Hera Resources Pty Limited
ABN: 72 138 992 999

Response to Submissions

for the

Hera Mine Modification 5
SSD 4384

Prepared by:

R.W. CORKERY & CO. PTY. LIMITED

May 2019

This page has intentionally been left blank

Hera Resources Pty Limited
ABN: 72 138 992 999

Response to Submissions

for the

Hera Mine Modification 5
SSD 4384

Prepared for:

Hera Resources Pty Limited
ABN: 72 138 992 9992
Suite 5 Level 2
60-62 McNamara Street
PO Box 8626
ORANGE NSW 2800

Telephone: (02) 6363 5200
Fax: (02) 6361 4711
Email: office@aureliametals.com.au

Prepared by:

R.W. Corkery & Co. Pty. Limited
Geological & Environmental Consultants
ABN: 31 002 033 712

Brooklyn Office:
1st Floor, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

Telephone: (02) 9985 8511
Email: brooklyn@rwcorkery.com

Orange Office:
62 Hill Street
ORANGE NSW 2800

Telephone: (02) 6362 5411
Email: orange@rwcorkery.com

Brisbane Office:
Suite 5, Building 3
Pine Rivers Office Park
205 Leitchs Road
BRENDALE QLD 4500

Telephone: (07) 3205 5400
Email: brisbane@rwcorkery.com

Ref No. 659/33 – Version 2

May 2019

R.W. CORKERY & CO. PTY. LIMITED

This Copyright is included for the protection of this document

CONTENTS

Page

This page has intentionally been left blank

1. INTRODUCTION

This document provides a response to submissions provided to the Department of Planning and Environment (DPE) following the public exhibition of the *Statement of Environmental Effects* (Hera Resources, 2019) prepared to support an application under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* by Hera Resources Pty Limited (the Applicant) to modify SSD 4384 for the Hera Mine (the Mine).

The following government agencies notified the DPE that they had no further comment in relation to the Proposed Modification.

- Office of Environment and Heritage – Heritage Division
- Resources Regulator
- Roads and Maritime Services

Submissions or comments requiring a response were received from the following government entities and have been reviewed by the Applicant.

- Bogan Shire Council
- Cobar Shire Council
- Environment Protection Authority
- Office of Environment and Heritage
- Department of Planning and Environment – Hazards
- Department of Planning and Environment – Division of Resources & Geoscience
- Department of Industry – Fisheries / Water / Land

No public submissions were received. This document addresses comments and requests for additional information from the above agencies. Each submission is addressed individually in the following sections, with submissions presented in *italics* and the Applicant's response presented in normal text.

2. BOGAN SHIRE COUNCIL

Comment(s)

Council notes Cobar Shire Council and Aurelia have a Voluntary Planning Agreement (VPA) whereby that council receives, inter alia, $60,000 pa + CPI for road maintenance. That sum equates to $3,000/km for the portion of the route within its LGA. Council thus seeks urgent discussions with the Aurelia with the aim of securing a similar agreement that will enable the delivery of road repair, maintenance and renewal in the Bogan LGA. The sum envisaged is $3,000 x 60 kms = $180,000 pa + CPI.

Response

The Applicant acknowledges Council's request and will continue to liaise with Council regarding the details of a VPA. It is envisaged that this process will be ongoing throughout the development application assessment process and the Applicant will keep the Department of Planning and Environment updated on the status of the discussions.

Comment(s)

Council seeks more definitive information from the Proponent as to its intentions regarding the future life of the Hera Gold Mine. Council notes the Mining Leases run until mid-2034 (ML 1686) and end 2037 (ML 1746), yet the current development consent only runs until December 2022. Council seeks discussions with the Proponent on this matter as soon as possible to gain a greater understanding of what is planned and the implications for Council's hard and soft infrastructure planning.

Response

The Applicant would be pleased to brief Council regarding the proposed future operations of Hera Mine to better inform Council's infrastructure planning and will make arrangements to do so in the coming weeks.

Comment(s)

Council understands from the SEE that the Proponent wishes to explore and further develop the adjacent Nymagee Copper Mine that closed in 1975 - nearly 45 years ago. Council would thus like a briefing from Aurelia so as to assist Council in its strategic planning.

Response

The Applicant would be pleased to provide a briefing regarding the Nymagee Mine to better inform Council's infrastructure planning and will make arrangements to do so once sufficient information is available.

3. COBAR SHIRE COUNCIL

Comment(s)

Council seeks more definitive information from the Proponent as to its intentions regarding the future life of the mine. Council raises this as an issue because the Mining Leases run until mid-2034 (ML 1686) and end 2037 (ML 1746), yet the current development consent only runs until December 2022. Council seeks discussions with the Proponent on this matter as soon as possible to gain a greater understanding of what is planned.

Response

The Applicant would be pleased to arrange a briefing to provide Council with a greater understanding of future plans for the Hera Mine and will make arrangements to do so in the coming weeks.

Comment(s)

First and foremost, as regards future plans for the Nymagee Copper Mine, Council seeks detailed discussions with the DPE, the Proponent and the Resources Regulator as to the assessment and determination process for the disused mine. In particular, Council seeks dialogue regarding:

- The *assessment process under the EP&A Act;*

- *What is to be the proposal for reactivating this closed mine – exploration, mine development and operations – and what is or will be the relationship, if any, with the existing Hera Gold Mine?*
- *What are the details regarding using the current versus the proposed new water pipeline?*
- *What are the plans regarding using the water from the Nymagee Mine versus using groundwater from production bores for make-up process water for the Hera Mine?*
- *If the water is not pumped to the Hera Mine, then what are to be the details of the proposed evaporation* pond?

At this point in time Council is not convinced the future of the Nymagee Copper Mine can be 'intertwined' with the Hera Gold Project, and doubts that a minor modification proposal submitted under Hera's banner will suffice.

Response

The Applicant acknowledges Council's comments; however, it is noted that the issues raised are not relevant to the current application. The Applicant would be pleased to further discuss the above issues with Council at the appropriate stage of any relevant future development application.

Comment(s)

The EIS contends the proposed increased height of the Southern Waste Rock Emplacement would be unlikely to be visible to viewers to the east and west of the Mine Site. Council wishes to be advised what does it mean for viewers from the north and the south?

Response

The Applicant notes that the only publicly accessible vantage points with views of the Mine Site are located to the east, on the Nymagee – Condobolin Road, and west, on Burthong Road.

Notwithstanding the above, in relation to views from private land to the north of the Mine Site, the proposed Southern Waste Rock Emplacement would have the same maximum elevation on 350m AHD as the approved Northern Waste Rock emplacement. As a result, visual amenity impacts from the north would be no greater that those approved.

In relation to views of the Southern Waste Rock Emplacement from the south, the emplacement is more than 2.5km from the southern boundary of the Mine Site and an 10m increase in height of the emplacement would be imperceptible at that distance.

As a result, based on the relative isolation of the Mine Site, both from residential locations and public vantage points, it is not anticipated that the increased height of the Southern Waste Rock Emplacement would significantly impact on visual amenity surrounding the Mine Site.

Comment(s)

If the Applicant is not able to construct the Water Management Dam, the Dam Safety Allowance will be required to be met within the Tailings Storage Facility itself. As a result, the capacity of the Tailings Storage Facility would be reduced, requiring construction of Stage 3 of the Facility earlier than would otherwise be the case. The SEE states 'this would adversely impact on the robustness of the Mine' but does not elaborate how. What does this statement mean?

Response

In the event that the Applicant is unable to construct the Water Management Dam, the Dam Safety Allowance would be required to be met within the Tailings Storage Facility. This would substantially reduce the capacity of the Tailings Storage Facility and bring forward the requirement for further lifts of the Tailings Storage Facility embankment.

However, more critical is that the proposed Water Management Dam would permit removal of water from the surface of the Tailings Storage Facility. The Applicant states that dry tailings are substantially more stable than wet tailings. As a result, a dry Tailings Storage Facility presents lower risks than a facility with a substantial volume of water on the surface. The Water Management Dam would provide a storage for water that cannot be discharged, whether that be from the Tailings Storage Facility or from elsewhere (provided of course that the minimum DSA capacity is maintained). In particular, during 2017/2018 financial year, the Applicant experienced substantial groundwater inflows to the underground workings, necessitating storage of substantial volumes of water on the Tailings Storage Facility. Should increased inflows be experienced again, the Proposed Modification would avoid the need for storage of that water within the Tailings Storage Facility.

Comment(s)

Council also seeks information as to any groundwater contamination arising from acid generation within the acid-forming waste rock encapsulation area and monitoring of leachate within the Leachate Management Pond. Council seeks an assurance that there is prompt transportation of acid-forming material back underground or temporary encapsulation of this material.

Response

The Applicant acknowledges Council's comment, however, it is noted that the issues raised are not relevant to the current application. Notwithstanding this, the prevention of groundwater contamination through the proper management of potentially acid-forming material within the Waste Rock Emplacement and Leachate Management Pond is a priority for the Applicant.

In order to firstly avoid the generation of any acidic leachate from the stockpiled waste rock and secondly to manage any such leachate generated, the following management measures are implemented.

- PAF material is preferentially placed directly into completed stopes and therefore, where practicable, is not brought to the surface.
- NAF material is stored on the Waste Rock Emplacement from where it is used on-site or returned underground for placement within completed stopes.
- Excess PAF material brought to the surface is temporarily stored in the Waste Rock Emplacement before being returned underground and placed into completed stopes.

- The Waste Rock Emplacement has been constructed to minimise the discharge of potentially acidic leachate with the following design parameters.
  - The footprint of the emplacement was extracted to bedrock to minimise the potential for seepage of leachate.
  - A bund has been constructed around the perimeter of the cell to capture and divert any potentially acidic leachate to the Leachate Management Pond and to divert any other surface water away from the cell. These structures are designed to cater for a 1 in 100-year, 72 hour ARI rainfall event.
  - Any water that collects within the Leachate Management Pond is promptly pumped to the Processing Plant.
- Waste rock is transported underground for placement within stopes. Once placed within completed stopes, the potential for further generation of acidic leachate is limited as a result of the limited availability of oxygen for oxidation reactions. PAF waste rock placed on the surface is not encapsulated as it is only temporarily stockpiled on the surface.
- Visual inspections of the Leachate Management Pond are undertaken during the life of the emplacement to identify any issues with the proposed management measures.

As a result of the proposed approach to managing waste rock and acid mine drainage, the risks associated with acid mine drainage resulting from the operation of the Waste Rock Emplacement and Leachate Management Pond is considered to be low. Further details regarding the management of waste rock and potential groundwater impacts are provided in Sections 2.7 and 4.3 of the original *Environmental Assessment*, respectively.

Comment(s)

Of concern to Council is that during the 2017/2018 AEMR reporting period, several exceedances occurred in the criteria for the concentration of Weak Acid Dissociable (WAD) cyanide present in discharges to the Tailings Storage Facility and the Process Water Dam. Council also notes the plant was shut down due to a WAD cyanide incident on 14 January 2018. Council seeks details as to any wildlife visitations and mortality associated with the exceedances.

These exceedances criteria are 10mg/L for discharges to the Tailings Storage Facility, and 20mg/L (90^{th} percentile) or 30mg/L (maximum) for discharges to the Process Water Dam. Disappointingly there were also several occasions when no result was recorded.

Council urges the regulators to impose the most stringent of consent/licence conditions to ensure absolute safety to human health and the environment across operations, monitoring and performance reporting. In particular, Council requests DPE/EPA redouble their efforts to impose conditions that will protect wildlife as regards bioavailable cyanide concentrations in the tailings and process water dams.

Furthermore, on the matter of surface water management, during the 2017-17 AEMR reporting periods, there were two reportable incidents where discharges from Licence Point 3 on 20 July 2017 and 16 December 2016 exceeded a number of water quality parameters identified in the EPL.

Again, Council urges rigorous and demanding safeguards be imposed in any revised consent.

Response

The Applicant acknowledges Council's comments, however, it is noted that the issues raised are not relevant to the current application. Notwithstanding this, the Applicant notes that all relevant authorities, including the NSW Environment Protection Authority (EPA), were notified and provided with full details of the non-compliances identified above. Furthermore, the Applicant has been in discussion with EPA and DPE regarding the ongoing management of WAD cyanide in tailings discharged to the Tailings Storage Facility and continues to work to ensure compliance with all relevant criteria.

The Applicant notes that the approved WAD cyanide limits for discharge to the Tailings Storage Facility (10mg/L) or the Process Water Dam (20mg/L - 90th percentile; 30mg/L - maximum) are each below the WAD cyanide concentrations that are expected to pose a risk to wildlife (50mg/L) (NICNAS, 2010; Department of Industry, Innovation and Science, 2008). The documents titled *Priority Existing Chemical Assessment Report No 31 – Sodium Cyanide* (NICNAS, 2010) and *Cyanide Management: Leading Practice Sustainable Development Program for the Mining Industry* (Department of Industry, Innovation and Science, 2008) confirm that WAD cyanide levels below 50mg/L in tailings storage facilities are unlikely to result in wildlife mortalities. It is noted that only two non-compliances during the 2017 to 2018 reporting period exceeded 50mg/L. On one occasion (250mg/L – 14/01/2018) this resulted in the shutdown of plant until the problem was rectified, whilst on the second occasion (100mg/L – 25/04/18) WAD cyanide concentrations returned to below 50mg/L within 24 hours. Whilst it is recognised that this is above the licenced criteria, no wildlife mortalities associated with the exceedances were recorded by the Applicant and if any such impacts were recorded, they would be reported to the relevant authorities.

Comment(s)

Council notes the EIS refers to attended daytime noise monitoring since the commencement of the project is inaudible at surrounding residences. However, Council suggests that the night-time noise from the Mine is much more important as this is when people are sleeping and the background noise is much less. Hence, could the DPE, the EPA and the Proponent please advise what the night-time noise levels are at the closest residences and do they comply with the required standard? Council considers that there should be best practice night-time noise limits applied.

Response

The Applicant will continue to manage noise in accordance with the *Noise Management Plan* which requires attended noise monitoring at each monitoring location to include three measurements taken over a 24-hour period so that noise levels during the full range of operating times (day, evening and night) are monitored. The results of attended noise monitoring undertaken in July 2017, and presented in the 2017-18 AEMR, indicate that the maximum $L_{Aeq\ (15\text{-}minute)}$ Site Contribution was 32dB at R3 on 24 July 2017 at 11:10pm. This is substantially below the 35dB night-time noise criterion identified in the consent. No exceedances of day-time or evening criteria were recorded during attended noise monitoring.

It is noted that an agreement between the Applicant and the occupier of residence R3 in relation to noise impacts has been signed. That agreement permits the Applicant to exceed the noise criteria at Residence R3. However, monitoring indicates that no exceedances are occurring, and that agreement has yet to be relied upon.

Comment(s)

Council notes the DPE letter dated 3 February 2017 only permits vehicle movements during daylight hours. Therefore, Council believes it reasonable to expect that any transportation on the secondary route (namely Burthong Road, Priory Tank Road, Kidman Way and the Barrier Highway) will similarly be during daylight hours only (rather than to 10pm).

On the compliance front, Council notes there were breaches of the consent where eleven individual truck movements departed the Mine outside of daylight hours in August 2016 and December 2017, and one month the then permissible average of 4 movements/2 loads of concentrate transported from the Mine was exceeded.

Whilst the reporting of compliance performance is noteworthy, Council requests that the Proponent redouble its efforts to ensure compliance with all consent conditions all of the time.

Response

The Applicant acknowledges Council's comments. In the interests of consistency and ease of management for both the Applicant and the relevant agencies, the Applicant agrees to limit the transportation of concentrate via the secondary Concentrate Transportation Route (i.e. Burthong Road, Priory Tank Road, Kidman Way, Barrier Highway) to daylight hours on the same terms as for the primary Concentrate Transportation Route.

The Applicant notes that Condition 7 of Schedule 2 of PA 10_0109 would be required to be updated to reflect the proposed change in approved concentrate transportation hours. Point 3.1 of the Statement of Commitments, included as Appendix 5 of PA 10_0109, would similarly be required to be updated to reflect the proposed concentrate transportation hours.

The suggested wording for Condition 7 of Schedule 2 of PA 10_0109 is as follows.

7. The Proponent shall comply with the operating hours in Table 1.

Table 1: Operating hours

Activity	***Operating Hours***
Vegetation clearing and topsoil stripping	*7am to 6pm, 7 days per week*
Construction	*24 hours, 7 days per week*
Mining, maintenance and processing operations	
Rehabilitation	*Day / Evening*
Transportation of lead and zinc concentrate and gold doré from the site	*Daylight hours, 7 days per week*

Note: Conditions 5 and 6 of Schedule 3 include restrictions on blasting times.

The Applicant will continue to work to ensure compliance with all relevant conditions of consent.

Comment(s)

Council would appreciate advice from the Proponent as to the outcomes to date of its commitments to implementing the following:

- *both the proponent and third-party contractors will engage new employees from the surrounding community in preference to candidates from elsewhere when of equivalent experience and qualifications.*
- *encourage the employment of members of the Aboriginal community in the workforce; and*
- *give preference to local suppliers of equipment, services or consumables, where practicable and cost-competitive.*

Response

The Applicant acknowledges Council's comments, however, it is noted that the issues raised are not relevant to the current application. Notwithstanding this, the Applicant will continue to prioritise diversity in the workplace and give preference to local employees and suppliers wherever practicable. To this end, employment opportunities will continue to be advertised in local media, including the Cobar Weekly, with preference given to employees within a 300km radius of the Mine Site, where appropriate. It is noted that this arrangement not only benefits the local community but provides a commercial benefit to the Applicant as commuting times are a significant factor in managing fatigue in the workplace. Local suppliers, from both Nymagee and Cobar, are also preferentially contracted wherever practicable and cost competitive. The Applicant notes that Nicholson's of Nymagee, a local civil contracting firm based in Nymagee, is one of the most substantial contractors used on site and is regularly contracted for on-site civil projects and labour hire.

Comment(s)

Council appreciates the collaboration achieved to date with the Proponent in securing a VPA. Moving forward, Council seeks an update in the CPA financial contributions to give recognition to the considerable amount of management time and costs incurred by Council in responding to matters pursuant to the Hera Gold Project. The related tasks include, inter alia:

- *Reviewing and preparing submissions to the DPE on frequent modifications;*
- *Travelling to and participating in Community Consultative Committee Meetings;*
- *Meetings with Company and Departmental officials; and*
- *Managing the Community Enhancement Fund.*

Thus, the Council seeks an additional $25,000 per annum + CPI for the remaining duration of the VPA. Council requests this matter be satisfactorily resolved before any granting of consent to the Modification is contemplated.

Response

The Applicant acknowledges Council's request and will continue to liaise with Council regarding the details of a VPA. It is envisaged that this process will be ongoing throughout the development application assessment process and the Applicant will keep the Department of Planning and Environment updated on the status of the discussions.

4. ENVIRONMENT PROTECTION AUTHORITY

Comment(s)

The EPA is concerned that the SEE does not adequately address management of air pollutants including dust. The EPA notes that the premises currently has a HVAS (high volume air sampler) on the premises to provide real-time dust monitoring and a project specific Trigger Action plan for dust is to be developed.

Recommended conditions for the consent:

1. *Any activity in or on the premises must be carried out by such practicable means as to prevent or minimise the emission into the air of air pollutants (which includes dust).*
2. *Trucks entering and leaving the premises that are carrying loads of dust generating materials must have their loads covered at all times, except during loading and unloading.*
3. *Prior to the commencement of excavation of the Water Management Dam, a Trigger Action Response Plan for dust management must be prepared by the proponent. The plan should include but not limited to:*
    a) *Define dust triggers levels;*
    b) *Locations of dust monitoring equipment;*
    c) *Monitoring program; and*
    d) *Proposed dust management control measures.*

Response

The Applicant agrees with the recommended conditions of consent.

Comment(s)

The EPA notes that the water management dam will be located within the existing footprint of the TSF. The SoEE refers to the existing surface water management structures within the TSF footprint but does not address potential sediment and erosion issues created by the stockpiling of material in laydown areas or vehicle movements during construction.

Recommended condition of consent:

1. *Prior to the commencement of the proposal, the proponent must develop an erosion and sediment control plan specific to the Water Management Dam construction.*

Response

That Applicant notes that the proposed Water Management Dam is not within the Tailings Storage Facility footprint. Rather the Water Management Dam is located immediately to the west of the approved Tailings Storage Facility. Notwithstanding this, the Applicant would develop an *Erosion and Sediment Control Plan* specific to the Water Management Dam prior to the commencement of construction.

