viridis	green mallee	N	1	2	
FG	Calotis cuneifolia	purple burr daisy	N	1	100	
FG	Sida cunninghamii	Ridge sida	N	0.5	100	
GG	Austrostipa nodosa	speargrass	N	8	500	
FG	Dysphania pumilio	Small crumbweed	N	0.5	20	
GG	Thyridolepis mitchelliana	mitchell grass	N	0.5	20	
GG	Austrostipa jerichoensis	Variable speargrass	N	4	50	
-	Malvaceae sp.	Chinese lantern	E	0.1	1	
EG	Cheilanthes seiberi	rock fern	N	0.1	25	
FG	Crassula sieberiana	Australian stonecrop	N	0.1	20	
FG	Gnephosis foliata		N	0.1	20	
OG	Persoonia eucalyptoides	geyala vine	N	0.1	8	
SG	Rhagodia gaudichaudiana	cotton saltbush	N	0.1	5	
FG	Rhagodia hastata	Saltbush	N	0.1	15	
GG	Aristida sp.	wallaby grass	N	0.1	10	
FG	Calandrinia sp.	- Purslane	N	0.1	1	
FG	Forb sp #1		N	0.1	5	
GG	Eragrostis sp.	purple lovegrass	N	0.1	2	
FG	Oxalis perennans		N	0.1	10	

	Count	Cover
TG	3	32
SG	1	0.1
GG	5	12.7
FG	10	2.6
OG	1	0.1
EG	1	0.1

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	**Date**	15/7/21	**Survey name**	Aurelia EIS (10 Jul)
Plot identifier	Plot 14				
Recorders	D Ellerman G. Bibb			**IBRA region**	
Veg zone ID					
[1]Datum		**Coordinate system**	☐ Projected ☐ Geographic	**MGA zone**	
[1]X coordinate	637266	**[1]Y coordinate**	6446717		
Location description					
[1]Plot dimensions			**[1]Orientation of midline from 0 m point**	111	**Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [3]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	3	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	61	80 + cm	1
	Shrubs (SG)	4		Shrubs (SG)	4.3	50 – 79 cm	2
	Grasses etc (GG)	3		Grasses etc (GG)	0.3	30 – 49 cm	4
	Forbs (FG)	14		Forbs (FG)	2.8	20 – 29 cm	9
	Ferns (EG)	0		Ferns (EG)	0	10 – 19 cm	32
	Other (OG)	4		Other (OG)	0.4	5 – 9 cm	52
						[4]*Tree regeneration <5 cm	Tick ✓
			Total high threat weed cover		0	[5]Length of fallen logs	Tally space 34 m
						[6]Hollow bearing trees	(3)

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 80 75 75 80	0 0 35 0 2	0 0 35 2 10	0 0 25 2 0
Average of the 5 subplots	66	7.4	9.4	5.4

These attributes require consideration of site observations and may be completed after field work

Vegetation class	Inland Dry Hills	**[8]Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)	278	**EEC**	Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (at. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Representative of Euc Interfacta and Euc sideroxylon community (PCT 278)

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:

Date	Survey name	Plot identifier	Recorders
15 7 21	Avalia EIS	Plot 14	D. Gleeson G. Bible

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.	N, HTW or non-HTW	² Foliage cover	Abund-ance	Voucher
• SG	Geijera parvifolia		4	1	
OG	Pandorea pandorana		0.1	1	
TG	Eucalyptus sideroxylon		10	1	
—	~~Eucalyptus [illegible]~~		—	—	—
TG	Callitris glaucophylla		50	200	
— FG	Calotis hispidula		0.5	100	
— FG	V. Hedinea cuneata		0.1	50	
— FG	Dianella sp Thin leaved		0.2	40	
GG	Austrostipa scabra		0.1	500	
— FG	Ptilotus sp		0.1	30	
— FG	Oxalis perennans		0.1	1000	
• SG	Maireana enchylaenoides Wingles		0.1	200	
EG	Cheilanthes sieberi		0.1	30	
— FG	Dichondra repens		0.1	1000	
—	Plantago sp		0.5	200	
GG	Eragrostis cilianensis		0.1	10	
— FG	Abutilon oxycarpum		0.1	2	
TG	Eucalyptus socialis		1	2	
— FG	Solanum coactiliferum		0.1	1	
GG	Rhytidosperma sp		0.1	<10	
—	Rosette weed		1	200	
— FG	Daucus sp		0.1	200	
—	Oxalis sp		0.1	1000	
— FG	Einadia nutans		1	200	
• SG	Dodonaea viscosa subsp cuneata Wedge leaved		0.1	4	
OG	Glycine sp.		0.1		
— FG	Sida cunninghamiana		0.1	7	
—	Galium murale		0.1	500	
— FG	Stackhousia monogyna		0.1	50	
• SG	Chenopodium desertorum		0.1	10	
OG	Parsonsia eucalyptophylla (Gargaloo)		0.1	1	
— FG	Portulaca oleracea		0.1	2	
OG	Rhyncharrhena linearis		0.1	2	
— FG	Euphorbia drummondii		0.1	10	
—	Hypochaeris radicata		0.2	500	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

² **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m*, and 1% = *2.0 x 2.0 m*, 5% = *4 x 5 m*, 25% = *10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Plot 15

Site sheet #	1 of	**Date**	2/10/21	**Survey name**	Federation Oct 2021	**Plot identifier**	(Plot 2 Oct 21)		
Recorders	AW / GP / PJC			**IBRA region**	Cobar Peneplain	**Veg zone ID**			
[1]**Datum**	GDA	**Coordinate system**	○ Projected ○ Geographic	**MGA zone**	55	[1]**X coordinate**	455393	[1]**Y coordinate**	6436561
Location description	Federation Walkway Track								
[1]**Plot dimensions**	For composition & structure (400m²): 20 m x 20 m For Function (1000m²): 20 m x 50 m					[1]**Orientation of midline from 0 m point**	358	**Photo #**	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). **MGA Zone** (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). **X/Y coordinate**: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	2	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	9	80 + cm	
	Shrubs (SG)	3		Shrubs (SG)	0·3	50 – 79 cm	1
	Grasses etc. (GG)	1		Grasses etc. (GG)	5	30 – 49 cm	11 (2)
	Forbs (FG)	10		Forbs (FG)	2·3	20 – 29 cm	IIII 1 (6)
	Ferns (EG)	–		Ferns (EG)	–	10 – 19 cm	IIII IIII 1 (11)
	Other (OG)	–		Other (OG)	–	5 – 9 cm	~
						[4]Tree regeneration <5 cm	Tick –
			Total high threat weed cover		0	[5]Length of fallen logs	Tally space Total 9 m
						[6]Hollow bearing trees	Tick 0

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	30 10 25 30 25	25 5 45 35 55	0 0 0 0 0	46 85 20 20 10
Average of the 5 subplots	24	33	0	36

These attributes require consideration of site observations and may be completed after field work

Vegetation class		[8]**Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)	PCT 184	**EEC**	Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)	0	–
Cultivation (inc. pasture)	0	–
Soil erosion	0	–
Firewood / CWD removal	0	–
Grazing (cl. native/stock)	3	R
Fire damage	0	–
Storm damage	0	–
Weediness	0	–
Other	0	–

Brief site description or other notes

PCT184 - Eucalyptus dwyeri dominant
Selected to be representative of veg zone & in development footprint

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 2 10 2021	Federation Oct 21	Plot 2 Oct 2021	GP / AW / PJC

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N: HTW or non-HTW	² Foliage cover	Abundance	Voucher
TG	Eucalyptus dwyeri	Dwyers red gum	N	4	1	
TG	Callitris glaucophylla	white cypress pine	N	5	5	
GG	Austrostipa nodosa	speargrass (not rough)	N	5	250	
FG	Sida cunninghamiana	Ridge sida	N	0.5	100	
SG	Sclerolaena sp.	Saltbush	N	0.1	10	
FG	Calotis cuneifolia	purple burr daisy	N	1	100	
FG	Parsonsia eucalyptophylla	gargaloo	N	0.1	12	
FG	Bulbine bulbosa		N	0.1	1	
FG	Oxalis perennans	small clover-like leaf	N	0.1	500	
FG	Dysphania pumilio	small crumbweed	N	0.1	100	
SG	Rhagodia gaudichaudiana	Cottony saltbush	N	0.1	10	
SG	Sclerolaena birchii	Gal burr	N	0.1	2	
FG	Erodium crinitum	Storksbill	N	0.1	5	
FG	Atriplex sp. 1		N	0.1	5	
FG	Lomax umbellata		N	0.1	1	
FG	Scaevola aemula	fanflower	N	0.1	1	
—	Abutilon indicum		E	—	—	

	Count	Cover
TG	2	9
SG	3	0.3
GG	1	5
FG	10	2.3
EG	-	-
OG	-	-

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

² **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ... 100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m*, and 1% = *2.0 x 2.0 m*, 5% = *4 x 5 m*, 25% = *10 x 10 m*. Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values)

Zone 1
Plot 16

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet # 1 of **Date** 2/10/21 **Survey name** Federation **Plot identifier** (Plot 1 Oct 21)

Recorders Addy Watson Gen Peel **IBRA region** Cobar Peneplain **Veg zone ID**

[1]Datum GDA **Coordinate system** ○ Projected ● Geographic **MGA zone** 55 **[1]X coordinate** 433921 **[1]Y coordinate** 6435693

Location description

[1] Plot dimensions 20 x 20 **[1]Orientation of midline from 0 m point** 53 **Photo #**

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field

Composition (400 m² plot)		Sum values	**Structure** (400 m² plot)		Sum values (%) (may sum to >100%)	**Function** (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	2	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	13	80 + cm	—
	Shrubs (SG)	6		Shrubs (SG)	11.2	50 – 79 cm	(1)
	Grasses etc. (GG)	5		Grasses etc. (GG)	25.3	30 – 49 cm	(2)
	Forbs (FG)	13		Forbs (FG)	21.5	20 – 29 cm	(4)
	Ferns (EG)	—		Ferns (EG)	—	10 – 19 cm	—
	Other (OG)	—		Other (OG)	—	5 – 9 cm	(3)
			Total high threat weed cover		—	*Tree regeneration <5 cm	✓
						[5] Length of fallen logs	38 m
						[6] Hollow bearing trees	✓ (1)

Vegetation integrity - function cont. (five 1 m²) **plots)**	[7] Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	40 50 50 3 50 40 10 25 90 25	2 5 5 5 3 0 0 0 0 0		
Average of the 5 subplots	38.6	40	4	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class **[8]Large tree benchmark size** 20/ 30/ 50/ 80 DBH **Confidence** H/ M/ L