Comment(s)

The EPA notes the proposed water management structures design, sizing and operating procedures are adequate to maintain containment requirements (1 in 100 year, 72-hour rainfall event) for the current and additional wastewater volumes.

The SEE states that the liner permeability of the proposed water management dam will be 1 x 10 ^{9}m/s over 1m (or equivalent), which is adequate. If an "equivalent" liner permeability is proposed then this should be properly demonstrated to be equivalent to 1 x 10^{-9}m/s over 1m.

Recommend condition of consent:

1. *Water management structures relating to SSD 4384 must be sized to designed to contain a 1 in 100 year, 72 hour rainfall event.*
2. *Prior to commencing construction of the Water Management Dam the applicant must provide in writing to EPA the type of material to be installed for the liner and demonstrate how the proposed liner is equivalent to the EPA's liner permeability requirement of 1 x 10-9m/s over 1m.*
3. *The applicant must provide in writing to the EPA certification that the Water Management Dam liner has been installed and meets the permeability requirement of 1 x 10-9m/s over 1m.*

Response

In relation to each of the matters raised, the Applicant notes the following.

1. The water management structures relating to SSD 4384 have been designed to contain a 1 in 100-year, 72-hour rainfall event.
2. The Applicant's preferred liner option would continue to be the in-situ geology or a combination of in-situ geology and locally obtained compacted earth. Notwithstanding this, the Applicant agrees to provide EPA with written confirmation of the type of liner material to be installed for the Water Management Dam with a justification of how the proposed liner meets EPA's permeability requirements.
3. The Applicant agrees to provide EPA with certification that the Water Management Dam liner meets the EPA's installation and permeability requirements following construction of the liner.

5. OFFICE OF ENVIRONMENT AND HERITAGE

Comment(s)

Table 8-1 of the BDAR outlines the proposed mitigation measures for the project. OEH is generally supportive of these measures but suggests that mitigation measures be adaptive to account for changes. For example, Table 8-1 indicates that two Grey-crowned Babbler dreys may need to be relocated. The location of these dreys is provided. It is possible that dreys may be abandoned, and new dreys constructed making the information provided redundant.

Recommendation:

The mitigation measures be adaptive and includes surveys to ensure that the mitigation measures proposed are still current and relevant.

Response

Table 8-1 of the BDAR has been updated to reflect more adaptive mitigation measures. The BDAR is included in full as Appendix 1 of this report.

Comment(s)

Section 9 of the BDAR outlines the offsetting requirement of the project. Table 9-1 indicates that 300 ecosystem credits are required for impact to 11.4 ha of PCT 103. This is confirmed by the BAM Credit Calculator report provided in Appendix B of the BDAR.

Table 9-3, which provides a summary of BioBanking (from previous Hera development projects) and BAM (Mod 5) credits, suggests that the number of ecosystem credits required for Mod 5 is 239 for 9.10ha of impact.

Recommendation:

Table 9-3 be amended to reflect the credit requirement generated by the BAM Credit Calculator.

Response

Table 9-3 of the BDAR has been amended to reflect the credit requirement generated by the BAM Credit Calculator. The BDAR is included in full as **Appendix 1** of this report.

Comment(s)

Table 9-3 provides the offsetting options for MOD 5 as well as previous Hera Mine developments. OEH notes that these previous offsetting commitments have yet to be realised as the proposed Chelsea BioBanking Site has yet to be finalised. The BDAR indicates that the proponent is in the process of commissioning a Biodiversity Stewardship Site Assessment Report (BSSAR) to establish a Biodiversity Stewardship Site on 'Chelsea'.

The credits in Table 9-3 are a mix of BioBanking and BAM credits. The BDAR correctly states that the BioBanking credits will need to be converted to BAM credits and that there can be no certainty that there are enough credits to retire the MOD 5 credit requirement until this occurs. The BDAR provides the commitment that any residual offsetting requirement will be achieved using other approved mechanisms under the BC Act.

Response

The Applicant confirms that any residual offsetting requirements unable to be secured using BAM credits would be achieved using approved mechanisms under the *Biodiversity Conservation Act 2016*.

6. DEPARTMENT OF PLANNING AND ENVIRONMENT – HAZARDS

Comment(s)

Condition 41, Hazardous Materials Management Plan should be updated as applicable and Condition 33 (reproduced below) will continue to apply.

Dangerous Goods

33. Transport of all dangerous goods to or from the site shall be undertaken in strict accordance with Australian Code for the Transport of Dangerous Goods by Road and Rail.

Response

The Applicant would review and update, if required, the *Hazardous Materials Management Plan* following any approval.

7. DEPARTMENT OF PLANNING AND ENVIRONMENT – DIVISION OF RESOURCES AND GEOSCIENCE

Comment(s)

Please note Exploration License Application 5733 (Act 1992) (ELA 5733), held by Network Designers Australia Pty Ltd, exists over a broad regional area that includes a portion of the Chelsea Biodiversity Offset area. Identification of the title is to make the consent authority aware that there are other stakeholders with interests in the region.

Response

The Applicant acknowledges that ELA 5733 exists over a broad regional area and would continue to consult with relevant stakeholders, as required.

8. DEPARTMENT OF INDUSTRY – FISHERIES

Comment(s)

The SoEE should specifically address impacts on the aquatic ecology of Key Fish Habitats (Third order streams or larger (Strahler Stream Order System)).

Response

The Applicant notes that Watercourse A which traverses the western section of the Mine Site is a third-order stream. However, the Applicant contends that the stream does not provide Key Fish Habitat as it is ephemeral, with flows typically ceasing after a few hours or days, as is the case with the majority of "mapped" streams within the Cobar Region.

Notwithstanding the above, the Applicant notes that the Water Management Dam would be designed to contain a 1 in 10,000 year, 72-hour rainfall event and that an *Erosion and Sediment Control Plan* would be prepared for the construction phase of the Dam. As a result, the Proposal would not result in adverse impacts to Key Fish Habitat within the Mine Site, should it exist.

Comment(s)

The SoEE should detail the controls to be established for underground water pipelines that will pass through Key Fish Habitats between Nymagee mine site and Hera mine site as proposed below.

Response

The Applicant notes that the construction of the underground water pipeline between Nymagee Mine and Hera Mine does not form part of this application. The construction and operation of the proposed underground pipeline would be subject to a separate development application which would consider any potential Key Fish Habitats between the two mine sites, should they exist.

Comment(s)

The aquatic ecological environmental assessment should include the following information:

- *A recent aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) should be provided.*
- *Area which may be affected either by the development or activity should be identified and shown on an appropriately scaled map (and aerial photographs).*
- *Waterways within the area of development are to be identified.*
- *The extent of aquatic habitat removal and riparian vegetation removal or modification which may result from the proposed development,*
- *Details of the location of waterways crossings, including any access tracks, or water pipelines.*
- *Details of the methodology (e.g. trenching, boring) for any water pipelines passing through Key Fish Habitats.*

Response

See previous comments in relation to Key Fish Habitat and the Nymagee to Hera pipeline.

9. DEPARTMENT OF INDUSTRY – WATER

Comment(s)

The receipt of water from dewatering Nymagee Mine raises no concerns in regard to additional impacts on the surface or groundwater sources. However, it is recommended that the use of mechanical evaporators be minimised with a preference to retain the water underground at Nymagee Mine to minimize water loss.

Response

Since drafting of the *Statement of Environmental Effects* the Applicant acknowledges that the drought situation has worsened. As a result, the Applicant would ensure that unless there is a substantial change in the present climatic situation, the rate of receipt of water at the Hera Mine would be adjusted to reflect the makeup requirements of the Hera Mine. Evaporation of water, whether through the use of evaporators or naturally, would be minimised.

Comment(s)

It is recognised dewatering the Nymagee Mine and the transport of that water to the Hera Mine is not part of this modification application. This will be subject to separate impact assessment and approval requirements which Lands and Water will have key interest in.

Response

The Applicant acknowledges that the dewatering of the Nymagee Mine and the transport of that water to the Hera Mine would be subject to a separate impact assessment and approvals process. DPI – Water would be consulted with as part of this process.

Comment(s)

Water for dust suppression will be required for construction of the water storage, increase in height of the southern waste rock emplacement and the additional transportation rate. This will need to be sourced from existing supplies and within existing licensed entitlements.

Response

The Applicant acknowledges this requirement, while noting that the intent of MOD5 is to facilitate an additional water source, namely the Nymagee Mine.

Comment(s)

The SEE refers to the proposed amalgamation of the water access licences (WAL) held at Hera mine and the Nymagee mine and that this could occur following an approval being issued for Mod 5. As Mod 5 does not include an increase in dewatering of the Nymagee Mine, further impact assessment would be required before consideration could be given to this proposal.

Response

The Applicant acknowledges and agrees that the amalgamation of water access licences held at Hera Mine and Nymagee Mine would require further impact assessment prior to approval.

Comment(s)

The proponent must update the Water Management Plan prior to commencement of activities.

Response

The Applicant would review and update the *Water Management Plan* following any approval in consultation with DPI – Water and consistent with Condition 5 of Schedule 5 of PA10_0191.

Comment(s)

Installation of piezometers around the proposed water storage will need to be able to monitor upgradient and downgradient conditions. This monitoring in conjunction with an adequate mitigation and response protocol will be with the aim to ensure any change in the groundwater quality does not lower the beneficial use category of the groundwater source beyond 40m from the activity.

Response

The Applicant would detail the specific monitoring, mitigation and response protocols in the updated *Water Management Plan* which would be completed prior to the commencement of activities.

10. DEPARTMENT OF INDUSTRY – LAND

Comment(s)

Further detail is required regarding the maintenance of the proposed final landform of the modification. This would include what the ongoing maintenance would be require, or who would be responsible for this at the cessation of the mining lease.

Response

The Applicant notes that rehabilitation of the Mine Site is regulated by the Resources Regulator, in consultation with relevant agencies, and that the existing approved *Mining Operations Plan* will be required to be updated and approved prior to the commencement of the proposed activities.

This page has intentionally been left blank

Appendix 1

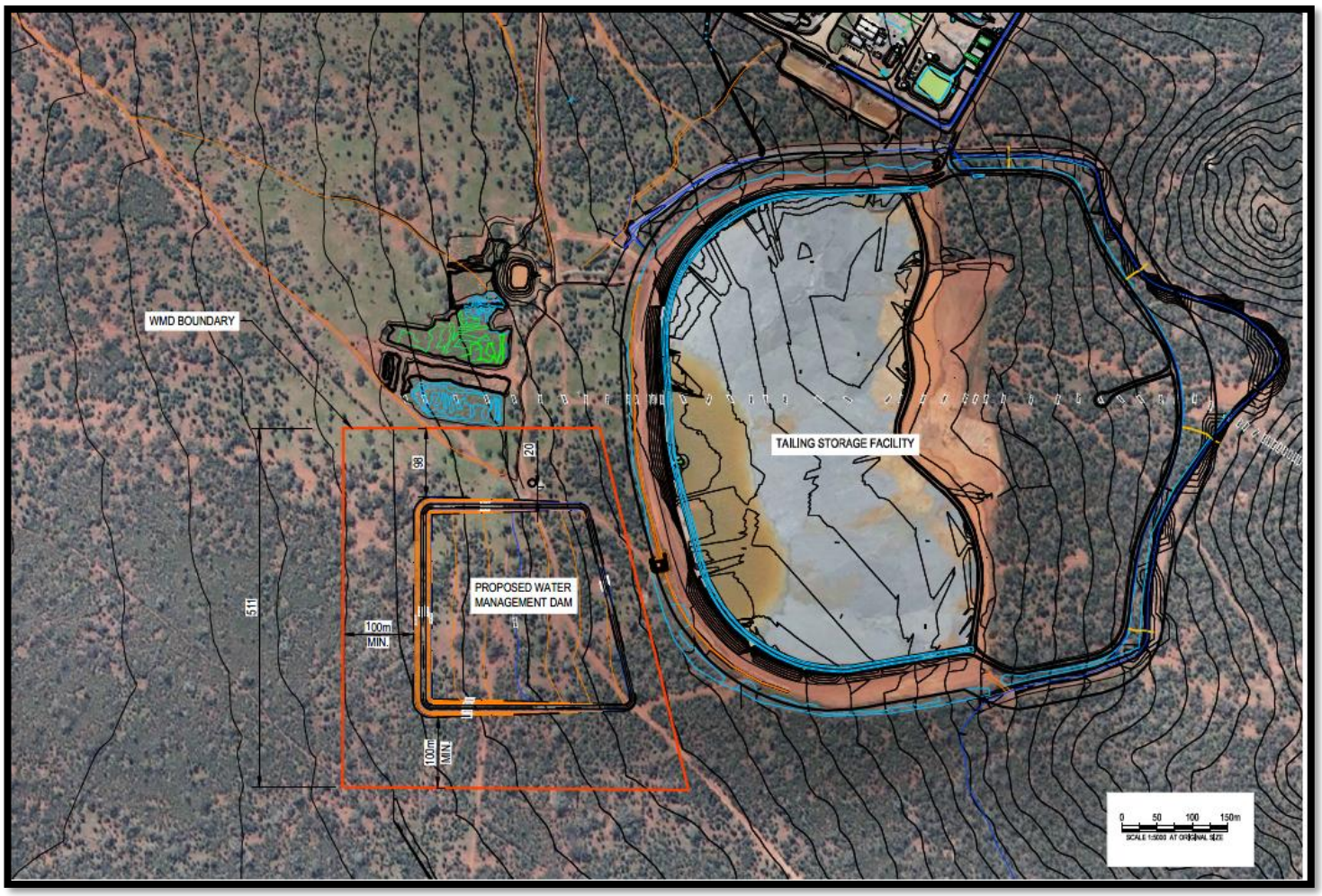
Biodiversity Development Assessment Report

(Total No. of pages including blank pages = 164)

This page has intentionally been left blank

Biodiversity Development Assessment Report
Aurelia Metal Limited
Hera Mine Modification 5

Cobar LGA NSW
February 2019



AREA Environmental Consultants & Communication
(a) 6 Belmore Street Dubbo NSW 2830
(b) “Thieles Gate” (Type 2 Conservation Agreement Area) 79 Huonbrook Rd Mullumbimby NSW 2482
Ph 0409 852 098
phil@areaenvironmental.com.au

ABN:29 616 529 867
Advanced Regional Environmental Assessments (AREA)

- ✓ Environmental impact assessment, approvals and auditing
- ✓ 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 and architecture

AREA Environmental Consultants & Communication acknowledge Traditional Owners of the country on which we work

ABN:29 616 529 867
Advanced Regional Environmental Assessments (AREA)

- ✓ Environmental impact assessment, approvals and auditing
- ✓ 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 and architecture

Cover picture: Proposed water management dam (the proposal). Source GHD.

Executive Summary

AREA Environmental Consultants & Communication (AREA) was commissioned by Aurelia Metals Limited to complete a Biodiversity Development Assessment Report (BDAR). This BDAR documents the assessment of potential and significant environmental impact of instillation of an external Water Management Dam at Hera Mine (the proposal).

The Hera Gold Mine (The Mine) is located on the property named 'Hera' (Lot 664, DP761702), approximately four kilometres south of the village of Nymagee in Western NSW (**Figure 1-1**). 'Hera' is also referred to as "The Peak" which refers to a geological feature on the property. The proposal is located at 'Hera', which is a 1,532.45-hectare property.

The proponent operates The Mine using underground mining techniques and flotation and carbon-in-leach processing methods to produce a base metal concentrate and gold dorè (unrefined gold bar).

The proponent requires a modification to PA 10_0191 under S75W of the *Environmental Planning and Assessment Act 1979* in accordance with the transitional arrangements of the Act associated with the repeal of Part 3A. An Environmental Assessment is being prepared to support the application for modification. The proponent has operated The Mine under development consent since 2012 and now proposes to seek approval for a proposed modification (MOD5) to include instillation of an external Water Management Dam to accommodate decant from the Tailings Storage Facility and other contaminated sources onsite. Water Management Dam MOD5 will affect up to 13.7 hectares (including a 25m buffer) of land which is the study area for this BDAR.

MOD5 includes the installation of a pipeline to receive water from the Nymagee Copper Mine. This BDAR refers only to the elements of MOD5 associated with land within The Mine and where the pipeline is proposed within The Mine it only affects cleared land in an existing road corridor.

This BDAR documents Stage 1 (assessing biodiversity values) and Stage 2 (impact assessment to biodiversity values) of the Biodiversity Assessment Method (2017). The BDAR considers potential effect to the environment by the proposal.

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

There are no drainage lines in the proposal.

The disturbance history in the study area is limited to 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 to 2012 when sheep were removed. Ninety-seven per cent of the study area supports native vegetation. The remaining three per cent is cleared – originally for farm tracks which are now Mine service roads). All native vegetation outside the study area will be retained. No State or Nationally listed threatened ecological communities would be impacted.

One Plant Community Type (PCT), PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion* was recorded in the study

area based on vegetation assessment plot results and landscape features matched against the VIS classification database. Vegetation condition was assessed using the site attributes compared with benchmark values. Up to 11.4 hectares of the proposal, including a 25m impact footprint buffer around the detailed design, will be affected. An 807.9 hectare patch of PCT103 occurs within a 1500m buffer of the study area and hence fragmentation will not occur and wildlife corridors will not be disrupted. PCT103 is **not** a component of a threatened or endangered ecological community listed in the BC Act or EPBC Act.

Threatened flora and fauna species were considered in implementation targeted surveys and the assessment of the impact.

Predicted species are those which are predicted to occur based on their known presence in the Interim Biogeographic Regionalisation for Australia (IBRA) subregion, the presence of associated PCTs, the size and condition of the vegetation patches on the site and listed species identified by the Office of Environment and Heritage in the BAM Credit Calculator (BAMCC) as ecosystem credit species or species credit species.

Predicted species were not afforded any further assessment if they are a vagrant in the IBRA subregion or if none of the habitat constraints for the species are present in the study area. The list of predicted species generated in the BAMCC was considered using these criteria which resulted in 11 ecosystem credit species and 14 species credit species. The 14 species credit species are referred to as candidate species.

Ecosystem credit species are those that can be reliably predicted based on the habitat surrogates. 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.

Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), Little Pied Bat (*Chalinolobus picatus*), Inland Forest Bat (*Vespadelus baverstocki*), Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) and Major Mitchells Cockatoo (*Cacatua leadbeateri*) were recorded at the study area. Of these Major Mitchells Cockatoo is a candidate species and the rest are ecosystem credit species, all are listed under the BC Act as vulnerable.

Elsewhere on ‘Hera’ the following additional listed species were recorded during the 2010 initial environmental assessment for project approvals or subsequently during pre-clearing assessment and annual monitoring between 2013 to 2018. These species have not been recorded at the study area:

- Large-eared Pied Bat (*Chalinolobus dwyeri*) vulnerable BC Act, EPBC Act
- Inland Forest Bat (*Vespadelus baverstocki*) vulnerable BC Act
- Eastern Cave Bat (*Vespadelus troughtoni*) vulnerable BC Act
- Major Mitchells Cockatoo (*Cacatua leadbeateri*) vulnerable BC Act
- Pied Honeyeater (*Certhionyx variegatus*) vulnerable BC Act
- Spotted Harrier (*Circus assimilis*) vulnerable BC Act
- White-browed Treecreeper (*Climacteris affinis*) vulnerable BC Act
- Hooded Robin (*Melanodryas cucullata*) vulnerable BC Act
- Turquoise Parrot (*Neophema pulchella*) vulnerable BC Act

- Gilberts Whistler (*Pachycephala inornata*) vulnerable BC Act
- Grey-crowned Babbler [eastern subspecies] (*Pomatostomus temporalis temporalis*) vulnerable BC Act
- Diamond Firetail (*Stagonopleura guttata*) vulnerable BC Act.

11 of the 12 of the threatened species listed above were assumed to have habitat affected by the proposal (Turquoise Parrot was not considered to be affected) and species not already predicted by the BAMCC were manually added as 'yes – recorded'. Species added were the microbats listed above.

No currently listed threatened flora species were recorded during the targeted survey on the site nor during previous assessments, including targeted orchid assessments during their ideal detection time in September 2018 (study area) and October 2011 (Hera). Based on the amount of collective survey effort on Hera (27.2 days and 18 nights – see running species recorded species list in **Appendix D**), and survey effort following requisite guidelines, the proposal would be unlikely to have a significant impact on any threatened flora species, populations or ecological communities listed under the BC Act, FM Act or the EPBC Act.

The proposal location was selected using a dedicated site planning and selection process which compared multiple sites using specific decision criteria. These criteria included the intent to avoid impact to remnant vegetation as much as possible. Hence the selection of a site is as close as possible to existing infrastructure and used existing important key attributes such as existing formed roads. A proposed pipeline associated with the proposal is located entirely within an existing mine road corridor (approved in the initial development consent) and entirely avoids impact to native vegetation.

A list of recommended mitigation measures, including biodiversity offsetting requirement is provided to address the impact during the construction and operational stages of the proposal (**Section 8 and Section 9**). These measures have been designed to address the following potential impact:

- Loss of vegetation and habitat for threatened species
- Potential fauna mortality during construction
- Long-term edge effects and weed invasion.

These measures are to be outlined in the EIS and CEMP prior to construction.

Document Controls

Proponent	Hera Resources Pty Limited		
Client	RW Corkery & Co Pty Limited		
Document Description	Biodiversity Development Assessment Report: Hera Mine Modification 5		
Clients Representative Managing this Document	AREA Person(s) Managing this Document		
Mitchell Bland Director / Principal Environmental Consultant R.W. Corkery & Co Pty Limited	Phil Cameron (PJC)		
Location	AREA Job No. 20.02.41		
\Clients\RW Corkery & Co Pty Limited			
Document Status: **FINAL**	Version	Date	Action
Series V1.X = Internal edits	V1.0 V1.1	21.1.19 22.1.19	PJC to AW AW to PJC
Series V2.X = Client internal edits	V2.0 V2.1	22.01.19 19.02.19	AREA to Client Edits incorporated
FINAL when draft is approved by client	V3.0 V3.1	20.02.19	AREA to Client
Prepared For	Prepared By		
Mitchell Bland Director / Principal Environmental Consultant R.W. Corkery & Co Pty Limited Orange 62 Hill Street ORANGE NSW 2800 Phone: (02) 6362 5411 Email: orange@rwcorkery.com	Phil Cameron- Principal Consultant AREA Environmental Consultants & Communication Pty Ltd 6 Belmore Street Dubbo NSW 2830 M 0409 852 098 E phil@areaenvironmental.com.au ABN:29 616 529 867		

TABLE OF CONTENTS

FIGURES

TABLES

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 development area.
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.
Development Area: 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 OEH 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 OEH 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 development area: the difference (gain) between the estimated vegetation integrity score without management at a development area and the predicted future vegetation integrity score with management at a development area, 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 development area.
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 development area.

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 unfavorable 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 development area, over time from undertaking management actions at a development area. Gain in biodiversity values is the basis for creating biodiversity credits at the development area.
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 development area 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 development area, native vegetation cover, vegetation connectivity, patch size and the strategic location of a development area.

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 study area or a population occupies part of the Study Area, 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 OEH, 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 development area, 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 development area.
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 development area 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 development area 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 OEH 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 OEH 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 OEH 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 development area 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
BAMCC	Biodiversity Assessment Method Credit Calculator
BASSR	Biodiversity Steward Site Assessment Report
BAMCC	BioBanking Credit Calculator
BOM	Bureau of Meteorology
BC Act	Biodiversity Conservation Act 2016
BOS	Biodiversity Offset Strategy
BVT	Biometric Vegetation Types
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environment Management Plan
CMA	Catchment Management Authority
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEE	Department of Environment and Energy formerly the Department of the Environment
DEWHA	Department of Environment, Water, Heritage and the Arts
DPE	Department of Planning and the Environment
DPI	Department of Primary industries
DotE	Department of the Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC	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
PCT	Plant Community Types
PMST	Protected Matters Search Tool
Proposal	Highview Country Estate Dubbo Regional LGA
Study area	The site comprises the following titles Lot 172 DP 753233
SAT	Scat Assessment Technique
SEARS	Secretary's Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SSD	State Significant Development
Study Area	Cumulatively all components in the Proposal i.e. Residential lots, roads, drains, APZ etc
Subject Site	An individual component of the study area i.e. the Pond 1 Subject Site
TAFE	Technical and Further Education Institute
TEC	Threatened Ecological Community

Acronym	Definition
TSPD	Threatened Species Profile Database
VEC	Vulnerable Ecological Community
VIS	Vegetation Information System
WIRES	Wildlife Information, Rescue and Education Services

1 Introduction to the proposal and the assessment team

1.1 Background

AREA Environmental Consultants & Communication (AREA) was commissioned by Hera Resources Pty Limited to complete a Biodiversity Development Assessment Report (BDAR). This BDAR documents the assessment of potential and significant environmental impact associated with Modification 5 to PA 10_0191 at Hera Gold Mine (the proposal). This BDAR informs the Department of Environment and Energy's determination of the proposal under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979*.

The proposal includes increasing the rate of transportation of concentrate from Hera Mine to the Hermidale rail siding; installation of an external Tailings Storage Facility Water Management Dam; and receipt water from dewatering of the Nymagee Copper Mine for use in processing or evaporation within the proposed Water Management Dam.

This BDAR assesses installation of a Water Management Dam. While part of a different process, AREA can confirm the proposed pipeline for dewatering of the Nymagee Copper Mine and transporting this water to The Mine for use in processing or evaporation within the proposed Water Management Dam is located in an existing regularly maintained internal road corridor where it occurs on The Mine. This road corridor does not support any vegetation.

This assessment addresses requirements of the following legislative frameworks:

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

The following modifications to PA 10_0191 would be required.

- Amendment of Condition 6(c), Schedule 2 to increase the amount of concentrate approved to be transported from the site in a calendar year from 50,000t to 60 000t.
- Removal of Condition 15 of Schedule 2 and Condition 35C of Schedule 3. These conditions are no longer relevant, as the unsealed sections of Nymagee-Hermidale Road they refer to have now been sealed.
- Amendment of Condition 37A of Schedule 3 consistent with the proposed amendment provided by the Department of Planning and Environment in February 2017.
- Replacement of Condition 7 of Schedule 5 with the following alternate form of words consistent with other recently granted mining-related development consents.

In addition, the following modifications to existing approvals would be required.

- The approved Biodiversity Offset Strategy would require modification to account for the additional area of disturbance.
- An additional licenced discharge point will be required for a proposed emergency spillway that would be installed on the Tailings Storage Facility with flows reporting to the proposed Water Management Dam.

To identify environmental constraints for the proposal, the following survey effort has been completed:

- September 2018 – two ecologists from AREA conducted surveys over three days and trapping and remote sensing over three consecutive nights including three BAM 2017 plots and transects and 10 to 20m species credit species transects in the Tailing Storage Facility Water Management Dam impact footprint (13.7 hectare). Opportunistic fauna survey and ultrasonic bat call analysis occurred. The timing of this assessment enabled targeted searches for spring flowering flora such as the Pine Donkey Orchid.
- November 2018 – one ecologist from AREA conducted surveys over one day using 10 – 20m species credit species transects in otherwise unsurveyed areas in response to a minor amendment to the proposed impact footprint.
- Results from 17 environmental assessments dating 2010, 2011 (environmental assessment for project approvals) and 2013 to 2018 on The Mine for pre-clearing assessment, MOD3 assessment and annual monitoring events.

1.2 Report structure

This BDAR documents Stage 1 (assessing biodiversity values) and Stage 2 (Impact assessment to biodiversity values) of the Biodiversity Assessment Method (2017), hereafter 'BAM'.

This BDAR supports a Development Application under Division 4.1, Part 4 of the EP&A Act.

The structure of the report is summarised in **Table 1-1**.

Table 1-1: Report structure

Section reference	Section heading / BAM requirement	Description
Executive summary	Executive summary	Concise summary of this technical paper and the key findings
viii and ix	Definitions and acronyms	Provides definitions and summarises the acronyms used throughout this report.
1	Introduction to the proposal and the assessment team • Background • Report structure • Project personnel	Description of the proposal. Provides an overview of the study objectives, structure of technical report and staff contributing to this document.
Stage 1 BAM document (assessing biodiversity values)		
2	Introduction to the biodiversity assessment • identification of development site footprint, including: ○ operational footprint ○ construction footprint indicating clearing associated with temporary construction facilities and infrastructure • general description of development/proposal • sources of information used in the assessment, including reports and spatial data.	Description of the proposal relevant to assessing biodiversity values in the development site footprint. Provides an overview of the study objectives and structure of

Section reference	Section heading / BAM requirement	Description
		technical report.

3	Landscape features
	• IBRA bioregions and subregions, NSW landscape region and area (ha)
	• native vegetation extent in the buffer area
	• cleared areas
	• evidence to support differences between mapped vegetation extent and aerial imagery
	• rivers and streams classified according to stream order
	• wetlands within, adjacent to and downstream of the site
	• connectivity features
	• areas of geological significance and soil hazard features
	  ○ site context components, including:
	  ○ identification of method applied (i.e. linear or site-based)
	  ○ percent native vegetation cover in the landscape (development site).
		Identifies landscape features at the development site footprint.

4	Native vegetation
	Describes PCTs within the development/Proposal, including:
	• vegetation class
	• vegetation type
	• area (ha) for each vegetation type
	• species relied upon for identification of vegetation type and relative abundance
	• justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.12 of the BAM)
	• TEC status (as outlined in Paragraphs 5.2.1.14–5.2.1.15 of the BAM)
	• estimate of percent cleared value of PCT (as outlined in Paragraph)
	Vegetation integrity assessment of the development site, including:
	• mapping vegetation zones (Subsection 5.3.1 of the BAM)
	• patch size (development site and proposal)
	• assessing vegetation integrity using benchmark data (Subsection)
	• survey effort as described in Subsection 5.3.4 (number of plots)
	• determining the vegetation integrity score (Appendix 6 of the BAM):
	  ○ composition condition score
	  ○ structure condition score
	  ○ function condition score
	  ○ vegetation integrity score.
	Where use of local data is proposed:
	• identify relevant vegetation type
	• identify source of information for local benchmark data
	• justify use of local data in preference to database values.
		Identifies native vegetation extent within the development / proposal, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery.

5	Threatened species Identify ecosystem credit species associated with PCTs on both the development site and proposal as outlined in Section 6.2, including: • list of species derived • justification for exclusion of any ecosystem credit species predicted above. Identify species credit species on both the development site and the proposal as outlined in Sections 6.3 to 6.5, including: • list of candidate species • justification for inclusions and exclusions based on habitat features • indication of presence based on targeted survey or expert report • details of targeted survey technique, effort, timing and weather • species polygons • biodiversity risk weighting for the species • threatened species survey • additional requirements for wind farm developments. Where use of local data is proposed: • identify relevant species	Identifies the list of species and habitat components and their sensitivity classes and risk to development

Section reference	Section heading / BAM requirement	Description
	• identify aspect of species data • identify source of information for local data • justify use of local data in preference to database values. Where expert reports are used in place of targeted survey: • identify the relevant species • justify the use of an expert report • indicate and justify the likelihood of presence of the species and information considered in making this assessment • estimate the number of individuals or area of habitat (whichever unit of measurement applies to the species/individual) for the development site or Proposal, including a description of how the estimate was made • identify the expert and provide evidence of their expert credentials.	
Stage 2 BAM document - Impact assessment (biodiversity values)		
6	Matters of National Environmental Significance	Provides information of MNES species, populations or communities with potential to be recorded in the Proposal.
7	Minimise impacts and nature of impact • Demonstration of efforts to avoid and minimise impact on biodiversity values in accordance with Chapter 8 of BAM (2017). • Assessment of direct and indirect impacts unable to be avoided at the development site in accordance with Sections 9.1 and 9.2 of BAM (2017). The assessment would include but not be limited to: type, frequency, intensity, duration and consequence of impact. • For major projects: details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (Section 9.4 of BAM (2017). • Identification and an assessment of the impacts which are potential serious and irreversible impacts, in accordance with Subsections 10.2.2 for impacts on CEECs and 10.2.3 for threatened species. • Identification of impacts requiring offset in accordance with Section 10.3. Identification of impacts not requiring offset in accordance with Paragraph 10.3.2.2. • Identification of areas not requiring assessment in accordance with Section 10.4.	Provides information on minimising harm to the environment in the proposal Provides information on residual harm to the environment in the proposal
8	Mitigation measures	Provides actions to minimise harm to the environment
9	Biodiversity offsets	Identifies if biodiversity offsets have been triggered
10	Conclusions and recommendations • Conclusions • Recommendations	Concise statement of key findings of biodiversity values in the proposal.
11	References	Information sources used

1.3 Project personnel

This assessment was carried out by appropriately qualified and experienced ecologists (refer to **Table 1-2**).

Table 1-1: Summary of AREA project teams' qualifications

Name	Position	CV Details	Role in this project
Phillip Cameron	Principal Consultant	• BSc. Major in Biology. Macquarie University • Ass Dip App Sci. University of Queensland • Certified Environmental Practitioner (EIANZ) and practicing member • NSW OEH BioBanking and Bio-certification Assessor: accreditation number 0117 • NSW OEH 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	Certification. Fieldwork Project Management. Report writing Data analysis.
Lynda Marshall	Senior Ecologist	• Central Queensland University Honours (BSc) • University of New England Bachelor of Science (Biology / Genetics)	Fieldwork data analysis.
Addy Watson	Principal Environment and Community Consultant	• Grad. Dip. Captive Vertebrate Management, Charles Sturt University • Grad. Cert. Social Impact, University of NSW (current) • B. Env. Sc. University of New England. • Diploma Project Management	Report review (editing / readability)
Heidi Kolkert	Principal Ecologist	• PhD candidate (Science) University of New England 2013 to current • BSc. (Hons) and Bachelor of Arts University of Tasmania Graduated 2005 • NSW OEH BioBanking and Bio-certification Assessor TAFE NSW • Practicing member of the NSW Ecological Consulting Association • WHS White Card and Blue Card • Apply First Aid (Medilife), Remote First Aid (St John)	Bat call analysis

STAGE 1 BAM: BIODIVERSITY ASSESSMENT

2 Introduction to the biodiversity assessment

This chapter has been prepared in accordance with Chapters 3 and 4 of the BAM.

2.1 Identification of Proposal footprint

The proposal affects 11.4 ha of land within Lot 664 DP761702 (1,532.45 ha), four kilometres south of the village of Nymagee in Western NSW (**Figures 2-1 to 2-3**).

2.1.1 History of disturbance

Copper was discovered at Cobar in 1869. Nymagee was founded by 1879 and the Nymagee Cooper Mine was developed by 1888. The Australian Town and Country Journal (Sydney, NSW: 1870 - 1907) [http://nla.gov.au/nla.news-title52] reported in part:

> *The town owes its existence almost entirely to the opening of the Nymagee copper mine, and anything which affects the mine naturally has a powerful influence on the town. When the mine has been in full work the business people have been in high spirits. But when, owing to the low price of copper, the mine was nearly closed, numbers of people left the town; and those who remained went about in a despondent manner, and wished that they could get away also.*
>
> *It is not much to be wondered at, therefore, if the Nymagee people generally consider the persons who form the French syndicate, which has raised the price of copper to a paying standard, as benefactors to the world in general, and to Nymagee in particular.*
>
> *In Cobar the copper mine is in the middle of the town and is the most prominent feature in the landscape. In Nymagee the mine workings are behind a ridge, and consequently out of sight in the main part of the town.*
>
> *Cobar is situated in a vast plain, in which a few small hills rise up at intervals. Nymagee is situated on a small plain surrounded by hills. For some distance round Cobar not a tree is visible; and scarcely a green leaf is to be seen. In Nymagee, thanks to the good sense of the managers of the mine, the trees in the company's grounds have been preserved; and even in the town several gum trees which have been spoiled by lopping are sprouting, and not only enliven the appearance of the town, but tend to make it more healthy than it could be without them.*
>
> *Nymagee is about ten years younger than its sister copper town and cannot boast of having so much dust or so many public buildings.*

At its peak over 2,200 people, half of those being Chinese migrants, lived in the area. As the mine had a wood-fired smelter, significant areas of timber were cleared from the surrounding country including on Hera and the study area where historical tree removal evidence (stumps) is still evident. When the Nymagee Copper Mine closed in 1917, most of the town's residents moved away. The 2016 census population was stated as 101 permanent residents.

As a result of widespread removal of eucalyptus from the region to fuel the wood-fired smelter, and heavy and continuous grazing by sheep and goats, the pre-European vegetation composition on the study area has changed. The ground stratum was effectively

stripped and White Cypress Pine dominated the landscape which significantly suppressed biodiversity.

2.1.2 The Regional context of the study area

The Regional context of the study area is provided in **Table 2-1**.

Table 2-1: Regional context of the Proposal

Attribute	Response
Interim Biogeographic Regionalisation for Australia (IBRA Region)	Cobar Peneplain > Nymagee (**Figure 2-2**)
State	New South Wales
Topographical map sheet	Nymagee (Figure 2-3)
Local Government Area	Cobar LGA
Nearest town / locality	Nymagee (Figure 2-2)
Accessed from nearest town by	Burthong Road
Lot and Development Portion	Lot664, DP761702 (**Figure 2-2)**.
Land use / disturbance	See section 2.11.
Nearest drainage line (Name, Strahler Order)	Box Creek, a Strahler second-order drainage line, runs through the Hera property. There are also several tributaries to it (**Figure 2-3).** The nearest waterway to the proposed Modification 5 boundary is Box Creek, approximately 1.1km to the west.
Spot point Australian Height Datum (AHD)	330 m. **(Figure 2-3)**.
Surrounding land use	Grazing agriculture (**Figure 2-4).**

Figure 2-1: Site map (per Section 4.2 of BAM)

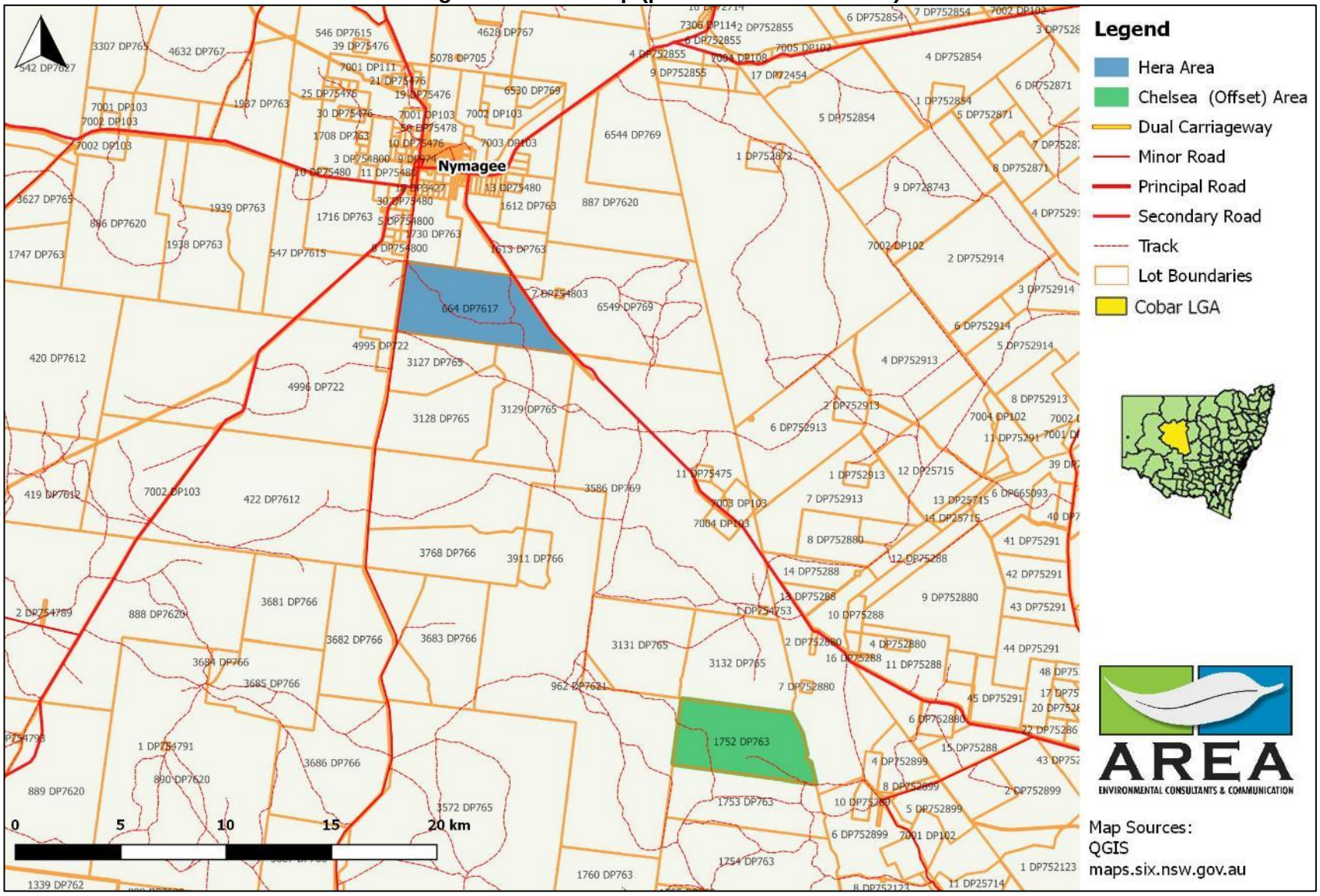


Figure 2-2: Aerial location map of the Hera property (per Section 4.2 of BAM)