Plant community type (PCT) PCT 103 **EEC** Tick **Confidence** H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet submission for a survey purpose

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)	1	0
Cultivation (inc. pasture)	0	—
Soil erosion	0	—
Firewood / CWD removal	1	0
Grazing (d. native/stock)	0	—
Fire damage	0	—
Storm damage	1	0
Weediness	0	—
Other	0	—

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: R=recent (<2yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Selected to be representative of veg zone 2 in development footprint

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date	2 10 2021 Fed Oct 2021	1 Oct 2021	GP AW

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Eucalyptus intertexta	Gum Coolabah	N	10	2	
TG	Callitris glaucophylla	white Cypress pine	N	3	3	
SG	Eremophila stuartii	Turpentine	N	10	30	
GG	Austrostipa scabra	rough Speargrass	N	15	1000	
FG	Callotis cuneifolia	purple burdaisy	N	10	1000	
FG	Swainsonia microphylla	Swainsonia	N	0.1	5	
SG	Ptilotus atriplicifolius	fox tail	N	0.2	10	
GG	Enteropogon acicularis	curly windmill	N	0.1	3	
SG	Sclerolaena diacantha	grey copper burr	N	0.2	15	
FG	Goodenia glabra		N	0.2	50	
FG	Vittadinia triloba	fuzzweed	N	0.3	100	
SG	Senna artemisioides	punty bush	N	0.1	3	
GG	Austrostipa nodosa	speargrass	N	10	1000	
GG	Aristida anthoxanthoides	Wire grass	N	0.1	10	
—	Salvia verbenaca	wild sage	E	—		
FG	Helipterum floribundum common	white sunray	N	10	0.2	
—	Medicago sp.	clover	E	—		
FG	Goodenia pinnatifida	scrambled eggs	N	0.1	10	
FG	Sida cunninghamii		N	0.1	10	
FG	Wahlenbergia sp		N	0.1	2	
SG	Olearia pimeleoides		N	0.2	5	
FG	Nicotiana simulans	native tobacco	N	0.1	10	
GG	Astrebla sp	Mitchell grass	N	0.1	5	
FG	Ajuga australis	Australian bugle	N	0.1	5	
FG	Dichondra repens	kidney weed	N	0.2	1000	
FG	forb sp		N	0.1	5	
FG	Scaevola aemula	fan flower	N	0.1	2	
SG	Rhagodia gaudichaudiana	Cotton saltbush	N	0.5	12	
				71		

	Count	Cover
TG	2	13
SG	6	11.2
GG	5	25.3
FG	13	21.5
		71

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%. Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Zone 1 Plot 17

Site sheet # 1 of	Date 2/10/21	Survey name Federation		Plot identifier (Plot 5 Oct 21)	
Recorders Geoff Peel Addy Watson Phil Carson		IBRA region Cobar Peneplain		Veg zone ID	
[1]Datum	Coordinate system ☐ Projected ☐ Geographic	MGA zone	[1]X coordinate 440352	[1]Y coordinate 6435780	
Location description					
[1]Plot dimensions		[1]Orientation of midline from 0 m point 250°		Photo #	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system) or Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools, it is not required while in the field

Composition (400 m² plot)		Sum values	Structure (400 m² plot)		Sum values (%) (may sum to >100%)	Function (1000 m² plot) [1]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted
Total count of native plant species **(richness)** in each growth form group (not individual plants within each growth form)	Trees (TG)	2	Sum of [2] **foliage cover** of native plant species by growth form group	Trees (TG)	10.2	80 + cm	
	Shrubs (SG)	4		Shrubs (SG)	1	50 – 79 cm	2
	Grasses etc (GG)	5		Grasses etc (GG)	61.4	30 – 49 cm	2
	Forbs (FG)	18		Forbs (FG)	2.9	20 – 29 cm	
	Ferns (EG)	–		Ferns (EG)	–	10 – 19 cm	
	Other (OG)	–		Other (OG)	–	5 – 9 cm	
			Total high threat weed cover		–	[8]Tree regeneration <5 cm	✓
						[3]Length of fallen logs	29 m
						[8]Hollow bearing trees	✓ 3

Vegetation integrity - function cont. (five 1 m²) plots)	[4]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	15 20 25 40 15	75 40 20 0 75	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	23	42	8	0

These attributes require consideration of site observations and may be completed after field work

Vegetation class	[8]**Large tree benchmark size**	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT) PCT 103		**EEC** Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (inc. native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe Age: P=recent (<3yrs), R=mid recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
m	m	m	m	m	m	m	m	m	m	m	m

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date	3 10 2021	Fed Oct 2021 5 Oct 2021	AW/PJC/GP

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N, HTW or non-HTW	[2] Foliage cover	Abundance	Voucher
TG	Eucalyptus intertexta	Gum Coolabah	N	10	1	
TG	Callitris glaucophylla	White Cypress Pine	N	0·2	2	
GG	Austrostipa nodosa	speargrass	N	60		
FG	Dichondra repens	kidney weed	N	0·5	500	
—	Medicago sp	clover	E	—	—	
FG	Einadia nutans		N	0·1	10	
SG	Rhagodia gaudichaudiana	Cotton saltbush	N	0·5	10	
—	Centaurea melitensis	Maltese cockspur	E	—	—	
FG	Maireana enchylaenoides	salt goosefoot	N	0·1	10	
FG	Oxalis perennans	small woodsorrel	N	0·2	100	
GG	Austrodanthonia sp.	wallaby grass	N	0·1	5	
GG	Paspalidium constrictum		N	0·1	1	
—	Salvia verbenaca	Wild sage	E	—	—	
SG	Sclerolaena diacantha	galvanised burr	N	0·3	5	
FG	Bulbine semibarbata		N	0·1	2	
—	Setaria verticillata	whorled pigeon grass	E	—	—	
SG	Sclerolaena birchii	grey roly-poly	N	0·1	2	
FG	Calotis lappulacea	yellow burr daisy	N	0·1	2	
FG	Sida corrugata		N	0·2	10	
FG	Calotis cuneifolia	purple burr daisy	N	0·5	30	
FG	Ptilotus sp.		N	0·1	5	
—	Cynoglossum lanceolatum	hounds tongue	E	—	—	
FG	Euphorbia drummondii	caustic weed	N	0·1	1	
—	Weed sp.	Apple of Sodom	E	—	—	
FG	Rhagodia nutans	Saltbush	N	0·1	1	
SG	Maireana humillima		N	0·1	3	
FG	Goodenia pinnatifida	upright goodenia	N	0·1	3	
FG	Atriplex nyellerii	Mealy saltbush	N	0·1	1	
FG	Crassula sieberiana	Australian stonecrop	N	0·1	1	
FG	Gnephosis foliata	little yellow daisy	N	0·2	50	
FG	Plantago drummondii	sago weed	N	0·1	1	
—	Convolvulus sp.	bindweed	E	—	—	
FG	Chthonocephalus pseudoax	grandhead	N	0·1	2	
GG	Eragrostis setifolia	Curly windmill grass	N	0·2	5	
FG	Dysphania pumilio	Crumbweed	N	0·1	2	
GG	Austrostipa sp.	Variable speargrass	N	1	10	

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed

[2] **Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m. 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values)

Zone 3
Plot 18
(4 OCT 21)

Numbers [1-8] on this page correlate with the numbers and explanatory notes on page 3

Site sheet #	1 of	Date	3/10/21	Survey name	Federation October	Plot identifier	
Recorders	Phil Cameron + Geo Abel	IBRA region	Cobar Peneplain			Veg zone ID	
[1]Datum		Coordinate system	Projected / Geographic	MGA zone		[1]X coordinate 440076	[1]Y coordinate 6444593
Location description	Description notes to locate site without gps reference						
[1]Plot dimensions	For composition & structure (400m²) 20 m x 20 m ✓ / For function (1000m²) 20 m x 50 m ✓			[1]Orientation of midline from 0 m point	140°	Photo #	

Datum: AGD66, WGS84, GDA94, GDA2020 or Other (specify). MGA Zone (for Projected coordinate system only): 56 (Coastal NSW), 55 (Central NSW) or 54 (Western NSW). X/Y coordinate: Long/Lat (for Projected coordinate system), Easting/Northing (for geographic coordinate system)

Vegetation integrity

Composition and structure sum values may be completed after entering data into available tools. It is not required while in the field.

Composition (400 m² plot)		Sum values	Structure (400 m² plot)		Sum values (%) (may sum to >100%)
Total count of native plant species (richness) in each growth form group (not individual plants within each growth form)	Trees (TG)	3	Sum of [2] foliage cover of native plant species by growth form group	Trees (TG)	35
	Shrubs (SG)	4		Shrubs (SG)	0.6
	Grasses etc (GG)	5		Grasses etc (GG)	12.6
	Forbs (FG)	12		Forbs (FG)	8.6
	Ferns (EG)	—		Ferns (EG)	—
	Other (OG)	—		Other (OG)	—
				Total high threat weed cover	—

Function (1000 m² plot)

[3]Tree stem size class (DBH)	If data are to be used as more appropriate local data i.e. to generate local benchmarks, stems must be counted		
80 + cm	Ø		0
50 – 79 cm	Ø		0
30 – 49 cm	①	①	2
20 – 29 cm	10	8	19
10 – 19 cm	2 19	3	22
5 – 9 cm	9	3	11
[4]Tree regeneration <5 cm	✓	✓	✓
[5]Length of fallen logs	27m		
[6]Hollow bearing trees	1 ✓ ✓	②	

Vegetation integrity - function cont. (five 1 m²) plots)	[7]Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	80 5 15 90 2	10 9 80 10 98	10 5 5 0 0	0 0 0 0 0
Average of the 5 subplots	38.4	41.4	4	—

These attributes require consideration of site observations and may be completed after field work

Vegetation class		[8]Large tree benchmark size	20/ 30/ 50/ 80 DBH	Confidence	H/ M/ L
Plant community type (PCT)	PCT 174	EEC	Tick	Confidence	H/ M/ L

Physiography and site features that may help in determining PCT and management zone (optional) or for BioNet systematic flora survey purposes

Morphological type		Landform element		Landform pattern		Microrelief	
Lithology		Soil surface texture		Soil colour		Soil depth	
Slope		Aspect		Site drainage		Distance to nearest water and type	

Disturbance	Severity code	Age code
Clearing (inc. logging)	—	—
Cultivation (inc. pasture)	—	—
Soil erosion	1	0
Firewood / CWD removal	—	—
Grazing (id. native/stock)	2	0
Fire damage	—	—
Storm damage	—	—
Weediness	—	—
Other	—	—

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe. Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Brief site description or other notes

Representative of PCT affected by proposal. In the impact footprint.