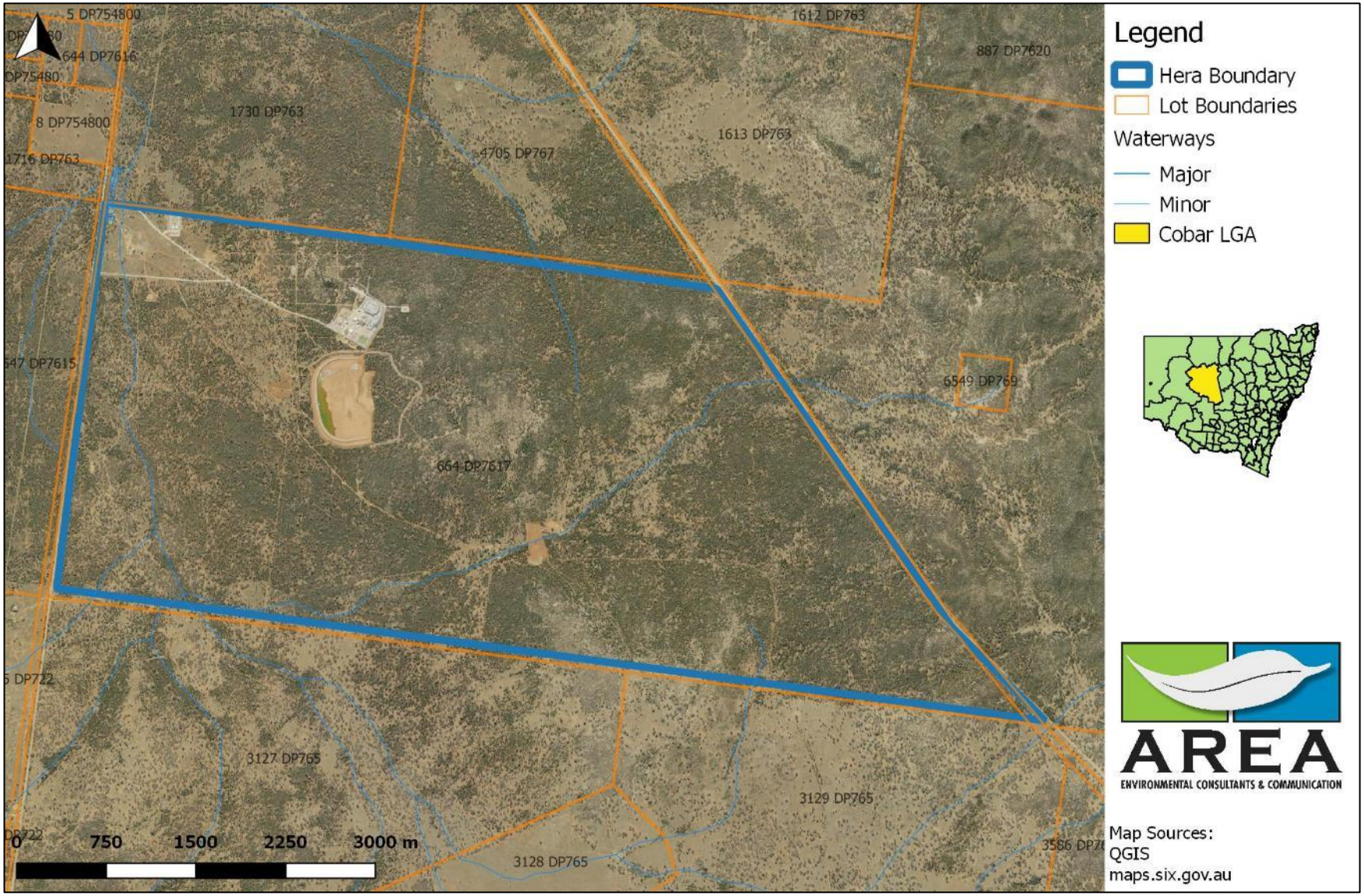


Figure 2-3: Aerial location map of the proposal (per Section 4.2 of BAM)

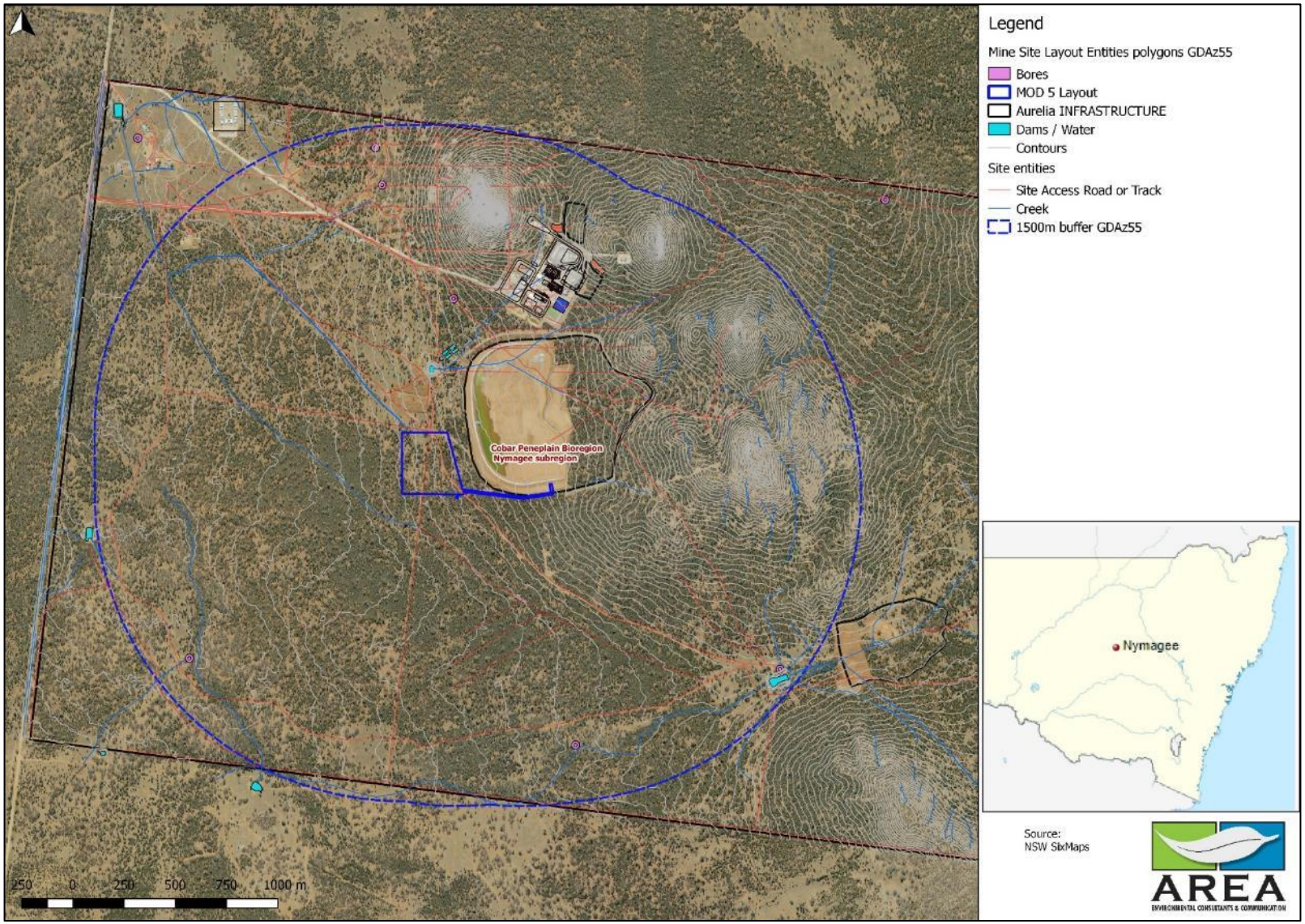


Figure 2-4: Aerial location map of the proposal (per Section 4.2 of BAM) Source: GHD (2018)

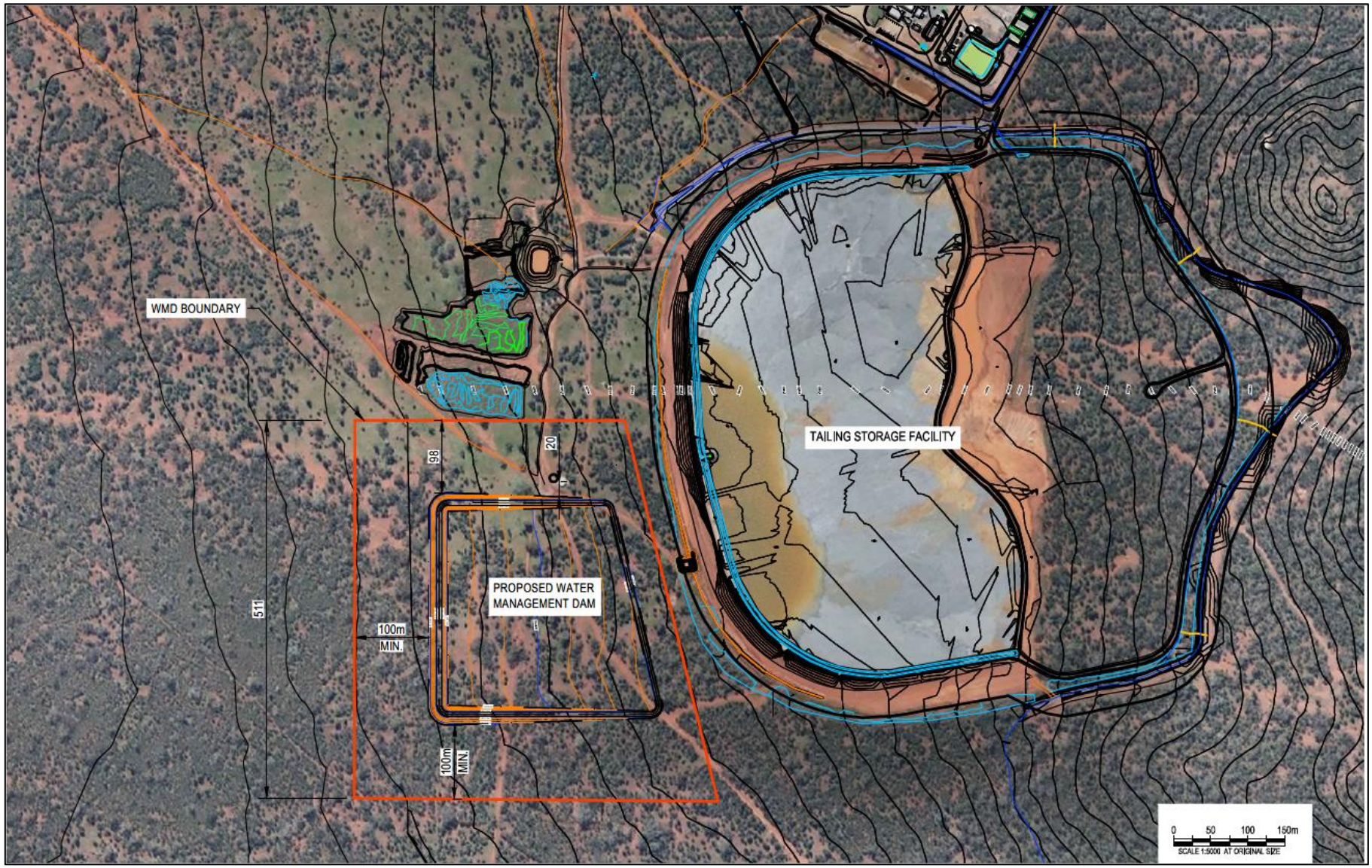


Figure 2-5: Topographic location map of the Hera property (per Section 4.2 of BAM)

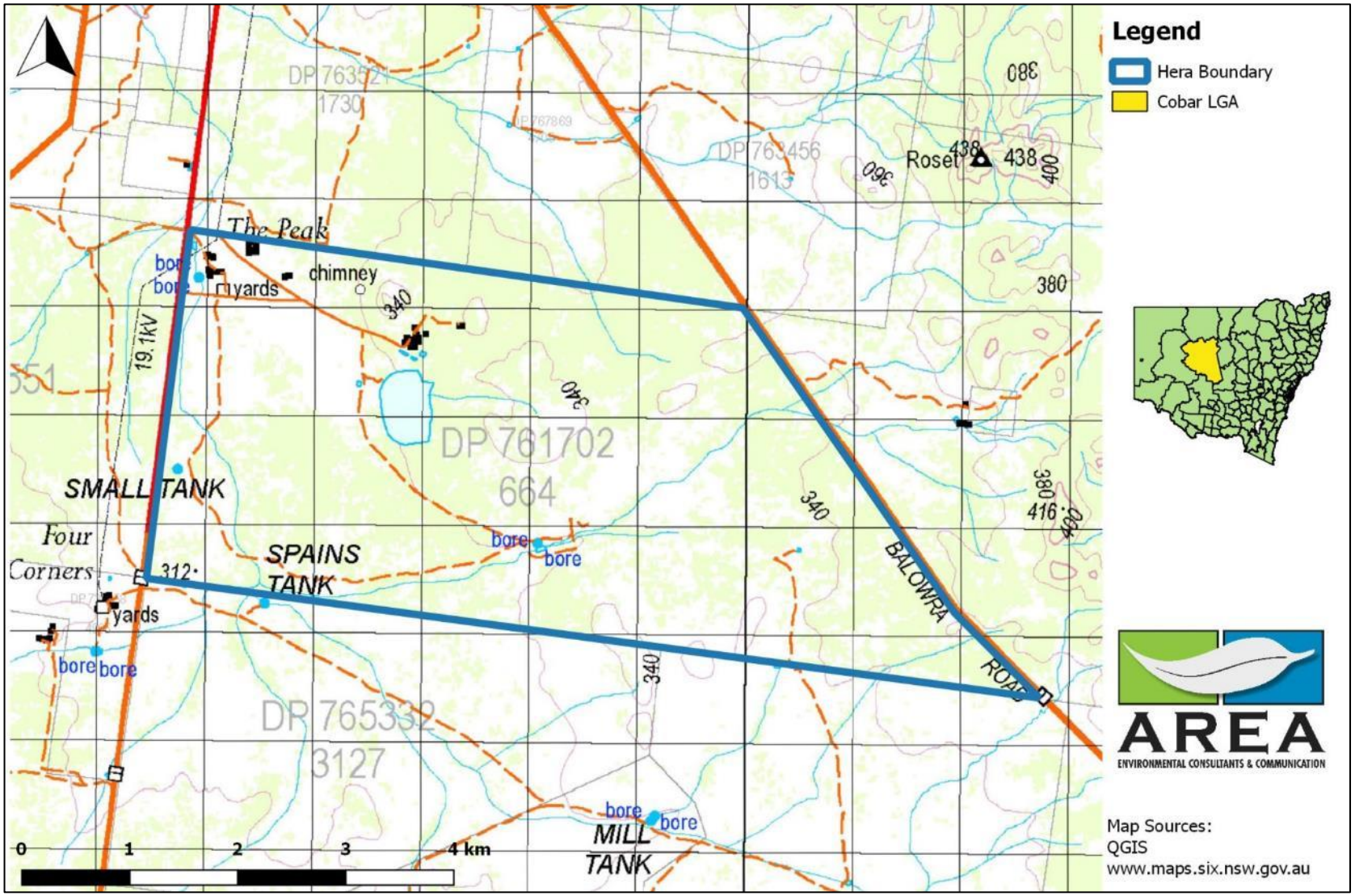


Figure 2-6: Topographic location map of the proposal (per Section 4.2 of BAM)

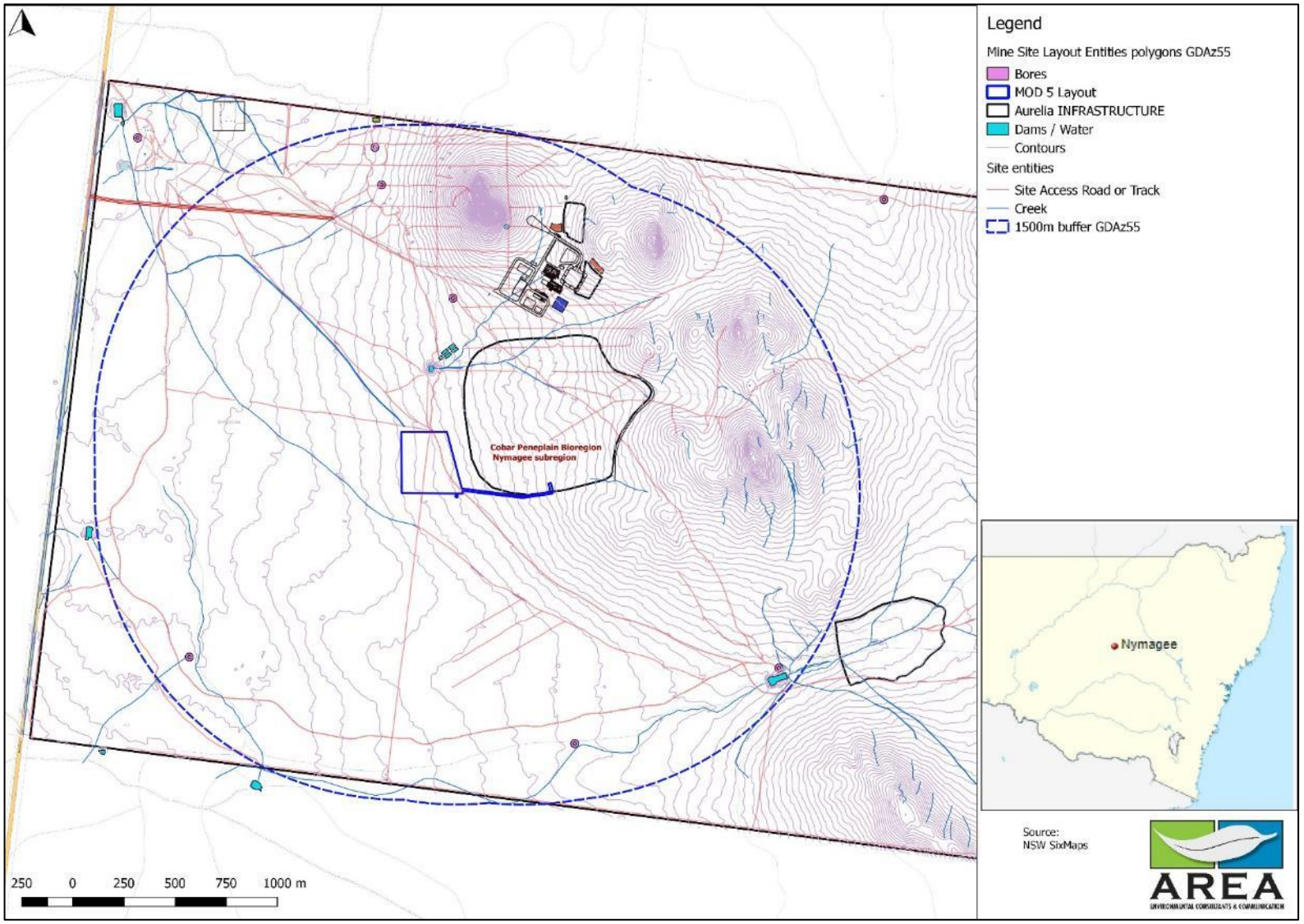
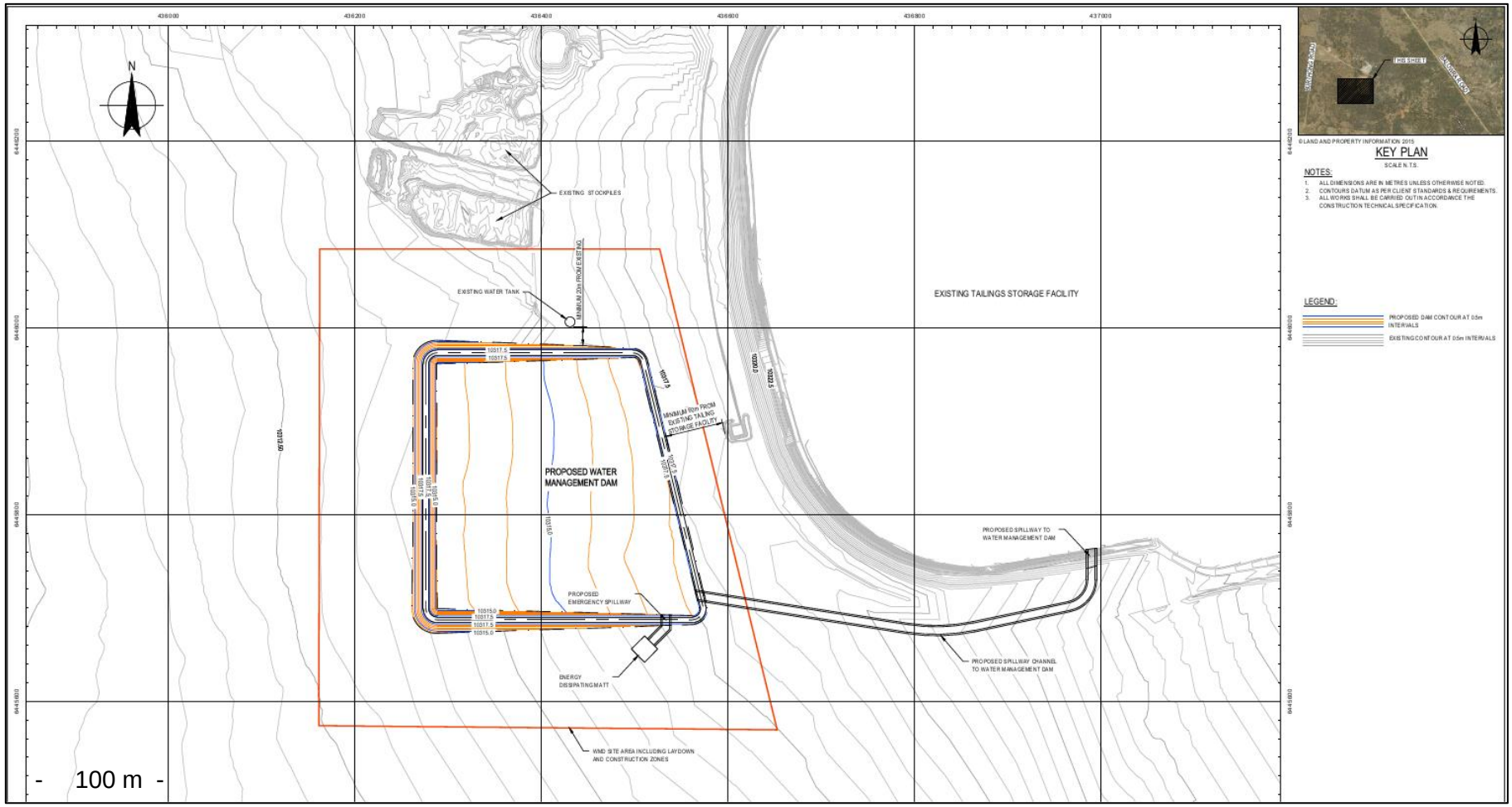


Figure 2-7: Topographic location map of the proposal (per Section 4.2 of BAM). Source: GHD (2008)



2.1.3 Operational footprint

The study area is located on Lot 664 DP7617 which is 1,532.45 ha. The proposal footprint will be 11.4 ha (**Figure 2-4 and 2-7**).

2.1.4 Construction footprint

Staging area
The staging area for the proposal will be within the 13.7 hectare proposal footprint (**Figure 2-4**). This staging area will house any equipment, materials and amenities for construction staff where required.

Amount of land impacted
Approximately 11.4 hectares of land surface will be disturbed by the proposal (**Table 2-2 and Figure 2-4**). This impact footprint has been calculated using a 25m buffer on the design detail which is ten meters more than what was required to build the existing Tailing Storage Facility.

Figure 2-8: Representative area affected by the proposal (BAM Plot 2)

Figure 2-9: Existing access road to the proposal

2.2 General description of the proposal

The proposal will build a Water Management Dam of 152.7ML capacity (**Figure 2-4**). See GHD 2018 for design detail and **Figure 2-8** for a representative area to be affected. Access roads to the proposal already exist and no additional work on these are required for the proposal (**Figure 2-9**).

2.3 Sources of information used in the assessment, including reports and spatial data.

Information used to inform this BDAR has been provided in the following sections of this report and on **Tables 2-2 to 2-4**.

2.3.1 Spatial data

Table 2-2: Spatial data used in this report

GIS layer name	Reference
IBRA bioregions and subregion	NSW data porthole
NSW landscape regions	Mitchell Landscapes V3
Rivers and streams	Geoscience 1:100K drainage and Nymagee 1: 50K topo map
Wetlands	Directory of Important Wetlands
Connectivity of different areas of habitat	Western Area VIS 4492 veg map and Six Viewer
Areas of geological significance and soil hazard features	Mine site geologists' feedback
Native vegetation extent	Western Area VIS 4492 veg map and Six Viewer

2.3.2 Web sites (and links to documents)

Table 2-3: 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
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+2000+cd+0+N
Local Land Services Act 2013	https://www.legislation.nsw.gov.au/~/view/act/2013/51
Biodiversity	
Biodiversity Assessment Methodology (OEH, 2017)	http://www.environment.nsw.gov.au/biobanking/assessmethodology.htm
BAM Credit Calculator	http://www.environment.nsw.gov.au/biobanking/calculator.htm
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
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.
Guide to Surveying Threatened Plants (OEH, 2015)	http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf
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

2.3.3 Reports and books

The following reports were reviewed for Stage 1 of this BDAR:

Cameron P.J. (2002) Actively Managing for Biodiversity: Some observations of the benefits of thinning cypress stands and discussion of management options for western forests and woodlands.

GHD (2018) Hera Mine TSF Proposed Water Management Dam Preliminary Concept Report November 2018

R.W. Corkery & Co (2018) Briefing Paper for the Hera Mine Modification 5 PA 10_0191 August 2018.

The resources on **Table 2-4** were reviewed for Stage 1 of this BDAR. **Appendix D** provides a running flora and fauna species recorded list for each year Hera was assessed.

Table 2-4: Prior ecological survey and monitoring activities undertaken for the project

Survey date	Survey personnel	Survey area	Report title	Company / Report date
25 – 29 April 2010 15-Oct-11	Heidi Kolkert Phil Cameron	Hera	Hera Project, via Nymagee – Ecology Assessment	OzArk Nov-11
15-Oct-11	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Preliminary Biobanking Assessment: Hera Project Via Nymagee NSW	OzArk Feb-12
24-Oct-11	Phil Cameron	Hera	Letter Re: Cobar Greenhood Orchid, *Pterostylis cobarensis*, (V) EPBC Act	OzArk Jul-12
15-Oct-11	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Hera Mine, via Nymagee - Biodiversity Offset Strategy	OzArk Oct-12
15-Oct-11	Phil Cameron	Hera and Chelsea (Biodiversity Offset Area)	Hera Mine, via Nymagee - Biodiversity Management Plan	OzArk Nov-12
20-May-13	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Tailings Dam (Stage 1) and Workshop Area	OzArk May-13
3-Jun-13	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Workshop Area	OzArk Jul-13
14-Aug-13	Rowan Murphy	Hera	Re: Pre-clearing Assessment for Tailings Dam Stage II and III & Back Tank East	OzArk Aug-13
4 – 8 November 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-13
14-Feb-14	Rowan Murphy	Hera	Pre-clearing survey of a small area for clay extraction	OzArk Feb-14
15 – 18 December 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-15
6 – 7 July 2015	Phil Cameron	Hera	Framework for Biodiversity Assessment: Biodiversity Assessment Report - Hera Mine Modification 3 Pa10_0191	OzArk 29-Jul-15
6 – 7 July 2015	Phil Cameron	Hera	Ecology Field and Heritage Desktop Assessment: Proposed Air Vent at Hera Gold Mine	OzArk Oct-15

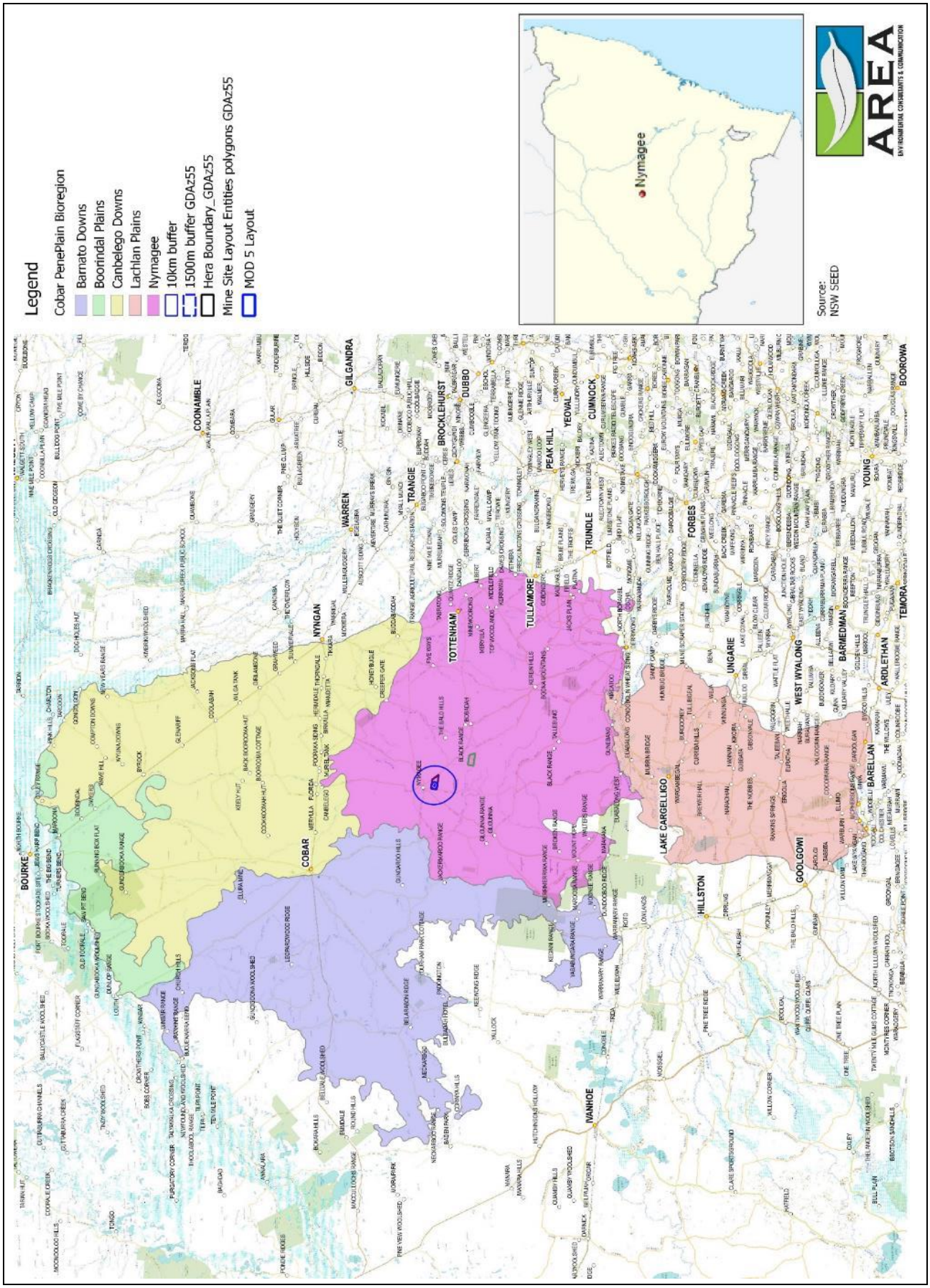
Survey date	Survey personnel	Survey area	Report title	Company / Report date
11 – 13 January 2016	Rowan Murphy Nikki Allen Heidi Kolkert	Hera, Nymagee Copper Mine and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2015	OzArk Jan-16
17-May-16	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-16
6 – 12 January 2017	Rowan Murphy Nikki Allen Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2017	OzArk Aug-17
16-21 September 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 Env Jan-19
22-25 September	Phillip Cameron Heidi Kolkert	Nymagee Copper Mine	Flora and Fauna Monitoring Report – Nymagee Copper Mine, 2018	AREA Env Jan-19

3 Landscape features

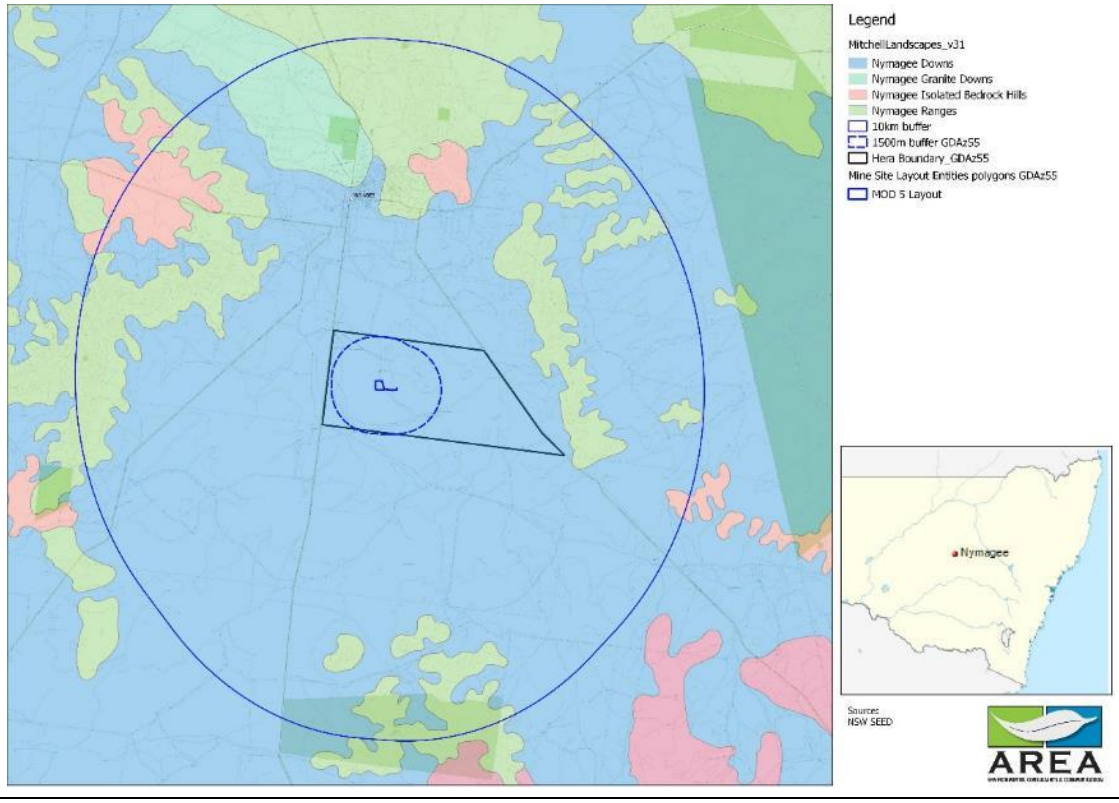
Landscape features of the Proposal is provided in **Table 3-1**.

Table 3-1: Landscape features of the proposal

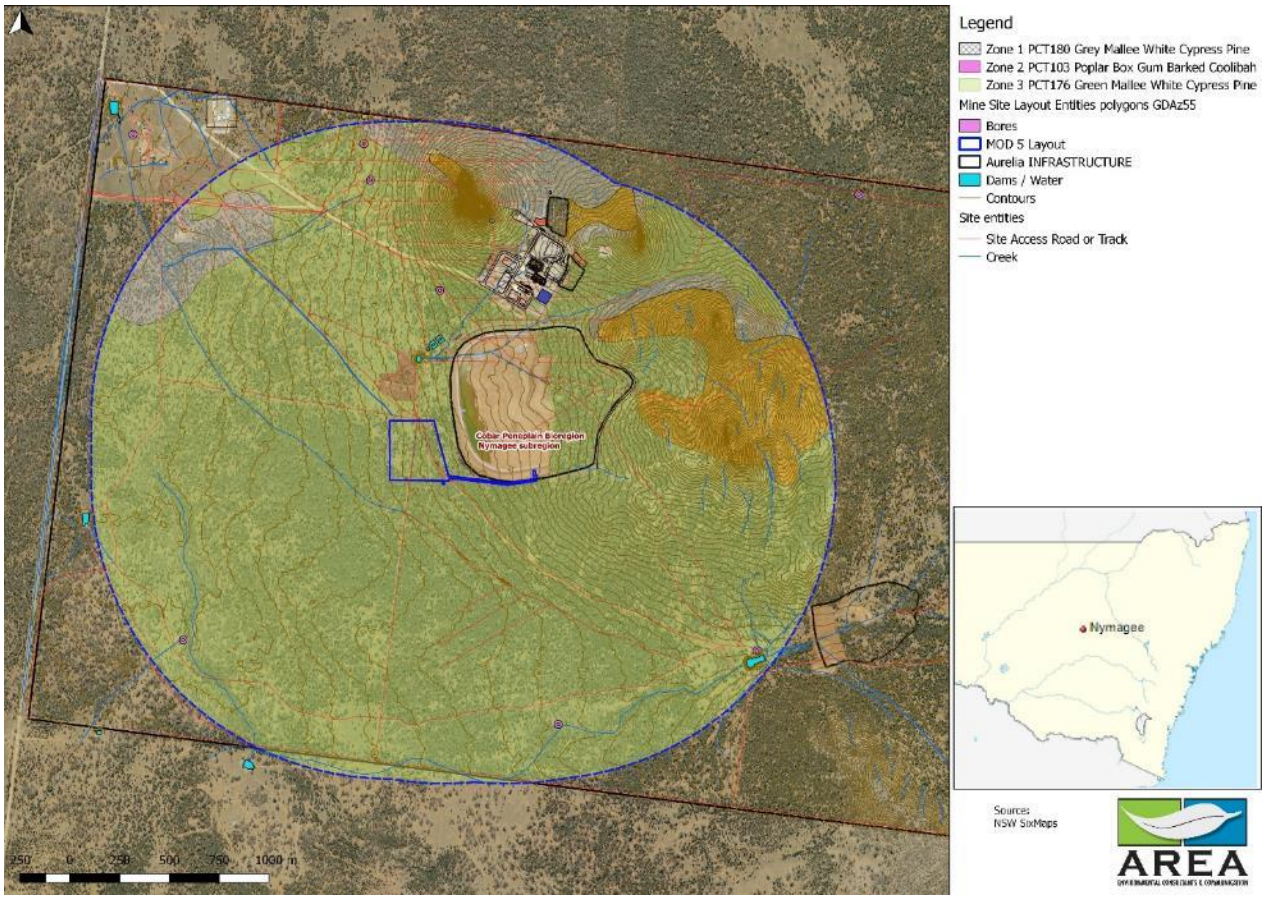
Landscape feature	BAM reference	Response	See
IBRA bioregions and subregions	IBRA bioregions and subregions (as described in Paragraphs 4.2.1.3–4.2.1.4)	The Cobar Peneplain Bioregion lies in central NSW and is entirely with NSW. The Bioregion extends from south of Bourke to north of Griffith. The bioregion 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 crisscrosses 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. https://www.environment.nsw.gov.au/resources/nature/cobarPeneplain.pdf The Study Area is within the Nymagee Downs subregion. **Overview of the Nymagee Downs BBSR Subregion** (Source: OEH 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 below


Legend
Cobar PenePlain Bioregion
Barnato Downs
Boorindal Plains
Canbelego Downs
Lachlan Plains
Nymagee
10km buffer
1500m buffer GDA z55
Hera Boundary_GDA z55
Mine Site Layout Entities polygons GDA z55
MOD 5 Layout
Nymagee
Source:
NSW SEED
AREA
BOURKE
COONAMBLE
GILGANDRA
BROCKLEHURST
DUBBO
WARREN
TRANGIE
PEAK HILL
YEOVAL
CUMNOCK
NYNGAN
TOTTENHAM
TULLAMORE
TRUNDLE
FORBES
YOUNG
BOOROWA
COBAR
LAKE CARGELLIGO
UNGARIE
WEST WYALONG
BARMEDMAN
TEMORA
GOOLGOWI
HILLSTON
IVANHOE
BARELLAN
ARDLETHAN