Emergents heights			Upper stratum heights			Middle stratum heights			Lower stratum heights		
Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom	Top	Mid	Bottom
25	20	—	12	10	2	1.5	1	0.4	0.5	0.3	0.1

400 m² floristics plot:	Survey name	Plot identifier	Recorders
Date 3 10 21	Federation Oct21	Plot4 Oct 21	Phil Cameron Geo Peel

GF code	Species name Full species name, or a unique means of identifying separate taxa within a survey is mandatory. Data from here will be used to assign growth form richness and cover.		N, HTW or non-HTW	Foliage cover	Abundance	Voucher
TG	Eucalyptus sideroxylon		N	15	3	
TG	Cypress glaucophylla		N	15	32	
TG	Eucalyptus intertexta		N	5	1	
SG	Phebalium glandulosum		N	0.1	5	
SG	Olearia pimeleoides		N	0.1	5	
SG	Sclerolaena diacantha	Grey Copperburr	N	0.3	150	
FG	Goodenia fasc	Smooth Goodenia	N	0.5	500	
GG	Austrostipa scabra		N	10	>1k	
GG	Aristida ramosa		N	0.5	400	
FG	Calotis cuneifolia		N	0.5	1k	
FG	Aristida behriana	Brush speargrass	N	0.1	25	
GG	Enteropogon acicularis	Curly Windmill G.	N	1	100	
FG	Goodenia hederacea	Forest Goodenia	N	1	250	
FG	Sida corrugata		N	0.1	70	
GG	Austrostipa scabra ?		N	1	10	
FG	Dianella ?		N	0.1	3	
FG	Pimelea umbellata	Pimelea	N	0.1	5	
FG	Ptilotus obovatus		N	2	40	
FG	Helipterum floribundum	Common White Sunray	N	2	50	
FG	Scaevola humilis	Fan flower	N	2	250	
—	Salvia verbenaca	Wild Sage	E	0.1	25	
FG	Einadia nutans – nutans		N	0.1	15	
GG	Thyridolepis mitchelliana	Mulga Mitchell G	N	0.1	35	
SG	Eremophila mitchelli	Turpentine bush	N	0.1	1	
FG	Chrysocephalum sp	Little Yellow Daisy Yellow	N	0.1	2	

	Count	Cover
TG	3	35
SG	4	0·6
GG	5	12·6
FG	12	8·6
EG	—	—
OG	—	—

Print more copies of this page to allow for higher species counts at a plot. All vascular plant species in a plot need to be recorded.

GF Code: see growth form definitions in BAM 2020 Appendix F. **N:** native, **HTW:** high threat weed.

²**Foliage cover:** 0.1, 0.2, 0.3, ..., 1, 2, 3, 4, 5, 10, 15, 20, 25, ...100%; Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately *1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m.* Note the top 3 dominant native species within each GF group.

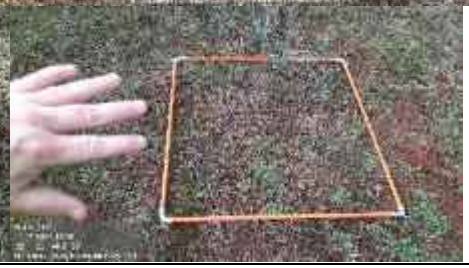
Abundance: Count 1, 2, 3 ..., when ≤10, estimate when >10, 20, 30 ... 100, 200, 300 ..., 1000, 2000, 3000 ... (as integer values).

Appendix C – BAM plot photos

See following pages (plot numbers are slightly out of number order due to staggered surveys)

Plot	Zone	PCT ID	Pictures
1	1	103	  

Plot	Zone	PCT ID	Pictures
2	1	103	  *this plot was originally known as July Plot 4
			

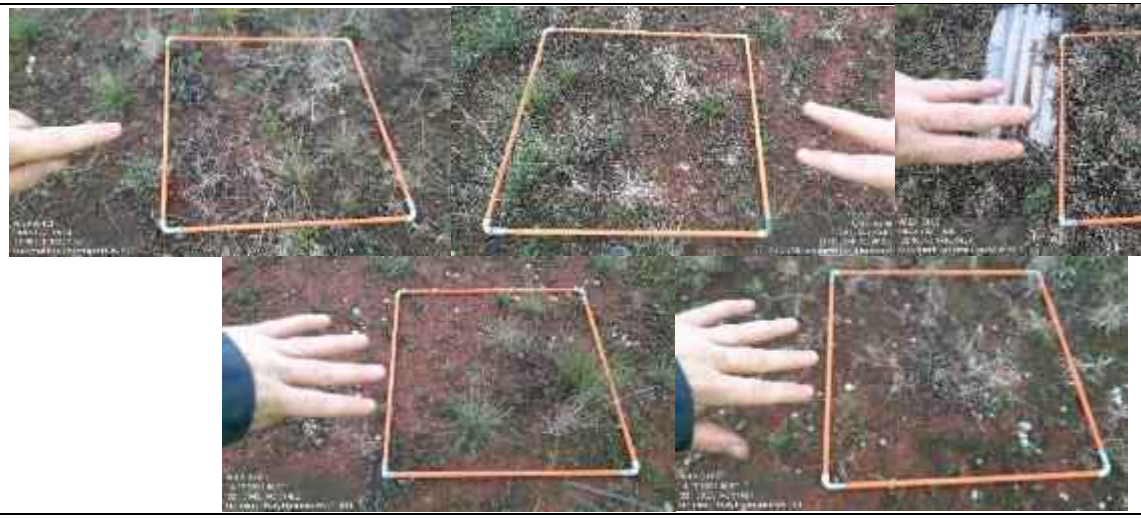
Plot	Zone	PCT ID	Pictures
3	1	103	  *this plot was originally known as July Plot 12
			    

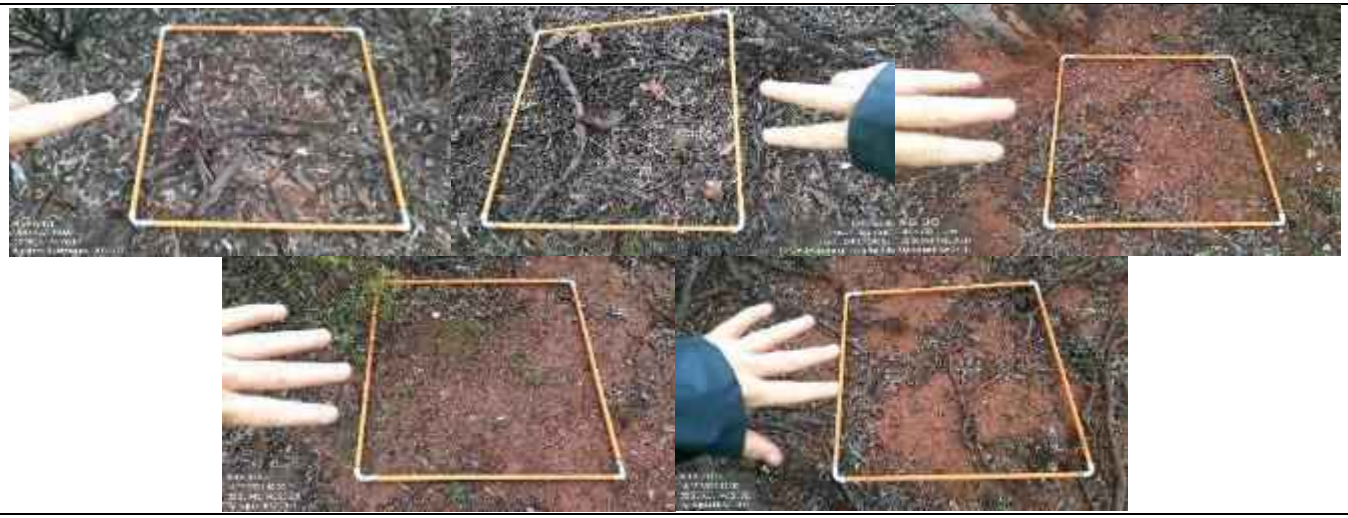
Plot	Zone	PCT ID	Pictures
4	1	103	  *this plot was originally known as 2020 Plot 10
			    

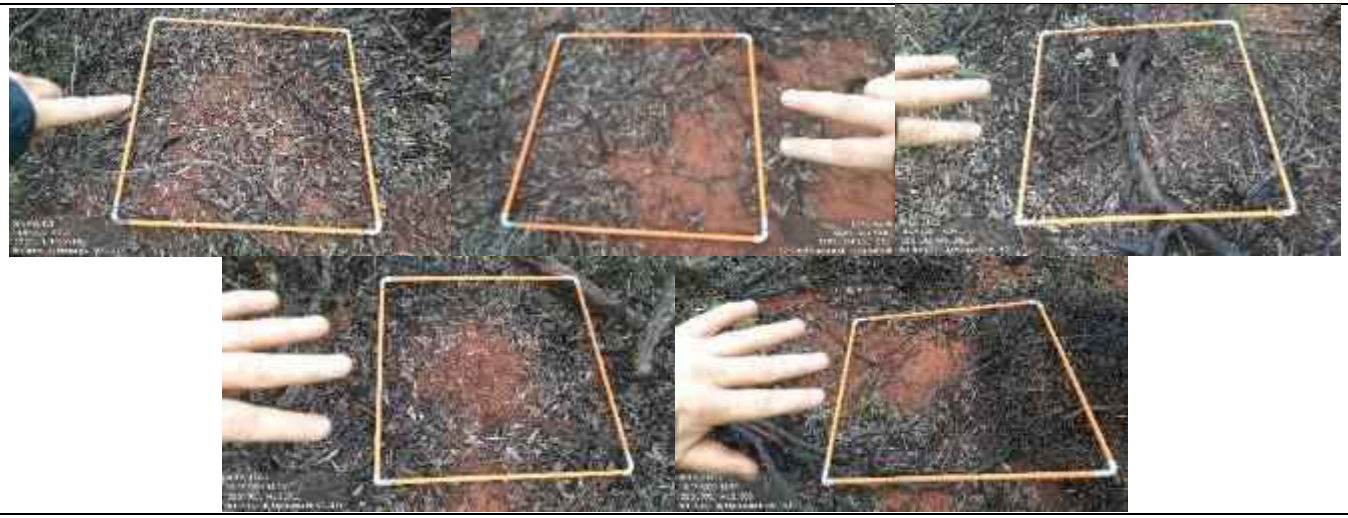
Plot	Zone	PCT ID	Pictures
5	1	103	  *this plot was originally known as 2020 Plot 11     