Landscape feature	BAM reference	Response	See
NSW landscapes region and area (ha)	Sections 4.2 and 4.3, Appendix 3 NSW landscape regions (as described in Paragraph 4.2.1.5)	The Proposal and the associated patches of native vegetation are entirely within the Nymagee Downs Mitchell Landscapes. At a cleared estimate of 35 per cent and 100533.7-hectare patch size the assessment equates to an extra-large patch size class. Mitchell (2002) states: Nymagee Downs landscape includes parts of eleven land systems: Boulkra, Cobar, Cottage, Hartwood, Ironstone, Killala, Kopyje, Lilyvale, Taringa and Yackerboon. 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.	Figure below



<table>
<tr><th>Landscape feature</th><th>BAM reference</th><th>Response</th><th>See</th></tr>
<tr><td>Native vegetation extent in the buffer* area

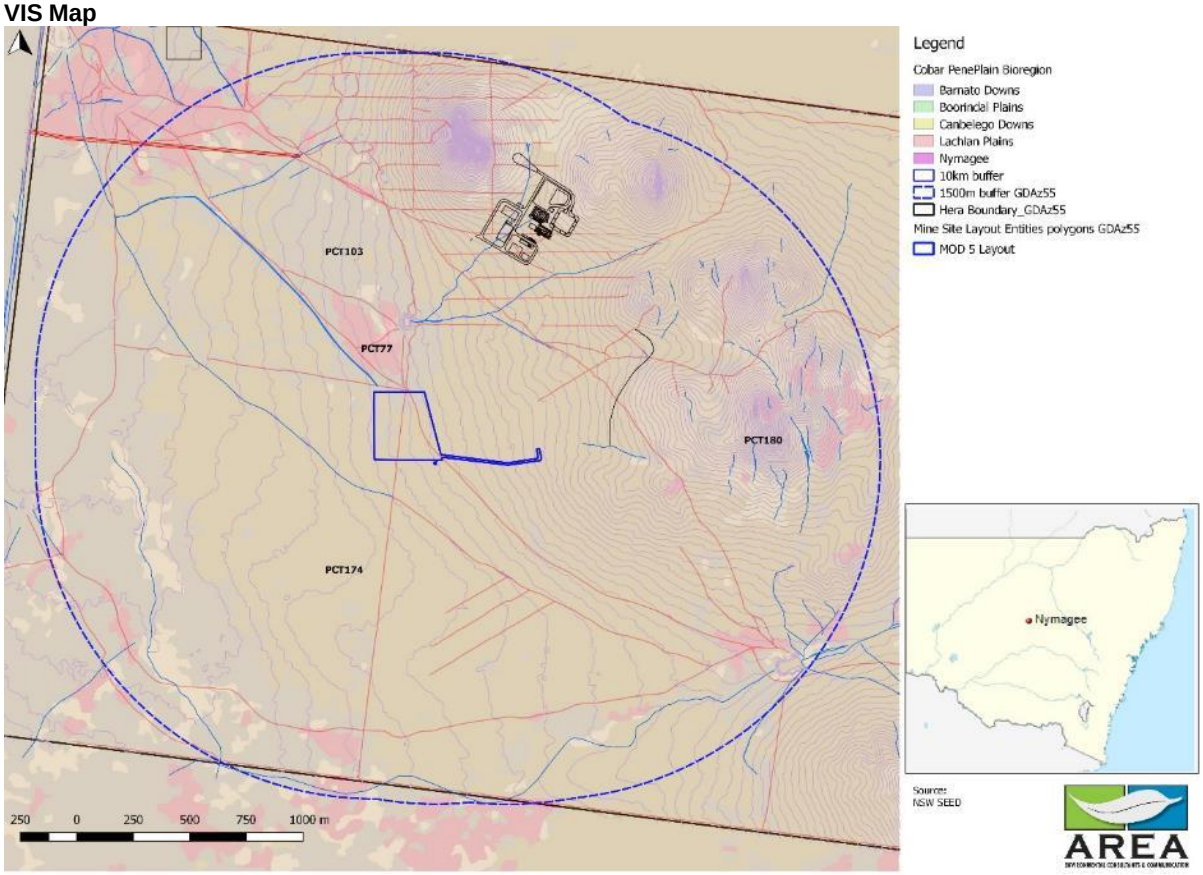
* Within 1500m</td><td>Native vegetation extent (as described in Subsection 4.3.2)</td><td>93.84 percent of vegetation in the extent buffer is native vegetation (See figure below). The native vegetation cover in the landscape was determined by QGIS software with reference to vegetation maps provided for the 2010 Environmental Impact Statement. Native vegetation cover per cent was calculated as a proportion of all land within the assessment buffer area containing mapped native vegetation by using the following attributes:
<table>
<tr><th>1500m circle (1005.27 ha)</th><th>Ha</th></tr>
<tr><td>PCT103</td><td>807.0889</td></tr>
<tr><td>PCT180</td><td>5.04591</td></tr>
<tr><td>PCT180</td><td>57.56037</td></tr>
<tr><td>PCT180</td><td>1.881989</td></tr>
<tr><td>PCT174</td><td>71.75897</td></tr>
<tr><td>Not Native</td><td>61.92963</td></tr>
<tr><td></td><td>1005.266</td></tr>
<tr><td>Native veg (%)</td><td>93.84</td><td>943.34</td></tr>
<tr><td>Not Native (%)</td><td>6.16</td><td>61.93</td></tr>
</table></td><td>Figure below</td></tr>
<tr><td colspan="4"> 
</td></tr>
<tr><td>Cleared areas</td><td>As above</td><td>61.93 hectares or 6.16 percent of the extent buffer is cleared area.

Cleared areas (non-native vegetation) in the landscape was determined as per native vegetation extent in the buffer area (above). Cleared areas was calculated as a proportion of all land within the assessment buffer that did not contain mapped native vegetation or looked cleared via aerial photos.</td><td>Figure above</td></tr>
</table>

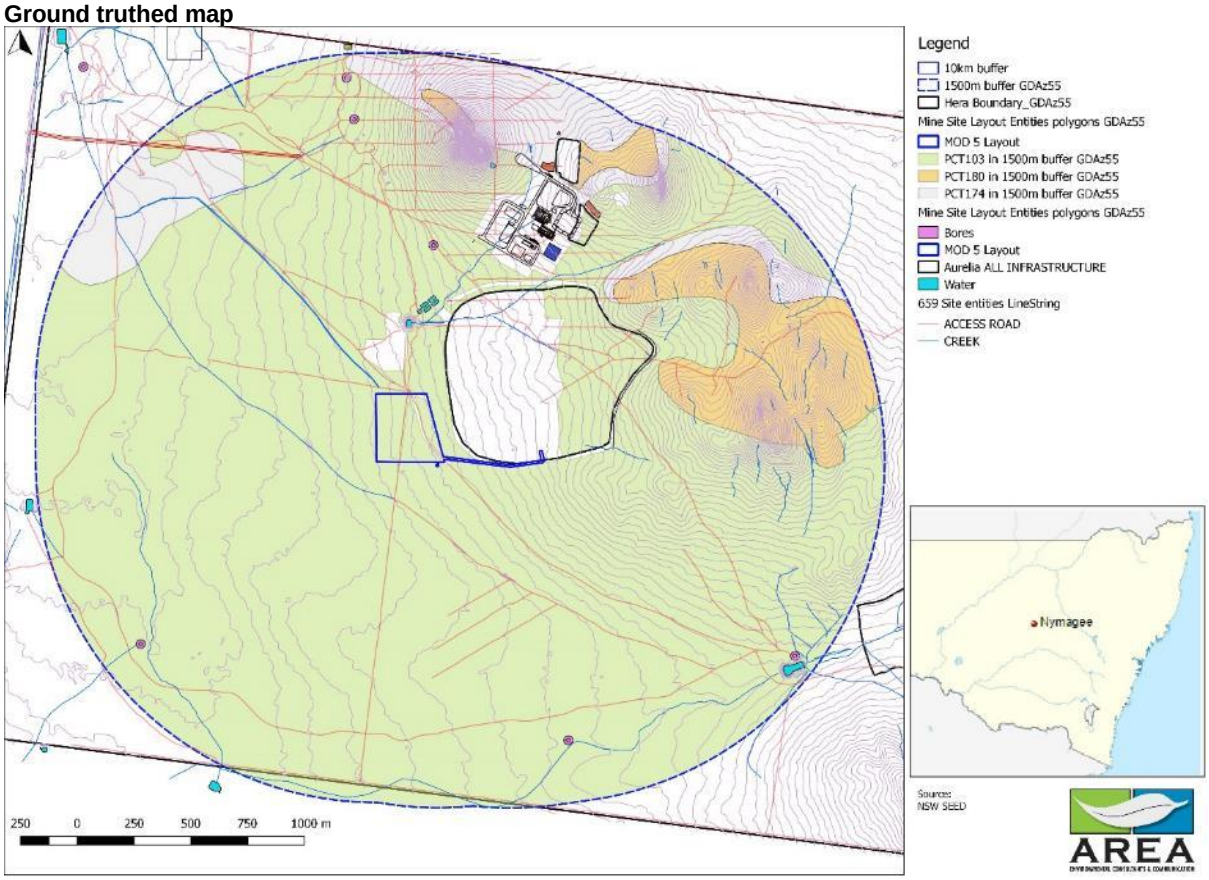
Landscape feature	BAM reference	Response	See

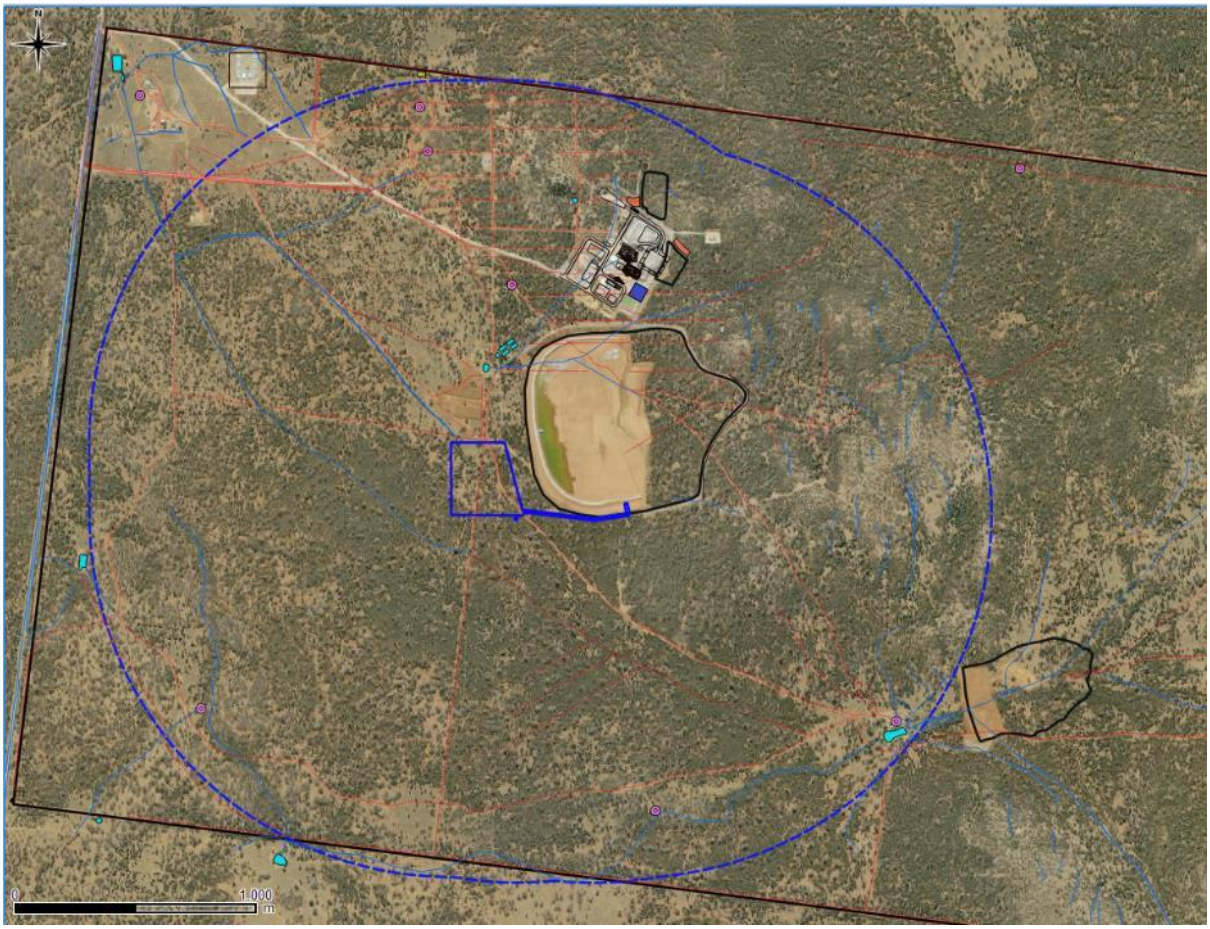
Evidence to support differences between mapped vegetation extent and aerial imagery	Sections 5.1.1.6 and 5.1.1.7	All PCTs mapped by Western Area VIS 4492 across Hera did not neatly overlap with the vegetation map created in the 2010 EIS. This is not an unusual situation and demonstrates the benefits of ground truthing the vegetation map. Western Area VIS 4492 map shows:
		
		• PCT 77 - Yarran shrubland of the NSW central to northern slopes and plains
		  ○ This was not recorded as a PCT in its own night across Hera. While individual Yarran occur in small stands their area of occupancy does not warrant mapping as stand-alone community.
		• PCT174: Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion
		  ○ Some areas were mapped on Hera as PCT174 matching the VIS map however the majority was instead mapped as PCT103. The descriptive attributes of PCT174 is the presence of mallee species (red, white and narrow leaved mallee). Where these species were not present, but Poplar Box was, the PCT was better described as PCT103. Slightly elevated areas near hills was ground truthed as this PCT.
		• PCT105 - Poplar Box grassy woodland on flats mainly in the Cobar Peneplain Bioregion and Murray Darling Depression Bioregion
		  ○ Small polygons, too small to label at the scale of mapping used are mapped by VIS on Hera. No areas were mapped on Hera in this report as a PCT in favour of PCT103 because Poplar Box occurred with Gum Coolabah, thus a more fitting description on Hera was PCT103.
		• PCT103 - Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion
		  ○ Small to medium sized patches of Hera is mapped as PCT103 which is characterised by an open woodland to 25 m high dominated by Poplar Box (Eucalyptus populnea subsp. bimbil) often with Gum Coolabah (Eucalyptus intertexta) and White Cypress Pine (Callitris glaucophylla). These key features are widespread across Hera and were recorded in the Proposal site. The main difference in the VIS map and the 2010 EIS map is PCT103 covered the majority of predicted extent of PCT174.
		• PCT180 - Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion.
		  ○ The VIS map and the 2010 EIS PCT maps are comparable with minor differences in the mapped areas of occupancy around similar boundary lines.
		
		The consultant based the PCT map used in this report from completing previous ecological assessments between 2010 and 2011 in the 1500m buffer.
			Figures below

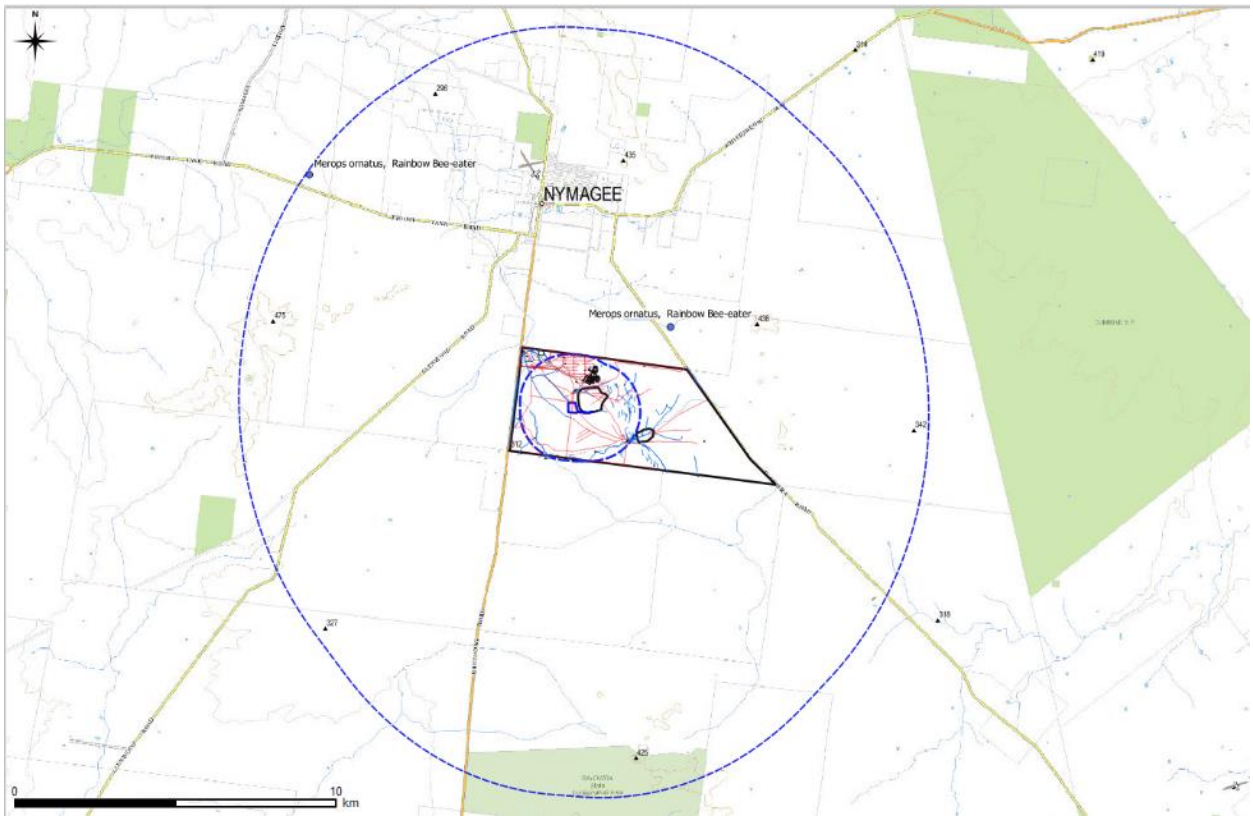
VIS Map

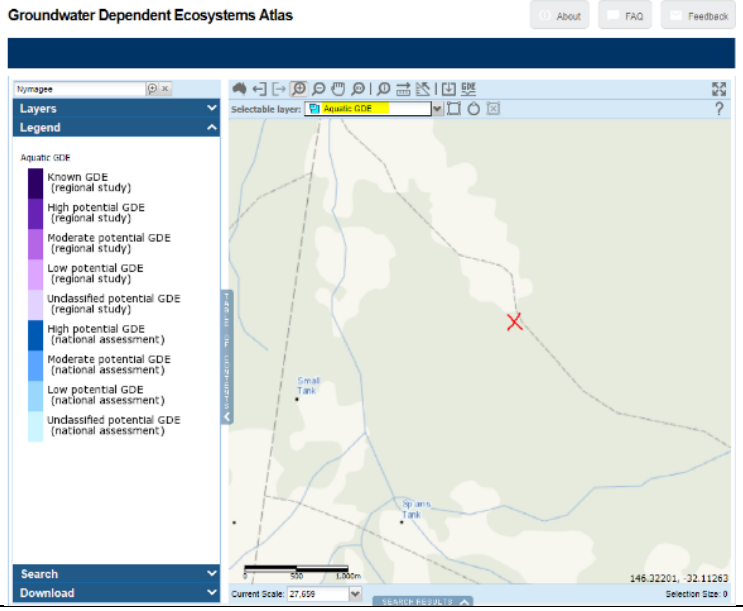


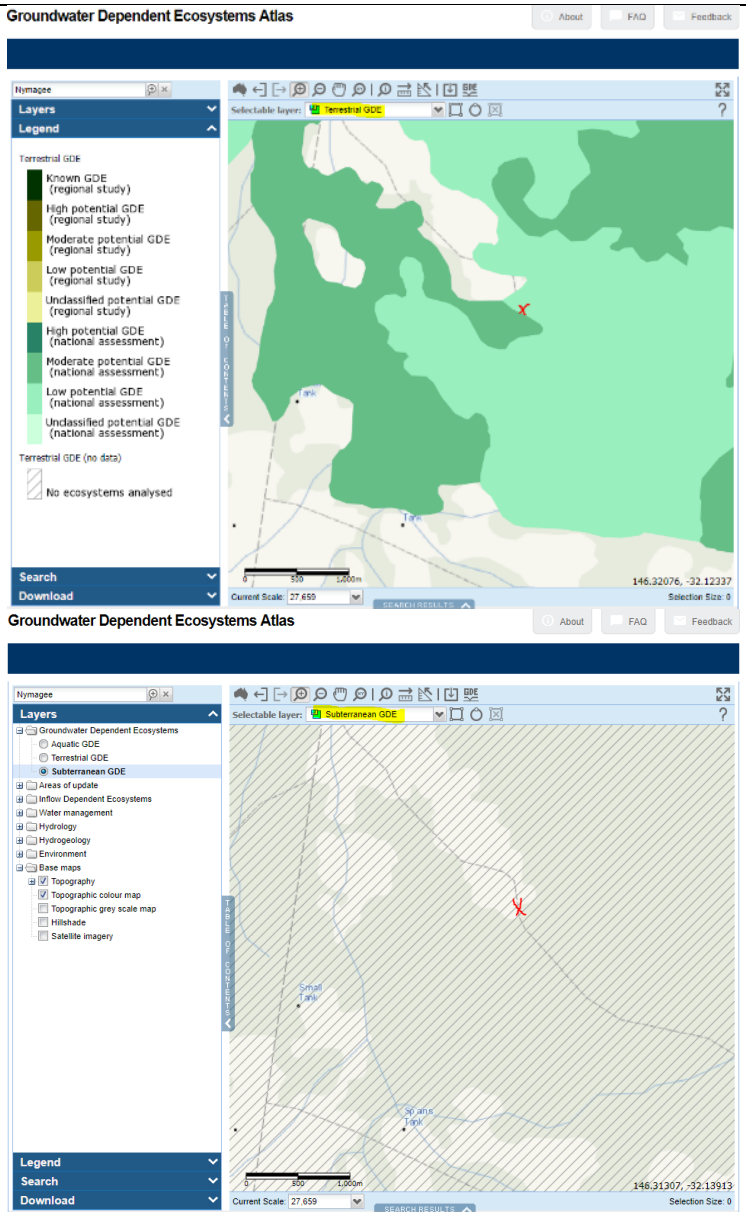
Ground truthed map

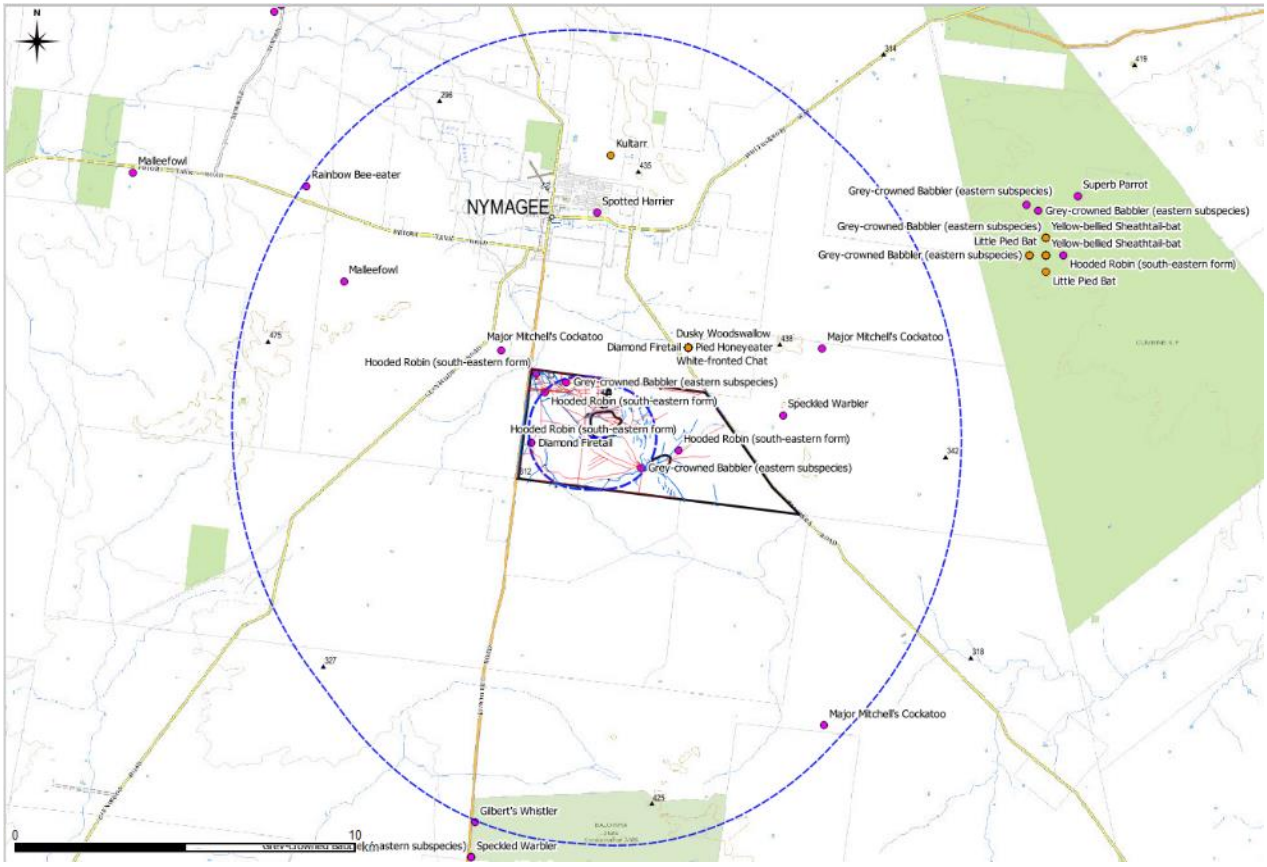


Rivers and streams classified according to stream order	Rivers and streams (as described in Paragraph 4.2.1.6)	Within the 1500m buffer, an unnamed drainage line (a Strahler second-order drainage line, as well as several tributaries to it) runs through the Hera goldmine property boundary (Figure below). These do not occur in the Study Area. The nearest named waterway to the proposed Modification 5 boundary is Box Creek, approximately 1.6km to the west beyond the 1500m buffer.	Figure below
			
Wetlands within, adjacent to and downstream of the site	Wetlands (as described in Paragraph 4.2.1.7)	No wetlands of International Importance occur in the Study Area 10 km buffer. The wetlands of the broader locality provide suitable breeding and foraging habitat for a range of fauna species of birds, fish (possibly), frogs, mammals and reptiles and provide a movement corridor and important habitat for migratory bird species. The BioNet database shows one species of wetland migratory bird, the Rainbow Bee-eater (listed as a migratory marine species and protected under the Japan bilateral agreement) has been recorded within 10 km of the Study Area. This bird can occur within many woodland habitats during its migration to Australia, however, is generally associated with waterways and coastal environments in which it builds breeding tunnels in sandy soils adjacent to water. The BioNet search criteria used was: Public Report of all Valid Records of Threatened (listed on BC Act 2016), Commonwealth listed, CAMBA listed ,JAMBA listed or ROKAMBA listed Entities in Cobar Peneplain - Nymagee IBRA Subregion returned a total of 848 records of 105 species. Report generated on 19/10/2018 11:48 AM.	Figure below



Groundwater dependant ecosystems		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 (DEHP, 2017). The BoM Aquatic GDE maps the Study Area as no potential interactions. The BoM Terrestrial GDE maps layer shows vegetation within the study area is mapped as having low potential for groundwater interaction. The BoM Subterranean GDE maps layer has no data for the Study Area. **Groundwater Dependent Ecosystems Atlas**  	

			
Connectivity features	Connectivity of different areas of habitat (as described in Paragraphs 4.2.1.8–4.2.1.11)	A connectivity site-based assessment was undertaken in accordance with the BAM. No formal state or regional biodiversity links are recorded across the Proposal or outer assessment buffer. There are dams, one a small farm dam the other a tailings storage facility, within 1500m of the Proposal which can be used as habitat for migratory species. The assessment of the impacts of the development on movement of threatened species that maintains their life cycle must: a) *identify movement patterns key to the life cycle of relevant threatened species that intersect with the subject land* ➢ No migratory species have been recorded or were observed in the Proposal. Movement patterns for migratory species will therefore not be affected. b) *describe the nature, extent and duration of short and long-term impacts* ➢ Work is expected to commence in 2019 and take approximately six months to complete. ➢ Generally, audible construction noise would be between 7am and 6pm Monday to Friday and 8am and 1pm on Saturday.	See Figure on page 29 for 'Rivers and streams classified according to stream order'

		c) *describe, with reference to relevant literature and other reliable published sources of information, the importance of the movement of the threatened species to their life cycle* ➢ BioNet shows 34 individual records of listed species within 10km of the Study Area (an additional five species of microbat were added to this list from data that should have been provided to BioNet from previous monitoring). i. 26 records are from 14 species of birds ii. Seven records are from six species of microbat iii. One record is from a mammal (Kultarr) iv. No listed flora has been recorded within 10 km ➢ None of these species will have their movement affected by the Proposal. d) *predict the consequences of the impacts for the bioregional persistence of the threatened species, with reference to relevant literature and other published sources of information* ➢ The impact to movement of threatened species in the study area would not be affected because 943 ha of residual habitat within 1500m will be retained.	
			
Areas of geological significance and soil hazard features	Areas of geological significance and soil hazard features (as described in Paragraphs 4.2.1.12–4.2.1.15)	Dialogue with Hera Resources geologists did not identify areas of geological significance and soil hazard features in the Proposal. The MNES report did not identify area areas of geological significance in the Proposal.	Figure not provided
Site context: identification		Proposal is a site-based Project.	Figure 1-2 to 1-3

of method applied (i.e. linear or site-based)			
Site context: percent native vegetation cover in the landscape (Proposal).	Section 4.3.2	The Proposal (the impact footprint) is 13.7 ha, of this 11.4 ha is vegetated (83.2 per cent vegetated). The 1500m buffer (1005.27 ha) is 93.84 per cent vegetated.	Figure 4-2

4 Native vegetation

4.1 Plant community types (PCTs) within the development area

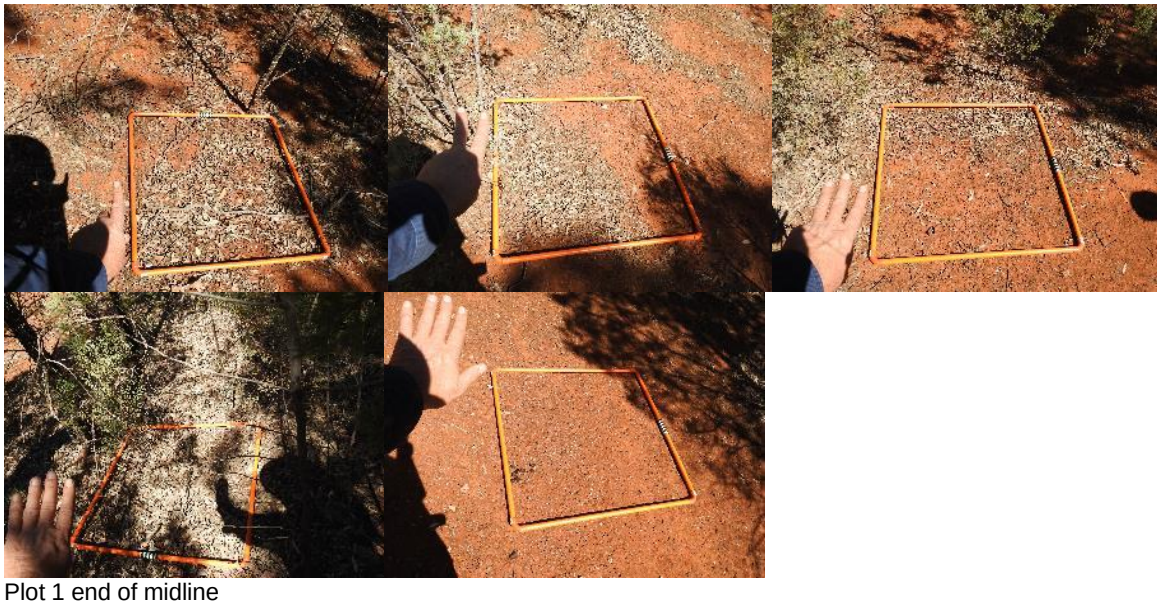
One PCT was recorded in the Study Area: *PCT103 Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion* (**Table 4-1**).

Table 4-1: PCT103: Poplar Box – Gum Coolabah – White Cypress Pine - Vegetation zone, PCT and management zone

PCT 103: Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	
Vegetation zones:	Zone 1 (Moderate to Good condition) – 11.4 ha
PCT Code:	103
Vegetation formation:	Semi-arid Woodlands (Shrubby sub-formation)
Vegetation class:	Western Peneplain Woodlands
Conservation status:	Not associated with a TEC
PCT Percent cleared:	50
Condition composition score (BAMCC): Zone 1	18.8
Structure condition score (BAMCC): Zone 1	60
Function condition score (BAMCC): Zone 1	59.8
Current vegetation integrity score (BAMCC): Zone 1	40.7
Extent in the Proposal: Zone 1	11.4 ha
Plots completed in vegetation zones: Zone 1	Three

MOD5 Plot 1 midline

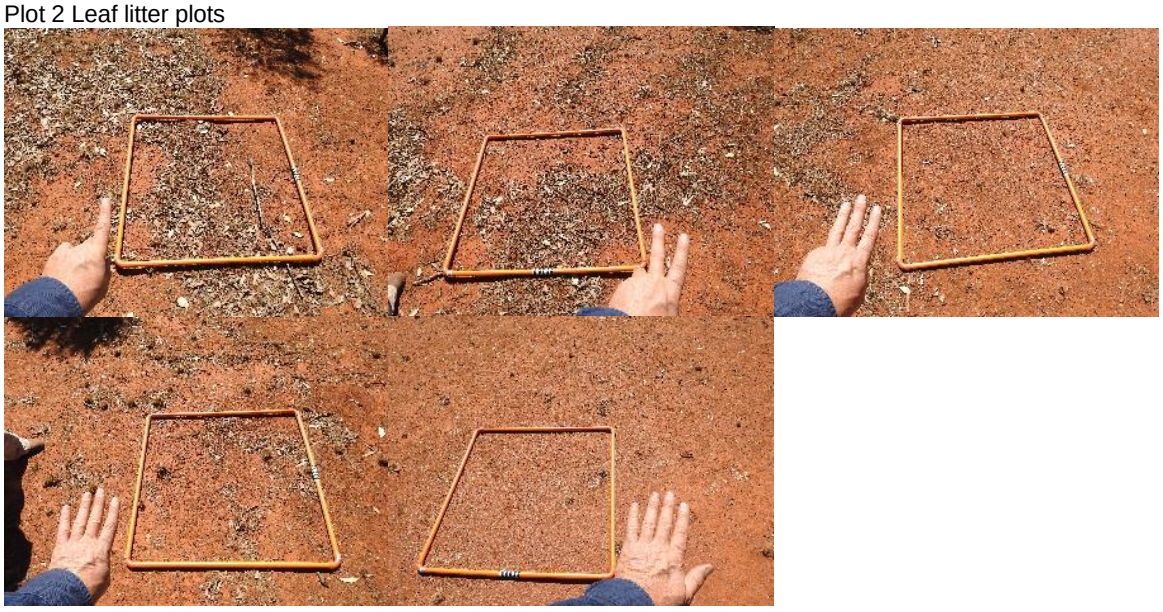
Plot 1 Leaf Litter Plots



Plot 1 end of midline

Plot 2 Midline

Plot 2 Leaf litter plots



Plot 2 end of midline

Plot 3 midline

Plot 3 leaf litter plots

Plot 3 end of midline

Description (VIS BioNet Profile):
PCT103 is an open woodland to 25 m high dominated by Poplar Box (Eucalyptus populnea subsp. bimbil) often with Gum Coolabah (Eucalyptus intertexta) and White Cypress Pine (Callitris glaucophylla). A dense to sparse shrub cover is usually present consisting of Wilga (Geijera parviflora), Budda (Eremophila mitchellii), Tar Bush (Eremophila glabra), various subspecies of Sticky Hop Bush (Dodonaea viscosa sens lat.), Bertya cunninghamii, Acacia deanei subsp. paucijuga, Emubush (Eremophila longifolia), Senna artemisioides s. lat. and Rhagodia spinescens. The ground cover is composed of small shrubs such as Maireana microphylla and copper burrs (Sclerolaena spp.). Grasses include Austrostipa scabra subsp. scabra, Aristida jerichoensis var. subspinulifera, Chloris truncata, Enteropogon acicularis and Monachather paradoxus. Forbs are very sparse and include Vittadinia and Calotis spp. Occurs on clay loam, sandy loam or lateritic soils on alluvial flats, footslopes and broad ridges of undulating plains mainly in the Cobar Peneplain Bioregion of central-western NSW with annual rainfall 350 - 450 mm. This community covers a large section of north-central NSW and varies in its understorey depending on soils and land use. It grades into Mulga communities to the west and White Cypress Pine dominated communities in the south. It grades into Eucalyptus intertexta woodland (ID104) upslope or on rockier ground, or Green Mallee or Eucalyptus dwyeri communities on ridges. This community is subject to woody regrowth of native shrubs including patches of Callitris glaucophylla. While this community is mainly not targeted for clearing is often cleared when adjoining grassy Poplar Box woodland is cleared (ID105). Clearing of woody native shrubs may inadvertently reduce tree cover.
Landscape features: Occurs alluvial flats, footslopes and broad ridges of undulating plains mainly in the Cobar Peneplain Bioregion.
Site and Regional Distribution: Mainly cleared in the Central Division (wheatbelt) and eastern edge of the Western Division for growing crops such as wheat but areas remain uncleared (but heavily grazed) in the Western Division. Dykes (2002) maps 352000 ha in the Cobar Shire as map unit BSW this having being reduced by about 10% through clearing. A higher proportion of this community has been cleared east of the Cobar Shire.
Diagnostic features: Open woodland to 25 m high. Occurs on clay loam, sandy loam or lateritic soils. This community covers a large section of north-central NSW and varies in its understorey depending on soils and land use.
Threatened ecological community: NIL.
Fauna habitat features: Woodlands provide important habitat for a diverse range of native fauna. The upper stratum provides nectar for many types of animal's including insects as well as tree hollows. The shrub layer provides essential resources such as nesting/breeding sites, protection from predators and sources of food (nuts, seeds, nectar from flowers and invertebrate prey). Many animals are only likely to be part of the Woodland at certain times. For example, seasonal transients through the community, such as honeyeaters, are most likely to visit during the local flowering season. Some bird species, such as the nationally vulnerable *Grantiella picta* (painted honeyeater) travel to these when resources are available. The grassy ground stratum layers provide protection for fauna such as Dunnarts and listed reptiles. Many bat species (insectivores, frugivores and nectivores) commonly use woodlands (Pennay and Freeman, 2005).

Condition (on site observation): The Proposal is a mix of disturbed vegetation remnants and better-quality vegetation on areas historically disturbed. Zone 1 has all three structural layers intact, but it was historically under scrubbed of the mid and lower stratum and were once grazing paddocks for sheep with only substantive trees remaining.

The composition score reflects levels of expected biodiversity in Zone 1 has a score of 18.8. This score was relatively low because Forb Richness, Fern Richness and Other Richness were below 25% of the benchmark value. This demonstrates a few things were affecting lower stratum biodiversity being; the severe drought and the legacy of former sheep / goat grazing.

The structure score reflects the abundance cover of each stratum in the Plot and shows Zone 1 (score of 60) has a good score. Shrub Cover was the only attribute below 25% of the benchmark value. This demonstrates despite the drought the lower stratum covers were within benchmark, but a legacy of former sheep and goat grazing has affected the midstratum.

The function score measures tree size classes and the presence or absence of regeneration in the Plot. Zone 1 (score of 59.8) has a good score reflected by total length of fallen logs and litter cover being within benchmark but the presence of large trees was below benchmark. This outcome was expected given historical timber harvesting described in **Section 2.1.1**.

The high threat weed cover score was near zero in Zone 1 reflecting the effects of a harsh dry summer and effectives of the Biodiversity Management Plan (BMP) on Hera.

Cumulatively, these attributes resulted in a current vegetation integrity score on the BAMCC of 40.7 which is a reasonable score despite the severe drought (think of the score as the assessed area scored 40.7 out of a possible 100 against the benchmark for the PCT).

A compassion of each Plot in Zone 1, and their average value against the benchmark for the PCT has been provided on the following table.