Plot	Zone	PCT ID	Pictures
16	1	103	  *this plot was originally known as Plot 1 Oct 2021     

Plot	Zone	PCT ID	Pictures
17	1	103	  *this plot was originally known as Plot 5 Oct 2021
			    

Plot	Zone	PCT ID	Pictures
6	2	103	  *this plot was originally known as July Plot 7 

Plot	Zone	PCT ID	Pictures
7	3	174	  *this plot was originally known as July Plot 5
			

Plot	Zone	PCT ID	Pictures
8	3	174	  *this plot was originally known as July Plot 6 

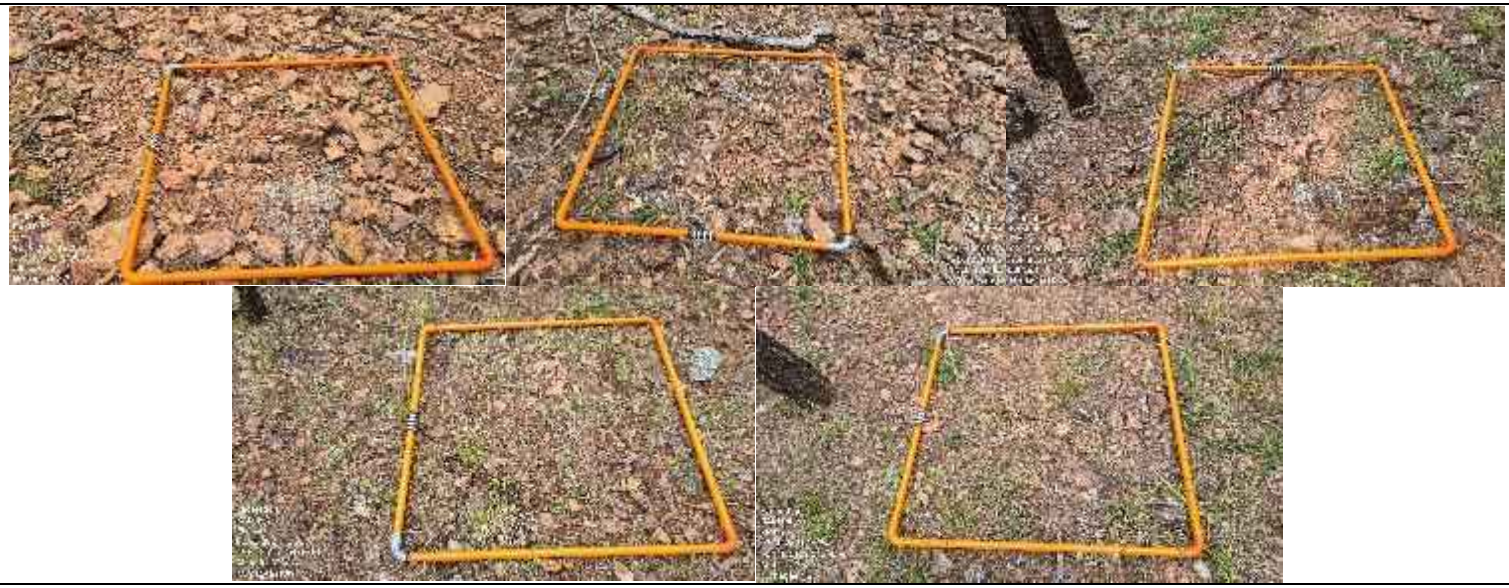
Plot	Zone	PCT ID	Pictures
9	3	174	  *this plot was originally known as July Plot 11
			

Plot	Zone	PCT ID	Pictures
18	3	174	  *this plot was originally known as Plot 4 Pct 2021    

Plot	Zone	PCT ID	Pictures
10	4	104	  *this plot was originally known as July Plot 8
			    

Plot	Zone	PCT ID	Pictures
11	4	104	  *this plot was originally known as July Plot 9     

Plot	Zone	PCT ID	Pictures
12	5	180	  *this plot was originally known as 2020 Plot 18
			    

Plot	Zone	PCT ID	Pictures
13	5	180	  *this plot was originally known as Plot 3 Oct 2021 

Plot	Zone	PCT ID	Pictures
14	6	258	  *this plot was originally known as July Plot 10
			    

Plot	Zone	PCT ID	Pictures
15	7	184	  *this plot was originally known as Plot 2 Oct 2021 

Appendix D – Bat and Bioacoustics Analysis Results

Insectivorous bats identified near the Project disturbance area via echolocation July 2021

			BAT 3				BAT 4			
no.	Scientific name	Common Name	12-Jul	13-Jul	14-Jul	15-Jul	12-Jul	13-Jul	14-Jul	15-Jul
1	*Austronomus australis*	White-striped freetail bat			x	x				x
2	*Chalinolobus morio*	Chocolate Wattled Bat	x	x	x	x				
3	*Chalinolobus gouldii*	Gould's Wattled Bat	x	x		x		x	x	
4	*Chalinolobus picatus #*	Little pied bat		x						
5	*Nyctophilus sp.*	Long-eared bats				x			x	x
6	*Ozimops petersi*	free-tailed bat	x							
7	*Ozimops planiceps*	Southern free-tailed bat	x	x		x	x		x	x
8	*Miniopterus orianae oceanensis #*	Eastern bentwing bat	x					x		x
9	*Saccolaimus flaviventris #*	Yellow-bellied sheathtail bat		P						
10	*Scotorepens balstoni*	Inland Broad-nosed Bat		x	x	x	x	x		
11	*Scotorepens greyii*	Little Broad-nosed Bat								x
12	*Vespadelus vulturnus*	Little Forest Bat	x	x	x	x	x			x
13	*Vespadelus darlingtoni*	Large forest bat		x		x				
	Miniopterus orianae oceanensis # or vespadelus sp		x	x		x				x
	Vespadelus species						x			
	O. planiceps or O. petersi							x	x	x
	S. balstoni or Ozimops or C. gouldi			x	x	x		x		
		Noise files	23	15	9	136	0	5	2	39
		Total bat calls	**97**	**216**	**116**	**128**	**4**	**49**	**45**	**79**
		Total files	120	231	125	264	4	54	47	118
Results. In total 13 bat species were positiveyl recorded. Miniopterus orianae oceanensis differentiated from Vespadelus darlingtoni by the lack of even consequtive pulses, short downtail or no tail on most pulses and 'messy appearance										

Aurelia Federation Decline Acoustics July 2021

Acoustic calls were collected at the Project disturbance area from 12 July 2021 to 15 July 2021. Spectrograms (a visual representation of the spectrum of frequencies of each acoustic call) was manually scanned to specifically detect calls from the Barking Owl and Masked Owl using Kaleidoscope Viewer (version 5.2.1). Further inspection of the spectrograms (when a possible species was detected) was undertaken using Audacity (version 3.0.2). Incidental species noted are included below.

Some calls were not loud enough or good enough quality to positively identify candidate species. No threatened species were detected.

	Species detected	**Possible species detected**
Birds	**x**	
Owlet nightjar	x	
Australian Magpie	x	
Willie Wagtail	x	
Striated thornbill	x	
Noisy Friarbird	x	
Weebill	x	
Olive-backed oriole		X confident on call and within distribution but few records west.
Honeyeater sp1 ?	x	
Honeyeater sp2 ?	x	

Insectivorous bats identified near the Project disturbance area via echolocation October 2020

Scientific name	Common Name	19/10/2020	20/10/2020	21/10/2020	22/10/2020	23/10/2020	24/10/2020	25/10/2020
Bat calls positively identified								
Austronomus australis	White-striped freetail bat	x	x	x	x	x	x	x
Chalinolobus morio	Chocolate wattled bat	x	x					x
Chalinolobus gouldii	Gould's wattled bat	x	x	x	x	x	x	x
Chalinolobus picatus #	Little pied bat	x				P	x	x
Nyctophilus	Long-eared bat complex			x	x	x		x
Ozimop planiceps	Southern free-tailed bat	x		x	P	x	P	x
Miniopterus orianae oceanensis #	Eastern bentwing bat	x	x	x	x	x	x	x
Saccolaimus flaviventris #	Yellow-bellied sheathtail bat	x	x	x	x	x		x
Scotorepens balstoni	Inland broad-nosed Bat					x		
Scotorpens greyii	Little broad-nosed bat	x		x	x	P		
Vespadelus darlingtoni	Large forest bat		x			x		x
V. vulturnus	Little forest bat	x	x	x	x	x	x	x
V. regulus	Southern forest bat	x	x	x	x	x		
V. baverstocki	Inland forest bat		x				x	
Bat calls not positively identified								
*Chalinolobus dwyeri #**	Large-eared pied bat				P			
V. darlingtoni or V. baverstocki		x	x					
Vespadelus sp. or Miniopterus orianae oceanensis #						x		
Scotorepens sp.		x				x		
C. gouldii or Ozimop sp.							x	
	Bat files	115	130	149	88	178	1221	233
	Noise	108	268	327	190	684	1096	546
	Total files	**223**	**398**	**476**	**278**	**862**	**2317**	**779**

\# species listed under the Biodiversity Conservation Act 2016
* species listed under the Environmental Protection and Biodiversity Act
P Probable record
✓ Positively identified

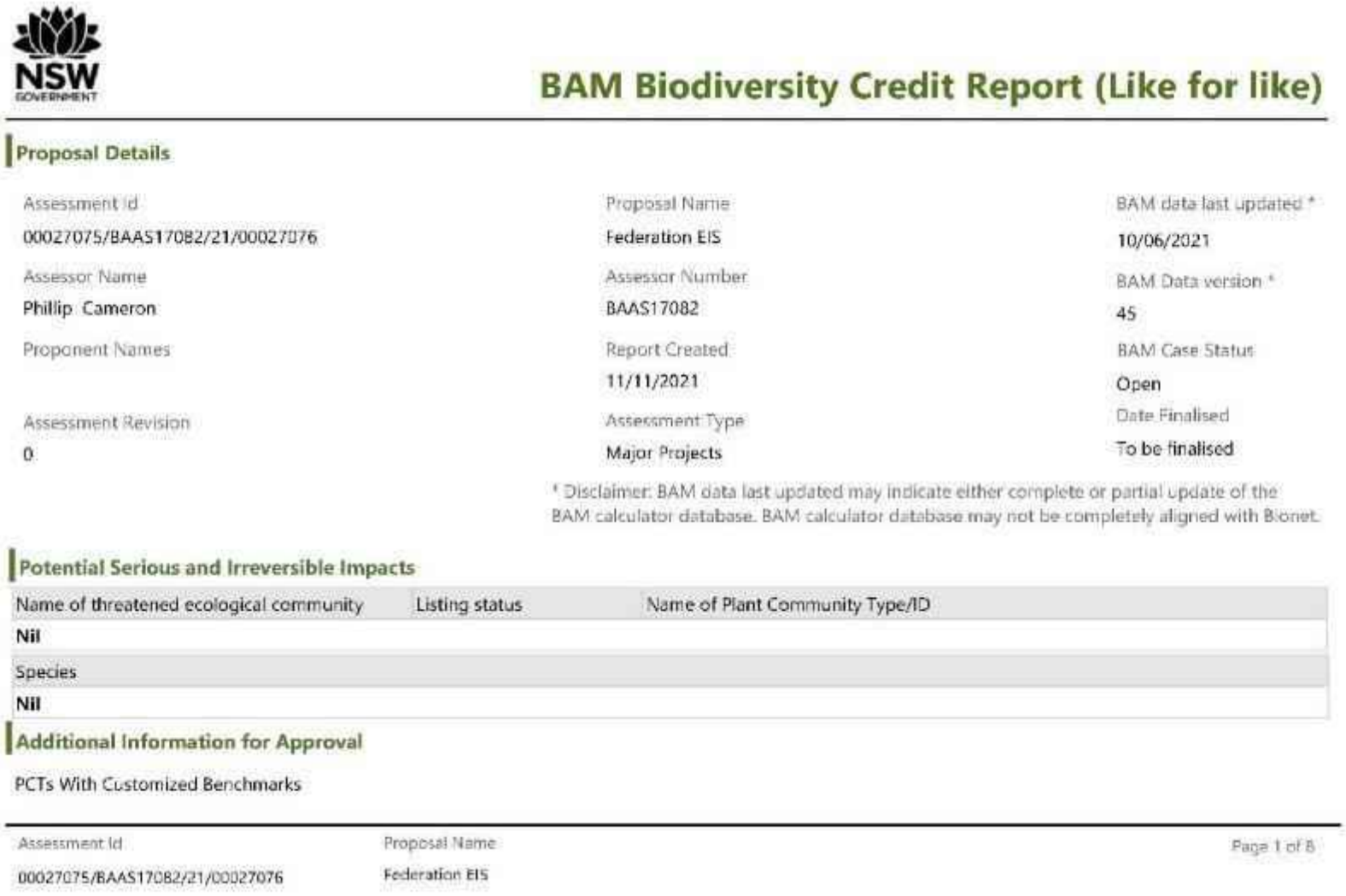
Insectivorous bats identified near the Project area (Hera Mine) via echolocation June 2020

Scientific name	**Common Name**	**Bat 1**								**Bat 2**						**Bat 3**		
		12/06/2020	13/06/2020	14/06/2020	15/06/2020	1/01/2020	2/01/2020	3/01/2020	4/01/2020	12/06/2020	13/06/2020	14/06/2020	15/06/2020	18/06/2020	19/06/2020	3/01/2020	13/06/2020	16/06/2020
Confidently recorded																		
Austronomus australis	White striped freetail bat	x								x	x				x			
Chalinolobus morio	Chocolate wattled bat		x								x		x					
Chalinolobus gouldii	Gould's wattled bat	x		x						x	x	x	x	x	x			
Chalinolobus picatus #	Little pied bat														x			

Nyctophilus sp.	Long-eared bats			x						x		x	x		x			
Mormopterus planiceps	Southern free-tailed bat									x	x	x	x	x	x			
Miniopterus orianae oceanensis #	Eastern bentwing bat											x	x	x				
Saccolaimus flaviventris #	Yellow-bellied sheathtail bat														x			
Scotorepens balstoni	Inland broad-nosed bat											x	x	x				
Scotorepens greyii	Little broad-nosed bat		x									x		x	x			
Scotorepens orion	Eastern broad-nosed bat													x				
Vespadelus vulturnus	Little forest bat	x	x	x	x					x	x	x	x	x	x			
Not positively identified																		
Vespadelus sp or ***Miniopterus orianae oceanensis #***		x	x	x	x						x				x			
C. gouldii or M. planiceps or M. petersi		x								x				x		x		
	Bat calls	20	16	36	34	0	0	0	0	213	207	169	203	126	72	1	0	0
	noise	11	418	6	20	5	1	9	2	28	41	22	12	20	51	6	1	1
	Files	31	434	42	54	5	1	9	2	241	248	191	215	146	123	7	1	1

x Species identified in the study area
P Potential record of species
species listed under the Biodiversity Conservation Act 2016
* species listed under the Environment Protection and Biodiversity Act

Appendix E – BAM Credit Reports



NSW GOVERNMENT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00027075/BAAS17082/21/00027076	Proposal Name Federation EIS	BAM data last updated * 10/06/2021
Assessor Name Phillip Cameron	Assessor Number BAAS17082	BAM Data version * 45
Proponent Names	Report Created 11/11/2021	BAM Case Status Open
Assessment Revision 0	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCTs With Customized Benchmarks

Assessment Id	Proposal Name	Page 1 of 8
00027075/BAAS17082/21/00027076	Federation EIS	

BAM Biodiversity Credit Report (Like for like)

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo
Grantiella picta / Painted Honeyeater

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
103-Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	Not a TEC	33.8	1282	5	1287
174-Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	Not a TEC	14.5	574	0	574
104-Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion	Not a TEC	3.9	100	0	100
180-Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	Not a TEC	2.4	0	52	52
258-Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion	Not a TEC	0.9	26	0	26
184-Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion	Not a TEC	0.5	0	6	6

103-Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Western Peneplain Woodlands This includes PCT's: 103, 135, 145	Western Peneplain Woodlands >=50% and <70%	103_good	Yes	1282	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Western Peneplain Woodlands This includes PCT's: 103, 135, 145	Western Peneplain Woodlands >=50% and <70%	103_cleared	No	5	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

104-Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	104_good	Yes	100	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
174-Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sand Plain Mallee Woodlands This includes PCT's: 142, 173, 174, 190, 193, 355, 474	Sand Plain Mallee Woodlands >=50% and <70%	174_good	Yes	574	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

180-Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	180_good	No	52	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

184-Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	184_good	No	6	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
258-Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Inland Rocky Hill Woodlands This includes PCT's: 104, 106, 122, 175, 176, 177, 178, 180, 184, 185, 186, 188, 218, 239, 256, 257, 258, 292, 317, 318, 319, 328, 329, 332, 334, 357, 424, 427, 439	Inland Rocky Hill Woodlands <50%	258_good	Yes	26	Nymagee, Barnato Downs, Bogan-Macquarie, Canbelego Downs, Darling Depression, Lachlan Plains and Lower Slopes. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

258-Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027075/BAAS17082/21/00027076	Federation EIS	10/06/2021
Assessor Name	Report Created	BAM Data version *
Phillip Cameron	11/11/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS17082	Open	To be finalised
Assessment Revision	Assessment Type	
0	Major Projects	

* Disclaimer: BAM data last upoated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion											
7	184_good	Not a TEC	35.7	35.7	0.45			High Sensitivity to Potential Gain	1.50		6
										Subtotal	**6**

Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion										
5	180_good	Not a TEC	58.5	58.5	2.4			High Sensitivity to Potential Gain	1.50	52
									Subtotal	**52**
Gum Coolabah - Mugga Ironbark - White Cypress Pine woodland on granite low hills in the eastern Cobar Peneplain Bioregion and central NSW South Western Slopes Bioregion										
6	258_good	Not a TEC	79.9	79.9	0.86			High Sensitivity to Potential Gain	1.50	26
									Subtotal	**26**
Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion										
4	104_good	Not a TEC	68.9	68.9	3.9			High Sensitivity to Potential Gain	1.50	100
									Subtotal	**100**
Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion										
3	174_good	Not a TEC	90.7	90.7	14.5			High Sensitivity to Potential Gain	1.75	574
									Subtotal	**574**
Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion										
1	103_good	Not a TEC	87.5	87.5	33.5			High Sensitivity to Potential Gain	1.75	1282
2	103_cleared	Not a TEC	36.4	36.4	0.32			High Sensitivity to Potential Gain	1.75	5
									Subtotal	**1287**
									Total	**2045**

Species credits for threatened species

BAM Credit Summary Report

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

Appendix F – Correspondence

From: Seanna Mccune <Seanna.Mccune@botanicgardens.nsw.gov.au>
Sent: Thursday, 21 October 2021 9:12 AM
To: Addy Watson <addy@areaenv.com.au>
Subject: RE: Greenhood orchid ID

Hi Addy,
I have identified your greenhood from Nymagee as is *Pterostylis boormanii* Det. SF McCune 19 Oct 2021.
The labellum is a major diagnostic feature and there is only one good photo of a labellum amongst your images. When photographing members of the Rufa complex try not to trigger their labellum. If you do, they will reset after a time. Sometimes they can be gently reset with a toothpick or similar shaped object.

Warm regards, Seanna

Seanna McCune
Botanical Identification Service
National Herbarium of New South Wales

Australian Institute of Botanical Science
Royal Botanic Gardens and Domain Trust
T 4631 5135
E seanna.mccune@botanicgardens.nsw.gov.au
Mrs Macquaries Rd, Sydney, NSW 2000, Australia
W botanicgardens.org.au

We pay respect to the First Peoples of this nation and their custodianship of the land, sea and sky. This place always was and always will be Aboriginal land.

Appendix G – Fauna Handling and Rescue Procedure

Purpose

This procedure explains the actions to be taken if an animal or eggs are discovered on the site that require handling or rescue during vegetation and soil clearance and ongoing construction activities. The procedure relates primarily to injured shocked and juvenile individuals but also applies to nocturnal fauna or slow-moving species that may not be capable of moving away from mobile plant and equipment.

Scope

This procedure is applicable to all native and introduced species that are found on the site. Attendee construction staff and contractors will attend a project induction, which will include a section on fauna.

Procedure

In the event wildlife (including shocked, juvenile animals or eggs) are discovered on the site during vegetation and soil clearance and ongoing construction activities the following steps shall be taken:

1. STOP ALL WORK in the vicinity of the fauna and immediately notify the work supervisor, who will then notify a member of the Environmental/ management team.

2. If required, contact project ecologist to obtain positive identification of the subject species.

3. Preferably allow fauna to leave the area without intervention.

4. If immediately available, use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling.

5. To minimise stress to native fauna and remove the risk of further injury an appropriately competent person shall:

    a. If time permits call ecologist or fauna rescue for advice.

    b. Attempt to herd animal into adjoining forest, outside construction area.

    c. If capture is necessary cover larger animals with a towel or blanket and place in a large cardboard box and/or cotton/calico bag

    d. Place smaller animals in a cotton/calico bag tied at the top

    e. Keep the animal in a quiet, warm, ventilated and dark place away from noisy construction activities.

    f. Aquatic fauna are to be placed in plastic aquaria or a moistened plastic bag. Frogs will be transported in moistened plastic bags (1 frog/bag) with a small amount of leaf litter. Handling and translocation of frogs shall be in accordance with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008)

6. Bats should only be handled by appropriately trained and vaccinated person.

Appendix H – Credit requirement for Federation exploration decline program

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00023975/BAAS19066/21/00024019	Federation decline and water supply REF	22/02/2021
Assessor Name	**Report Created**	**BAM Data version ***
Addy Watson	27/10/2021	37
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS19066	Finalised	09/03/2021
Assessment Revision	**Assessment Type**	**BOS entry trigger**
0	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion											
5	184_Zone5_Mod	Not a TEC	55.3	55.3	0.16			High Sensitivity to Potential Gain	1.50		3
										Subtotal	**3**

Gum Coolabah woodland on sedimentary substrates mainly in the Cobar Peneplain Bioregion										
2	104_Zone2_Mod	Not a TEC	78.5	78.5	0.54			High Sensitivity to Potential Gain	1.50		16
										Subtotal	**16**
Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion										
1	174_Zone1_Good	Not a TEC	80.9	80.9	19.1			High Sensitivity to Potential Gain	1.75		676
										Subtotal	**676**
Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion										
3	103_Zone3_GoodDense	Not a TEC	83.6	83.6	14.3			High Sensitivity to Potential Gain	1.75		524
4	103_Zone4_GoodOpen	Not a TEC	79.3	79.3	1.7			High Sensitivity to Potential Gain	1.75		58
										Subtotal	**582**
										Total	**1277**

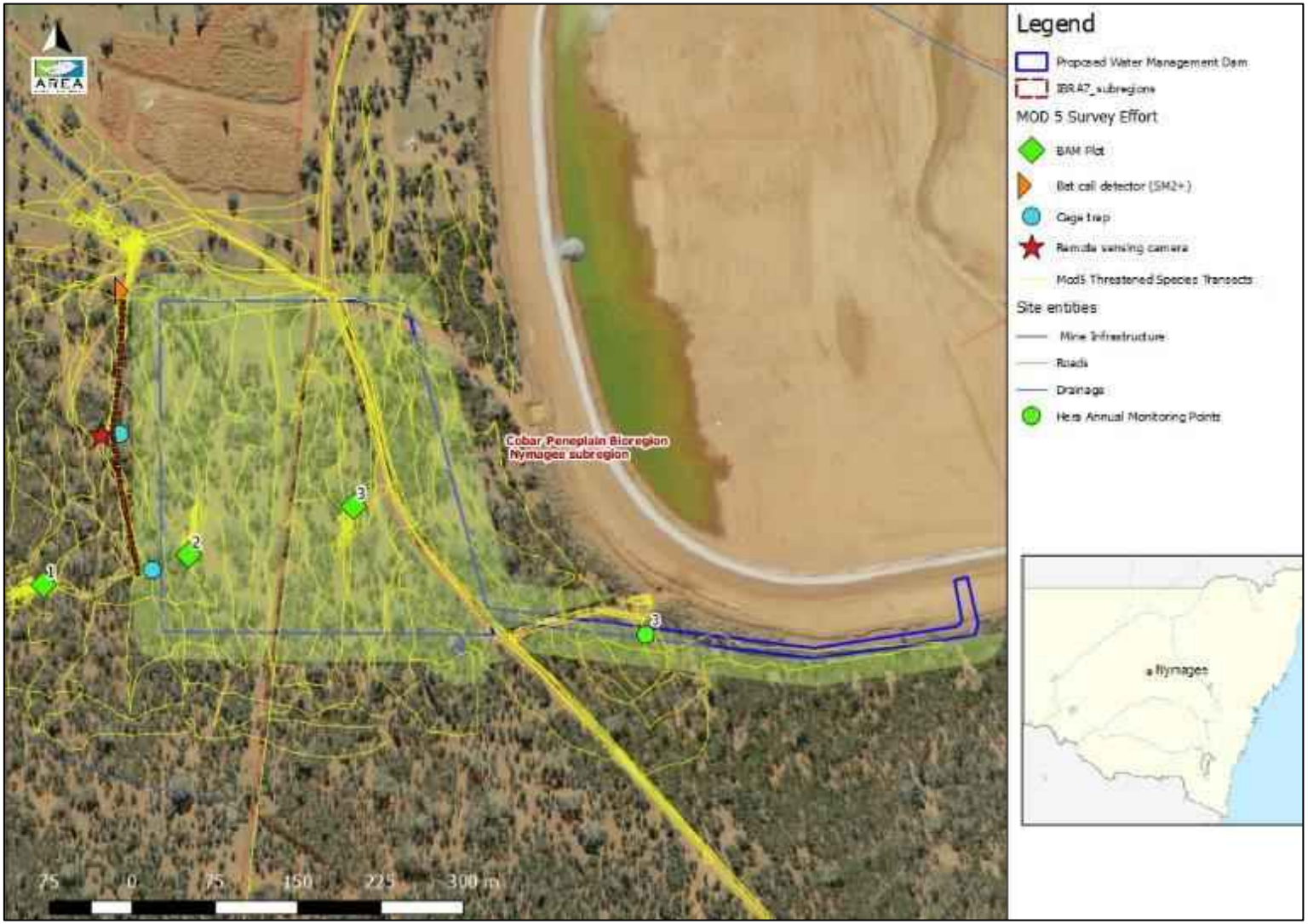
Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

Appendix I – Survey effort for Hera Mine Modification 5

See three Figures (with original numbering) on following pages taken from ‘Hera Mine Modification 5 Biodiversity Assessment Report’ prepared by AREA in February 2019.

Figure 1: Proposal survey effort 22-15 September and 7 November 2018



Note: the species credit transects in yellow show the combined former and current area of occupancy of the study area

Figure 2: Survey effort within 1500m

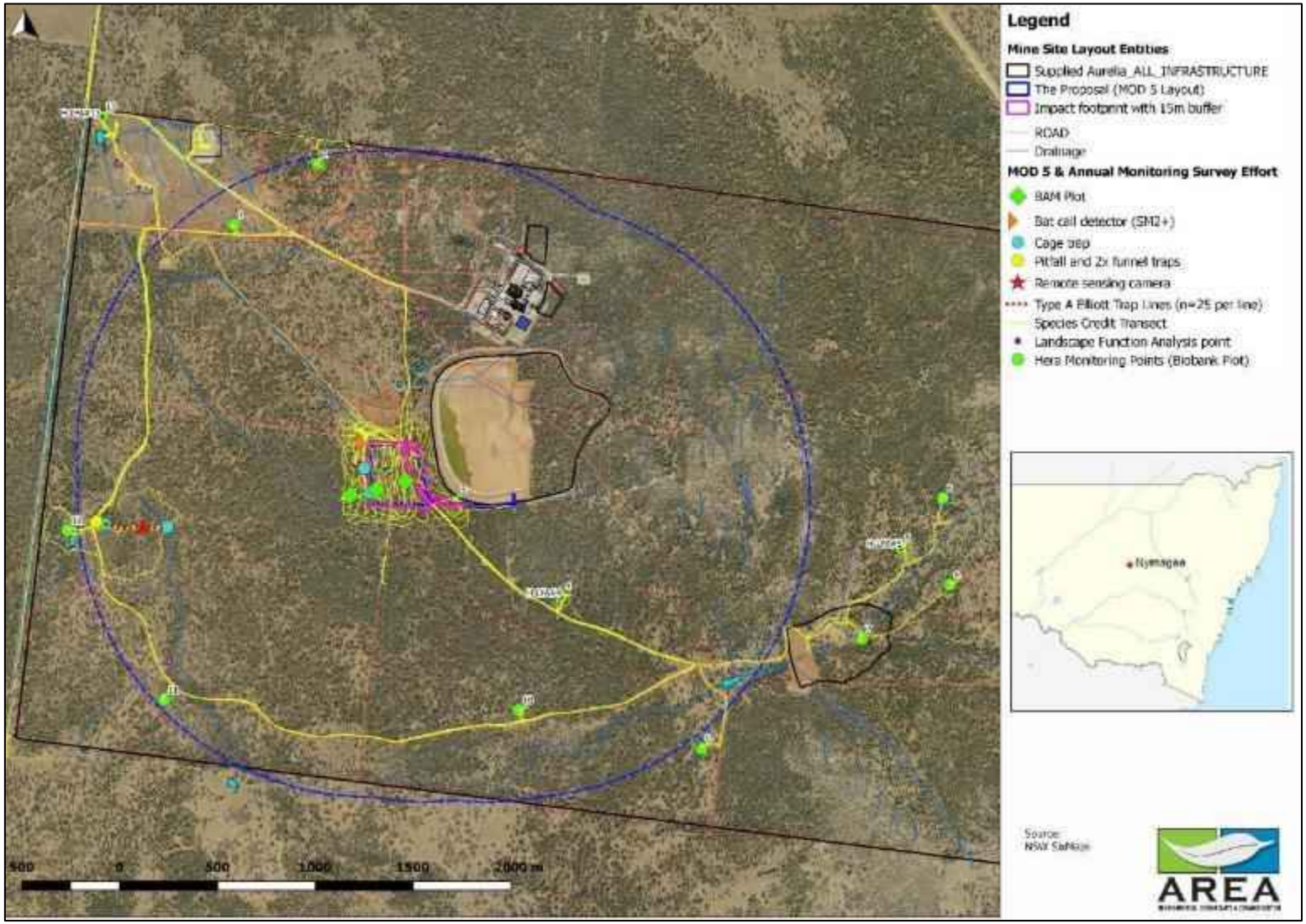
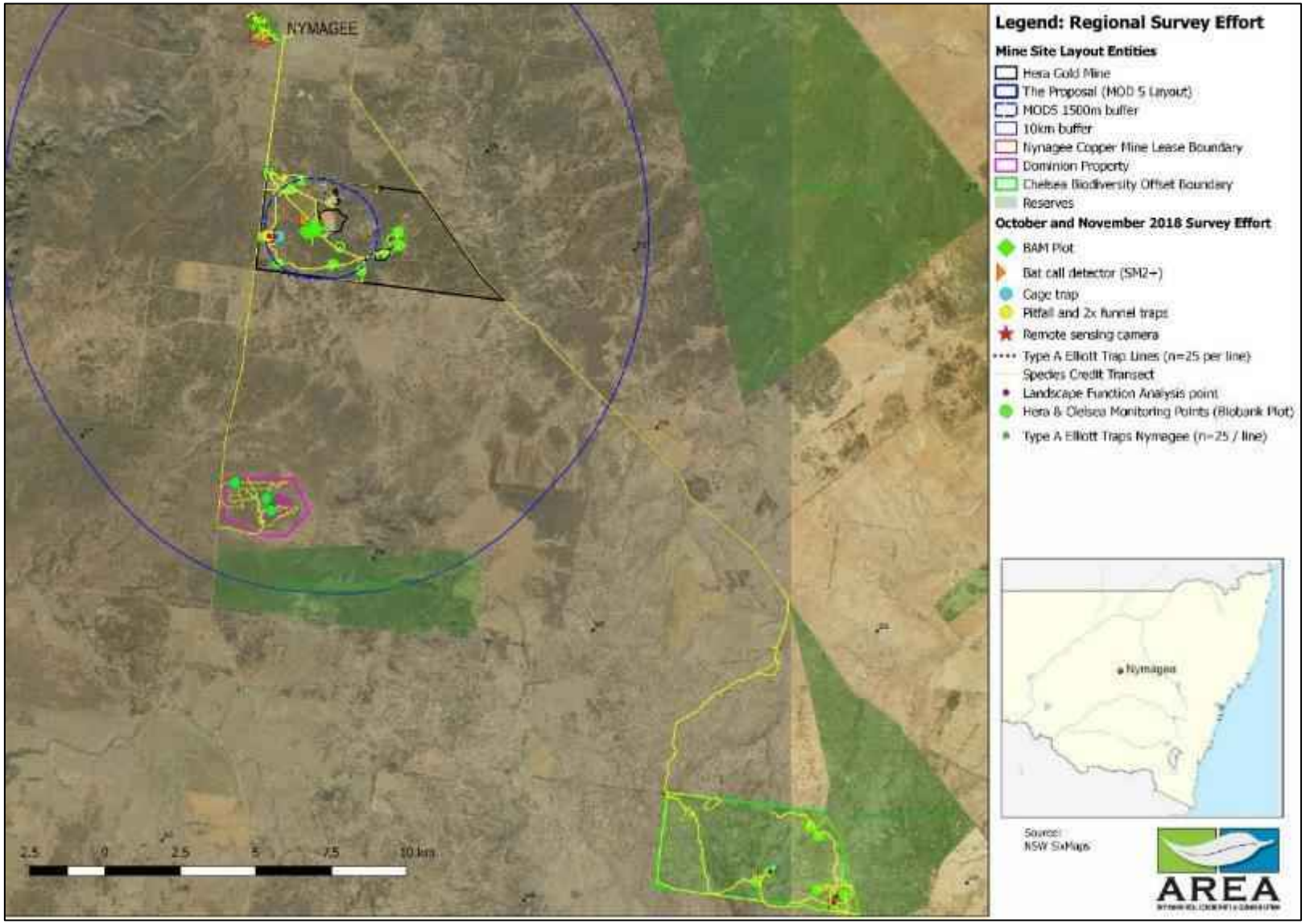


Figure 3: October and November 2018 Survey effort within the region



Appendix J – Glossary of terms from BAM (2020)

BAM definitions and acronyms used in this document

Definitions

Accredited person: has the same meaning as in the BC Act, referred to in the BAM as 'assessor'.
Ancillary rules: has the same meaning as set out in clause 6.5 of the BC Regulation.
Annual probability of decline in vegetation and habitat condition: an estimate of the average probability of decline of each attribute through clearing, stochastic factors or ongoing degrading actions (firewood removal, weed invasion, livestock grazing).
Areas of geological significance: geological features such as karst, caves, crevices, cliffs.
Assessment area surrounding the subject land: the area of land in the 1500m buffer zone around a Development Site, or land to be biodiversity certified or a biodiversity stewardship site, that is determined in accordance with Subsection 4.3.2.
Assessor: the person accredited under the BC Act referred to in Subsection 2.1.2 and who has been engaged by the proponent.
Averted loss: the gain in vegetation and habitat condition that arises from managing the proposed land as an offset compared to the probable future vegetation condition if the land was to be left unmanaged (see *Annual probability of decline*).
Avoid: measures taken by a proponent such as careful site selection or actions taken through the design, planning, construction and operational phases of the development to completely avoid impacts on biodiversity values, or certain areas of biodiversity. Refer to the BAM for operational guidance.
BAM: the Biodiversity Assessment Method.
BC Act: the Biodiversity Conservation Act 2016.
BC Regulation: the Biodiversity Conservation Regulation 2017.
Benchmark data: for a PCT, vegetation class or vegetation formation benchmark data is contained in the BioNet Vegetation Classification. A local reference site may also be used to establish benchmark data for a PCT that may be used in a BAM assessment.
Benchmarks: the quantitative measures that represent the 'best-attainable' condition, which acknowledges that native vegetation within the contemporary landscape has been subject to both natural and human-induced disturbance. Benchmarks are defined for specified variables for each PCT. Vegetation with relatively little evidence of modification generally has minimal timber harvesting (few stumps, coppicing, cut logs), minimal firewood collection, minimal exotic weed cover, minimal grazing and trampling by introduced or overabundant native herbivores, minimal soil disturbance, minimal canopy dieback, no evidence of recent fire or flood, is not subject to high frequency burning, and has evidence of recruitment of native species.
Biodiversity certification: has the same meaning as in the BC Act.
Biodiversity Certification Assessment Report (BCAR): has the same meaning as in the BC Act.
Biodiversity credit report: the report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a Development Site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
Biodiversity Development Assessment Report (BDAR): has the same meaning as in the BC Act.
Biodiversity offsets: management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity Stewardship Agreement: has the same meaning as in the BC Act.
Biodiversity Stewardship Assessment Report (BSAR): the report that must be prepared in accordance with the BAM and submitted as part of an application for a biodiversity stewardship agreement.
Biodiversity values: has the same meaning as clause 1.5(2) of the BC Act.
Biodiversity values map: is established according to clause 7.3 of the BC Regulation. Development within an area identified on the map requires assessment using the BAM.
BioNet Atlas: the DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish.
BioNet Vegetation Classification: the master vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by DPIE and available at www.environment.nsw.gov.au/research/Visclassification.htm.
Broad condition state: areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Certified more appropriate local data: has the same meaning as set out in Subsection 2.2.2.
Change in vegetation integrity score for a biodiversity stewardship site: the difference (gain) between the estimated vegetation integrity score without management at a biodiversity stewardship site and the predicted future vegetation integrity score with management at a biodiversity stewardship site, calculated in accordance with Equation 28.
Class of biodiversity credit: as defined in Section 11.3.
Clearing site: the site proposed to be cleared of native vegetation where approval is sought under Part 5A of the *Local Land Services Act 2013* or the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*.
Clonal species: flora species that propagate asexually at a site or have a limited degree of sexual reproduction, either within or between sites. Modes of asexual reproduction will include vegetative reproduction such as by rhizomes, root suckers or bulb replication.
Connectivity: the measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator: the computer program that provides decision support to assessors and proponents by applying the BAM, in particular by using the data required to be entered and the equations in Appendix 6 and Appendix 9 to calculate the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Critically endangered ecological community (CEEC): an ecological community specified as critically endangered in Schedule 2 of the BC Act and/or listed under Part 13, Division 1,
Subdivision A of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
Crown cover: the vertical projection of the periphery of tree crowns within a designated area.
Derived vegetation: PCTs that have changed to an alternative stable state as a consequence of land management practices since European settlement. Derived communities can have one or more structural components of the vegetation entirely removed or severely reduced (e.g. over-storey of grassy woodland) or have developed new structural components where they were previously absent (e.g. shrubby mid-storey in an open woodland system).
Development footprint: the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials. The term *Development Footprint* is also taken to include clearing footprint except where the reference is to a small area development or a major project development.

Development Site: an area of land that is subject to a proposed development that is under the EP&A Act. The term *Development Site* is also taken to include clearing site except where the reference is to a small area development or a major project development.
Ecosystem credits: a measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a Development Site and the gain in biodiversity values at a biodiversity stewardship site.
Endangered ecological community (EEC): an ecological community specified as endangered in Schedule 2 of the BC Act, or listed under the EPBC Act.
Environment Agency Head: has the same meaning as in the BC Act.
EP&A Act: the NSW Environmental Planning and Assessment Act 1979.
EPBC Act: the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
Ephemeral flora species: flora species where the abundance of the species above ground fluctuates in response to the plant life history in combination with environmental conditions and/or disturbance regimes. Fluctuations in abundance may be short-term (seasonal) or long-term (yearly to decadal). Many ephemeral species persist underground through unfavourable conditions via soil seed banks or dormant vegetative organs (bulbs, tubers, rootstocks).
Estuarine area: a semi-enclosed body of water having an open or intermittently open connection with the ocean, in which water levels do not vary with the ocean tide (when closed to the sea) or vary in a predictable, periodic way in response to the ocean tide at the entrance (when open to the sea).
Expert: a person who has the relevant experience and/or qualifications to provide expert opinion in relation to the biodiversity values to which an expert report relates.
Foliage cover: the percentage of a plot area that would be covered by a vertical projection of the foliage and branches and trunk of a plant, or plants or a growth form group. Foliage cover can also be referred to as percent foliage cover.
Gain: the gain in biodiversity values at a biodiversity stewardship site, over time from undertaking management actions at a biodiversity stewardship site. Gain in biodiversity values is the basis for creating biodiversity credits at the biodiversity stewardship site.
Grassland: native vegetation classified in the vegetation formation 'Grasslands' in Keith (2004)[2]. Grasslands are generally dominated by large perennial tussock grasses, lack of woody plants, the presence of broad-leaved herbs in inter-tussock spaces, and their ecological association with fertile, heavy clay soils on flat topography in regions with low to moderate rainfall.
Growth form: the form that is characteristic of a particular flora species at maturity. Growth forms are set out in Appendix 4.
Habitat: an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.
Habitat component: the component of habitat that is used by a threatened species for either breeding, foraging or shelter.
Habitat surrogates: measures of habitat that predict the occurrence of threatened species and communities: IBRA subregion, PCT, percent vegetation cover and vegetation condition.
Herbfield: native vegetation which predominantly does not contain an over-storey or mid- storey and where the ground cover is dominated by non-grass species.
High threat exotic plant cover: plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species. Also referred to as high threat weeds.
Hollow bearing tree: a living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the entrance width is at least 5cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1m above the ground. Trees must be examined from all angles.
IBRA region: a bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system[3], which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.
IBRA subregion: a subregion of a bioregion identified under the IBRA system.
Impact assessment: an assessment of the impact or likely impact of a development on biodiversity values which is prepared in accordance with the BAM.
Impacts on biodiversity values: loss in biodiversity values from direct or indirect impacts of development in accordance with Chapters 8, 1 and 10.
Important wetland means:
(a) a wetland that is listed in the Directory of Important Wetlands of Australia
(DIWA) from time to time, and
(b) for the purposes of all paragraphs except 4.2.1.6 the actual location on the
ground that corresponds to a SEPP 14 Coastal wetland
(c) for the purposes of Paragraph 4.2.1.6:
(i) a SEPP 14 Coastal Wetland, and
(ii) the actual location on the ground that corresponds to a SEPP 14 Coastal
Wetland.
Individual: in relation to organisms, a single, mature organism that is a threatened species, or any additional threatened species listed under Part 13 of the EPBC Act.
Intact vegetation: vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present.
Intrinsic rate of increase (*ir*): an estimate of the rate of gain for an attribute at a biodiversity stewardship site from actions undertaken as part of the management plan. The intrinsic rate of increase is specified for an attribute according to the formation of the PCT being assessed (see Appendix 8).
Landscape attributes: in relation to a Development Site or a biodiversity stewardship site, native vegetation cover, vegetation connectivity, patch size and the strategic location of a biodiversity stewardship site.
Large tree benchmark: is the largest stem size class for a PCT as determined by the benchmark for the PCT.
Life cycle: the series of stages of reproduction, growth, development, aging and death of an organism.
Life form: the form that is characteristic of a particular species at maturity. In the BAM, life form has the same meaning as growth form for flora species.
Linear shaped development: development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length.
Litter cover: the percentage ground cover of all plant material that has detached from a living plant, including leaves, seeds, twigs, branchlets and branches (<10cm in diameter).
Local population: the population that occurs in the study area. In cases where multiple populations occur in the Development Site or a population occupies part of the Development Site, impacts on each subpopulation must be assessed separately.
Local wetland: any wetland that is not identified as an important wetland (refer to definition of *Important wetland*).
Loss of biodiversity: the loss of biodiversity values from a Development site, native vegetation clearing site or land where biodiversity certification is conferred.
Major project: State Significant Development and State Significant Infrastructure.

Minimise: a process applied throughout the development planning and design life cycle which seeks to reduce the residual impacts of development on biodiversity values.
Mitchell landscape: landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.
Multiple fragmentation impact development: developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines.
Native ground cover: all native vegetation below 1m in height, including all such species native to NSW (i.e. not confined to species indigenous to the area).
Native ground cover (grasses): native ground cover composed specifically of native grasses. **Native ground cover (other):** native ground cover composed specifically of non-woody
native vegetation (vascular plants only) <1m in height that is not grass (e.g. herbs, ferns).
Native ground cover (shrubs): native ground cover composed specifically of native woody vegetation <1m in height.
Native mid-storey cover: all vegetation between the over-storey stratum and a height of 1m (typically tall shrubs, under-storey trees and tree regeneration) and including all species native to NSW (i.e. native species not local to the area can contribute to mid-storey structure).
Native over-storey cover: the tallest woody stratum present (including emergent) above 1m and including all species native to NSW (i.e. native species not local to the area can contribute to over-storey structure). In a woodland community, the over-storey stratum is the tree layer, and in a shrubland community the over-storey stratum is the tallest shrub layer. Some vegetation types (e.g. grasslands) may not have an over-storey stratum.
Native plant species richness: the number of different native vascular plant species that are characteristic of a PCT.
Native vegetation: has the same meaning as in section 1.6 of the BC Act.
Native vegetation cover: the percentage of native vegetation cover on the subject land and the surrounding buffer area. Cover estimates are based on the cover of native woody and
non-woody vegetation relative to the approximate benchmarks for the PCT, taking into
account vegetation condition and extent. Native over-storey vegetation is used to determine
the percent cover in woody vegetation types, and native ground cover is used to assess cover in non-woody vegetation types.
Number of trees with hollows: a count of the number of living and dead trees that are hollow bearing.
Offset rules: are those established by the BC Regulation.
Onsite measures: measures and strategies that are taken or are proposed to be taken at a Development site to avoid and minimise the direct and indirect impacts of the development on biodiversity values.
Operational Manual: the Operational Manual published from time to time by DPIE, which is a guide to assist assessors when using the BAM.
Patch size: an area of intact native vegetation that:
a) occurs on the Development site or biodiversity stewardship site, and
b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).
Patch size may extend onto adjoining land that is not part of the Development site or biodiversity stewardship site.
PCT classification system: the system of classifying native vegetation approved by the NSW Plant Community Type Control Panel and described in the BioNet Vegetation Classification.
Percent cleared value: the percentage of a PCT that has been cleared as a proportion of its pre-1750 extent, as identified in the BioNet Vegetation Classification.
Plant community type (PCT): a NSW plant community type identified using the PCT classification system.
Plot: an area within a vegetation zone in which site attributes are assessed.
Population: a group of organisms, all of the same species, occupying a particular area.
Probability of reaching benchmark: the probability of a specific attribute or growth form group reaching benchmark conditions in the vegetation zone at the end of the management timeframe.
Proponent: a person who intends to apply for consent or approval to carry out development, clearing, biodiversity certification or for approval for infrastructure.
Reference sites: the relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration: the proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height <5cm within a vegetation zone.
Residual impact: an impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits: the retirement of biodiversity credits from a biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer: an area of land determined according to Appendix 3.
Risk of extinction: the likelihood that the local population or CEEC or EEC will become extinct either in the short term or in the long term as a result of direct or indirect impacts on the viability of that population or CEEC or EEC.
SEPP 14 Coastal wetland: a wetland to which *State Environmental Planning Policy No 14 – Coastal Wetlands* applies or an area that is identified as a coastal wetland within the meaning of the term *coastal wetlands and littoral rainforests area* for the purposes of *Coastal Management Act 2016*.
Site attributes: the matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development: a development other than a linear shaped development, or a multiple fragmentation impact development.
Site context: the value given to landscape attributes of a Development Site or biodiversity stewardship site after an assessment undertaken in accordance with Section 4.3.
Species credit species: are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.
Species credits: the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
State Significant Development: has the meaning given by Division 4.1 of Part 4 of the EP&A Act.
State Significant Infrastructure: has the meaning given by Part 5.1 of the EP&A Act. **Stream order:** has the same meaning as in Appendix 3.

Subject land: is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a Development Site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threat status class: the extent to which a species or ecological community is threatened with extinction, or the extent to which a PCT is estimated to have been cleared (see *Percent cleared value*).
Threatened Biodiversity Data Collection: part of the BioNet database, published by DPIE and accessible from the BioNet website at www.bionet.nsw.gov.au.
Threatened ecological community (TEC): means a critically endangered ecological community, an endangered ecological community or a vulnerable ecological community listed in Schedule 2 of the BC Act.
Threatened species: critically endangered, endangered or vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Threatened species survey: a targeted survey for threatened species undertaken in accordance with Section 6.5.
Threatened species survey guidelines: survey methods or guidelines published by DPIE from time to time at www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/surveys-and-assessments.
Total length of fallen logs: the total length of logs present in a vegetation zone that are at least 10cm in diameter and at least 0.5m long.
Transect: a line or narrow belt along which environmental data is collected.
Upland Swamp Policy: the document entitled *Addendum to NSW Biodiversity Offsets Policy for Major Projects: Upland swamps impacted by longwall mining subsidence* as in force on the day when the BAM is published until such time as the Environment Agency Head publishes any further document for the purpose of it being adopted by the BAM as the Upland Swamp Policy.
Vegetation Benchmarks Database: a database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by DPIE and is part of the BioNet Vegetation Classification. It is available at www.environment.nsw.gov.au/research/Visclassification.htm.
Vegetation class: a level of classification of vegetation communities defined in Keith (2004)[4]. There are 99 vegetation classes in NSW.
Vegetation formation: a broad level of vegetation classification as defined in Keith (2004)[4]. There are 16 vegetation formations and sub-formations in NSW.
Vegetation integrity: the condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT.
Vegetation integrity score: the quantitative measure of vegetation condition calculated in accordance with Equation 15 or Equation 16.
Vegetation zone: a relatively homogenous area of native vegetation on a Development Site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Viability: the capacity of a species to successfully complete each stage of its life cycle under normal conditions so as to retain long-term population densities.
Vulnerable ecological community (VEC): an ecological community specified as vulnerable in Schedule 2 of the BC Act and/or listed under Part 13, Division 1, Subdivision A of the EPBC Act.
Wetland: an area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water (see also *Important wetland* and *Local wetland*).
Woody native vegetation: native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs.

Acronyms

Acronym	Definition
BAR	Biodiversity Assessment Report
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Credit Calculator
BASSR	Biodiversity Steward Site Assessment Report
BC Act	Biodiversity Conservation Act 2016
BOM	Bureau of Meteorology
BC Act	Biodiversity Conservation Act 2016
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
DAWE	Department of Agriculture, Water and the Environment
DPIE	Department of Planning, Industry and Environment
DPI	Department of Primary industries
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FBA	Framework of Biodiversity Assessment
GDE	Groundwater dependent ecosystems
GIS	Geographic information system
GPS	Global positioning system
IBRA	Interim Biogeographic Regionalisation for Australia
KTP	Key threatening process
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NP&W Act	National Parks and Wildlife Act 1974
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEH	Office of Environment and Heritage (Now DPIE)
PCT	Plant Community Types
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAT	Spot Assessment Technique (for koala)
SEARS	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TAFE	Technical and Further Education Institute
TEC	Threatened Ecological Community
TSPD	Threatened Species Profile Database
VEC	Vulnerable Ecological Community
VIS	Vegetation Information System
WIRES	Wildlife Information, Rescue and Education Services