PCT103 Benchmark			comparison			
Vegetation Class	Western Peneplain Woodlands					
IBRA	Cobar Peneplain					
Benchmark Calculation Level	Class/IBRA	25% of benchmark value	Plot 1	Plot 2	Plot 3	Average (n=3)
Tree Richness	3	0.75	2	2	2	**2.0**
Shrub Richness	8	2	3	2	2	**2.3**
Grass and Grass Like Richness	6	1.5	2	1	1	**1.3**
Forb Richness	8	2	3	0	0	**1.0**
Fern Richness	1	0.25	0	0	0	**0.0**
Other Richness	1	0.25	0	0	0	**0.0**
Tree Cover	17	4.25	50	35	35	**40.0**
Shrub Cover	14	3.5	0.3	0.2	1.1	**0.5**
Grass and Grass Like Cover	5	1.25	3	3	3	**3.0**
Forb Cover	2	0.5	3	3	3	**3.0**
Fern Cover	0	0	0	0	0	**0.0**
Other Cover	0	0	0	0	0	**0.0**
Total length of fallen logs	26	6.5	5.3	1	41	**15.8**
Litter Cover	30	7.5	51.6	12.6	59	**41.1**
Number of Large Trees	3	0.75	0	0	1	**0.3**
Large Tree Threshold Size	30					

Key to table:
Less than 25% of the benchmark
More than 25% of the benchmark (within benchmark)
Purple text = Composition score
Green text = structure score
Black text = Function score

4.2 Vegetation integrity assessment of the development area

4.2.1 Mapping vegetation zones (Subsection 5.3.1 of the BAM)

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). In this section we use two reference points stating:

1. how many hectares of each PCT zone are in the proposal (Development Area)
2. how many hectares are within the 1500m buffer (The local populations / the patch size).

Vegetation zones within the 13.7-hectare Proposal were identified and mapped as one zone of PCT103 covering 11.4 hectares (**Table 4-2**). The extent of the PCT zone is mapped on **Figure 4-1** showing its area of occupancy within 1500m (1005.27 hectares) and in the Proposal (11.4 hectares), **Figure 4-2.**

Table 4-2: Identification of vegetation zones in the proposal

Zone	PCT ID	Plant Community Type (PCT) Name	Hectares in 1500m	Hectares in Proposal
1	103	Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	807.09	11.4
2	180	Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	64.49	0
3	174	Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	71.76	0
	N/A	Not native vegetation	61.93	2.3
			1005.27	**13.7**
		Native veg (%)	93.84	83.21
		Not Native (%)	6.16	16.78

Figure 4-1: Vegetation map showing vegetation zones and the proposal

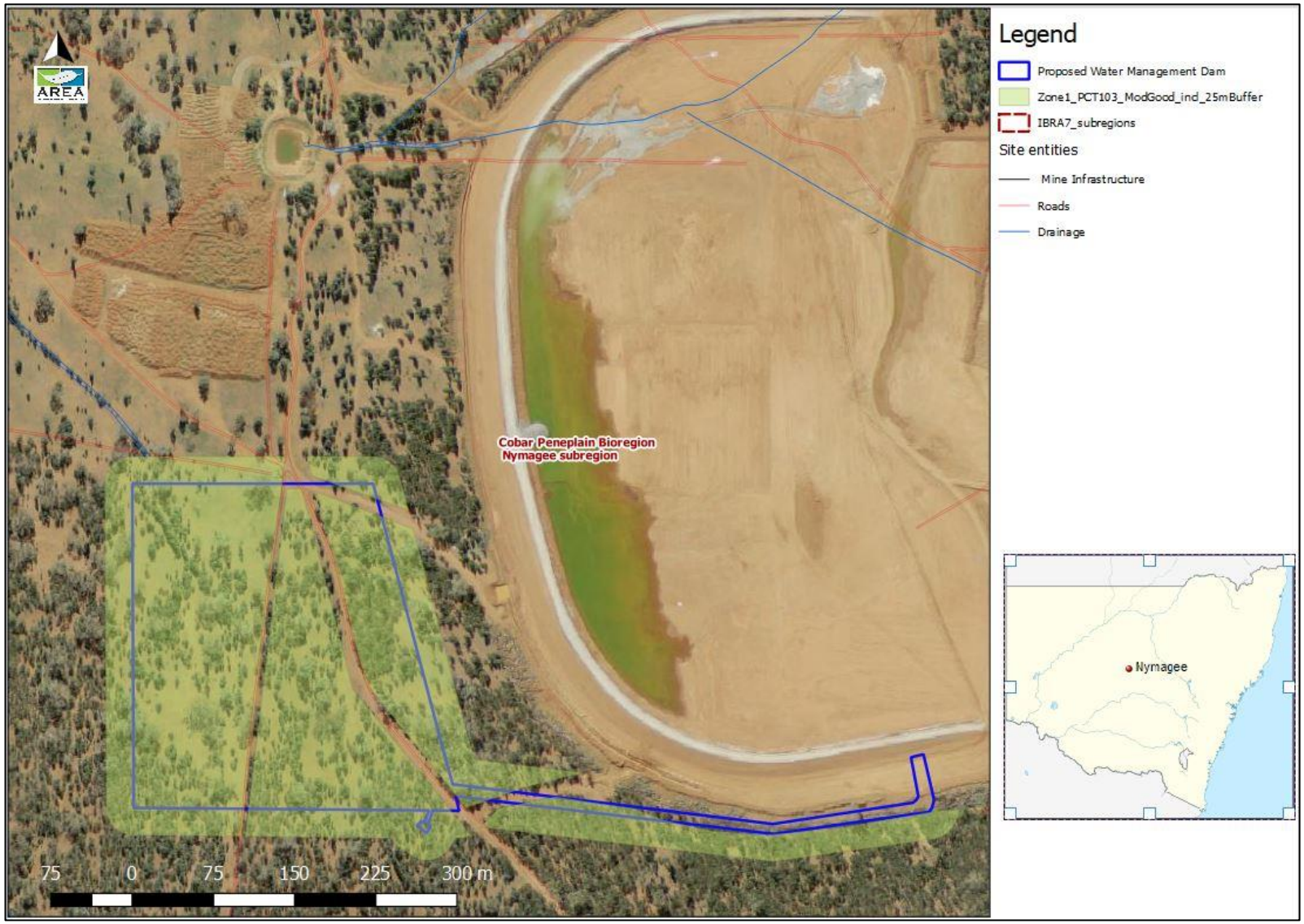
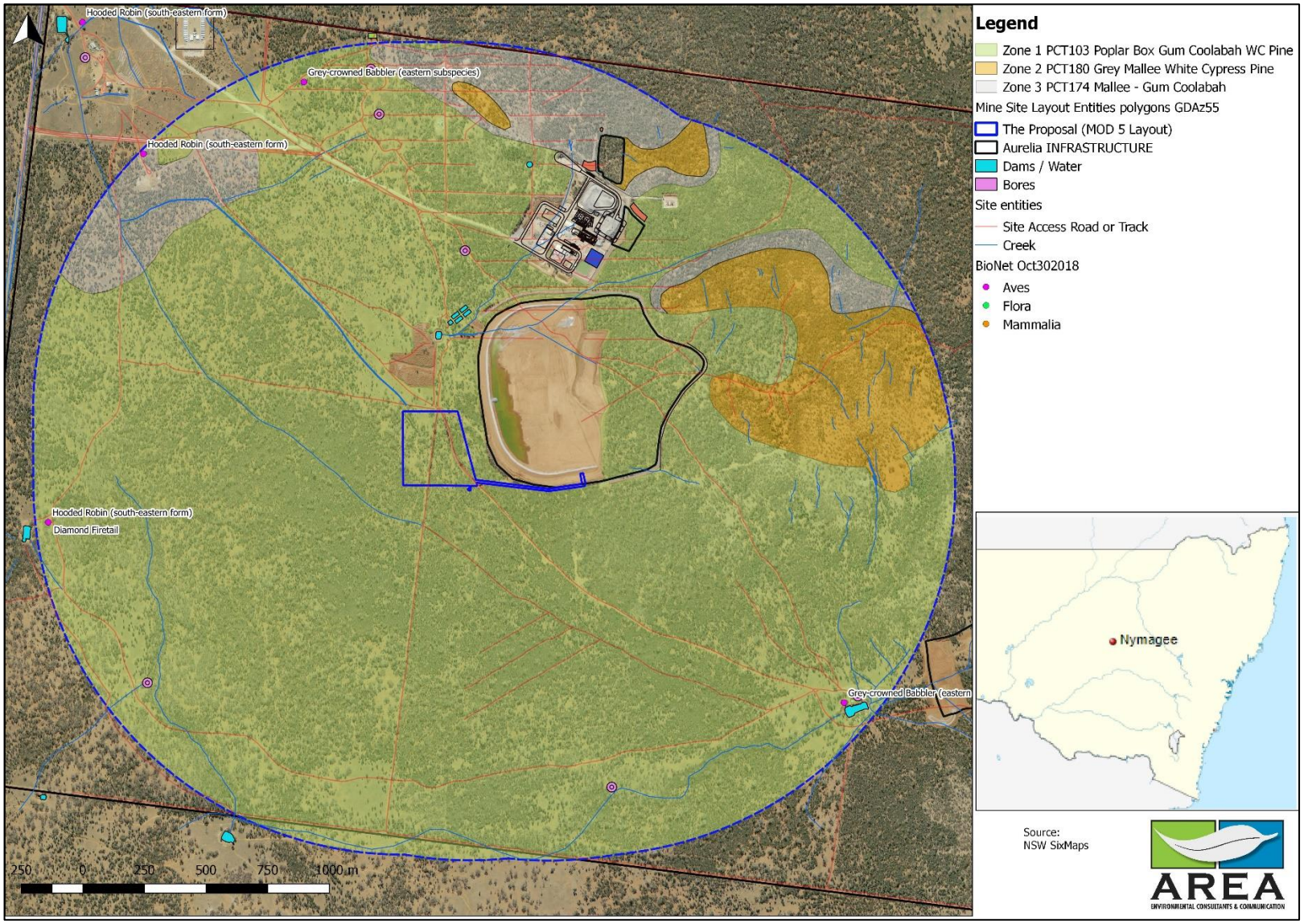


Figure 4-2: Vegetation map within 1500m (the patch size)



4.2.2 Patch size (proposal)

The proposal (impact footprint plus 25m buffer) possesses 11.4 hectares of Zone 1 PCT103 *Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion*. This is located within a 1005.27 hectare patch (within 1500 m) of PCT103.

The proposal is entirely within the Nymagee Downs Mitchell Landscape. The portion of this landscape the proposal is located on has a 11406km^2 patch size.

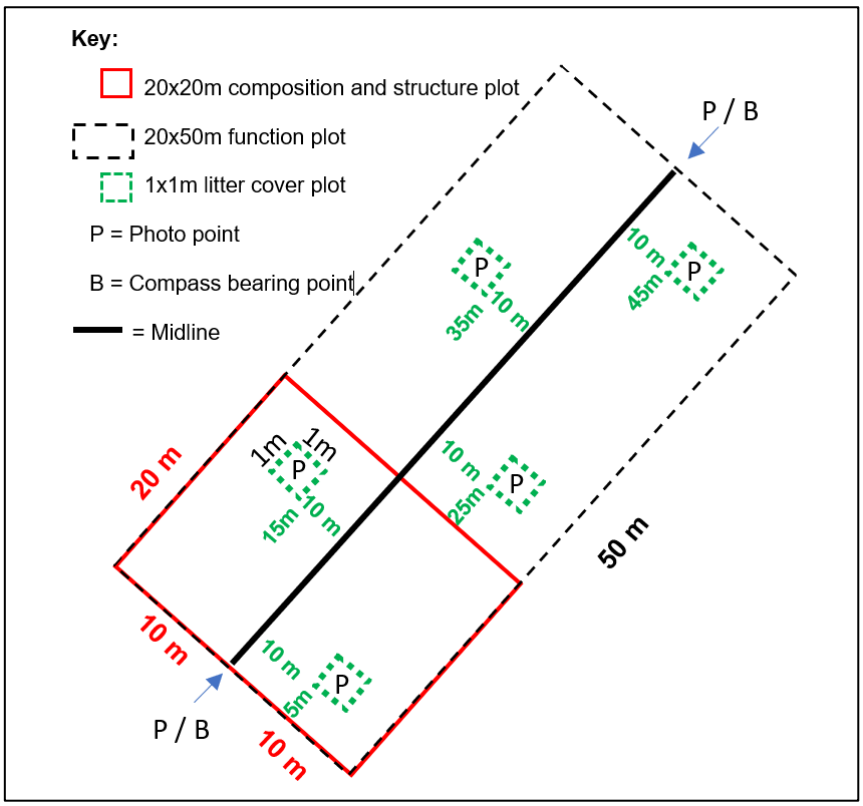
4.2.3 Assessing vegetation integrity using benchmark data

The field data collected using three BAM (2017) plots is presented **Appendix A**.

The following site attributes were assessed in the plots to obtain a quantitative measure of vegetation condition applied in Zones 1 to 3 (also see **Tables 4-1 and 4-2):**

- **Composition score** based on the number of native plant species (richness) recorded by the assessor within the 20m x 20m plot boundary for each growth form group (**Figure 4-3**)
- **Structure score** based on the assessment of foliage cover for each growth form group within the 20m x 20m plot boundary
    - Foliage cover for a growth form group is the percentage of cover of all living plant material of all individuals of the species (**Figure 4-3**).
- **Function score** based on the number of large trees, tree stem size class, tree regeneration, tree hollows and length of fallen logs is recorded within a 20m x 50m plot boundary (**Figure 4-3**)

Figure 4-3: BAM plot lay out (not to scale)



These site attributes were ranked against benchmark data for PCT103 and site value scores for the vegetation zones were determined in accordance with subsection 5.3.4.9 to 5.3.4.28 of the BAM (2017) – see Table on page 39. Additionally, a High Threat Exotic weed assessment was undertaken.

4.2.4 Survey effort as described in Subsection 5.3.4 (number of plots)

The vegetation survey was completed using field survey methods in line with Chapters 5 and 6 of the BAM and by implementing the guidelines for *Threatened Biodiversity Survey and Assessment* (DEC, 2004) and *NSW Guide to Surveying for Threatened Plants* (2016). AREAs Principal Consultant and Senior Ecologist completed surveys for this proposal:

- Three days including three nights of targeted ecological assessments for MOD 5 22-25 September 2018 in the study area following the Biodiversity Assessment Method 2017 (**Figure 5-2**).
- One day of additional assessment on 8 November 2018 to complete species credit species search transects in response to a minor shift of the proposal closer to the existing Tailing Storage Facility (**Figure 5-2**).
- Three days including three nights of targeted ecological assessments for annual monitoring on Hera 16-21 September 2018 (within the 1500m buffer), (**Figure 5-3**). Ecological data collected over three days and night of assessment on Hera from 2013 to 2017 (15 days and nights of data) have also been used to confirm the presence of absence of the regions listed species recorded in PCT103 on Hera (within the 1500m buffer).
- Two days and three nights of targeted ecological searches 23-25 September 2018 on the Nymagee Copper Mine (within the 10km buffer), (**Figure 5-4**).
- Two days of targeted ecological assessment on 'Dominion' (within the 10km buffer) on 7 and 8 November 2018 (**Figure 5-4**).

AREAs ecologists completed the minimum number of transects and plots for each vegetation zone and undertook targeted threatened species searches.

As PCT103 Zone 1 in the study area is 11.4 ha , three plots and transects were required (refer to **Table 4-4**).

Table 4-3: Minimum number of transects / plots required per vegetation zone area

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

The survey effort for all threatened flora, especially for orchids in 2018 was consistent with the document published by OEH: *NSW Guide to Surveying Threatened Plants 2016.* Two surveyors walked potential habitat for *Diuris tricolor* in the study area using 10 to 20 m spaced transects which varied depending on the density of the tree canopy. The assessor was approved as an expert for the species and participated in the Northwest Region for BAMCC review in November 2018.

The preliminary vegetation mapping used vegetation maps produced for the property for the EIS approved in 2013 as well as aerial photography at a desktop level to identify vegetation extent in the study area. Broad-scale soil and vegetation mapping and contour data were used to stratify vegetation across the study area. This mapping was then ground-truthed using a mobile GPS unit and GIS and was converted into polygons. The polygons were then mapped as PCTs and any identified Threatened Ecological Communities (TECs).

Surveys were used to identify variation within vegetation zones in the study area. The structure, function and composition condition of PCTs were then assessed in accordance with Chapter 5 of the BAM. Vegetation zones were assigned by comparing the dominant canopy species, general description of location, soil type and other attributes described in the TSPD (OEH 2016b) and OEH online VIS classification database (OEH 2016c).

Plot-based floristic survey

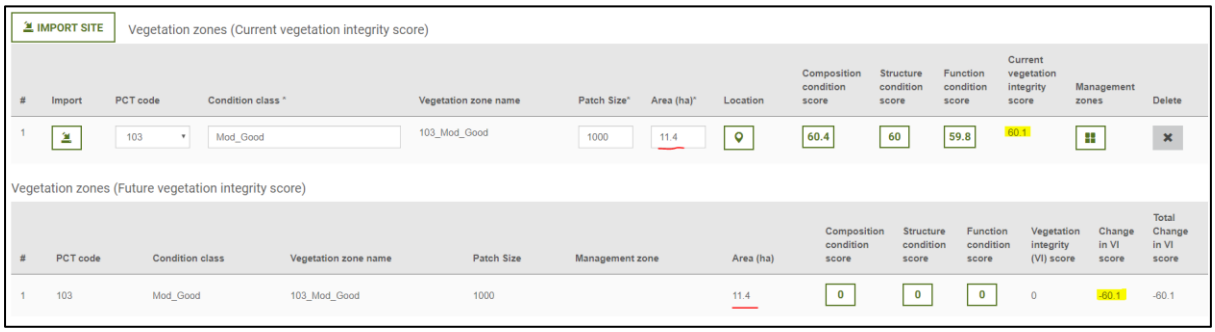
Zone 1 was assessed with 20 by 20 metre quadrats nested inside 20 by 50 metre transects. The following information was collected:

- Stratum and layer – in which each species occurs.
- Growth form – for each recorded species.
- Species name – above ground vascular plant species were identified to the lowest taxonomic order possible using nomenclature consistent with PlantNet NSW.
- Cover – a measure or estimate of the appropriate cover measure for each recorded species; recorded from one to five per cent and then to the nearest five per cent. If the cover of a species is less than one per cent and the species is considered important, then the estimated cover should be entered (e.g. 0.4).
- Abundance rating – a relative measure of the cover abundance of individuals or shoots of each species within the plot was estimated and assigned a cover abundance score using the BAM.

4.2.5 Determining the vegetation integrity score (Appendix 6 of the BAM):

The vegetation integrity score according to the BAMCC for Zone 1 (11.4 hectares of PCT103) is 60.1 (**Figure 4-4**). This score means Zone 1 scores 60.1 out of 100 of the benchmark for the PCT.

Figure 4-4: vegetation integrity score



4.3 Local data

Local benchmark data of BAM plots collected on the property have not been used for this assessment.

Extra data was collected at the three closest BioBanking plots used for annual monitoring 2013 to 2018 to convert a BioBanking Plot to a BAM Plot. This allowed the ground stratum data from these three plots from 2016 to be used in the MOD5 application. The intent of this conversion was to mitigate the skew in the 2018 ground stratum data which was collected during a severe drought by using ground stratum data collected at a time with average rainfall. The author decided not to draw on these data once it was realised the ground stratum values in MOD5 collected in 2018 were within benchmark for PCT103 (i.e. it would set a bad precedent to use local benchmark data at a Development Site as well as a Stewardship Site when data collected was within benchmark).

5 Threatened species

The following section addresses the potential presence of threatened flora and fauna species to be considered in the assessment of impacts and targeted surveys:

- Ecosystem credit species are predicted to occur based on their known presence in the IBRA subregion, the presence of associated PCTs, and the size and condition of the vegetation patches on the site.
- 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 species credit species have habitat constraints within the study area, they are known as candidate species and require further consideration.

A default list of threatened species with potential to occur in the proposal was firstly identified using the assessment filtering tool in the BAMCC. A background review was also conducted to confirm these and possible additional threatened species using the resources shown in **Table 5-1**.

Table 5-1: Wildlife databases used to identify potentially occurring candidate species

Database / resource	Search area	Date accessed
BAM credit calculator (BAMCC)	Brigalow Belt South IBRA > Pilliga > PCT217 and PCT70	30 May 2018
OEH NSW Atlas of Wildlife	10 X10 km centred on Proposal	30 May 2018
Protected Matters Search Tool (DEE)	10 km radius	30 May 2018
OEH Threatened Species Profile Database (TSPD)	Potential presence of vegetation class	30 May 2018
Ecology report for 2013 EIS and data from 2014 to 2018 annual monitoring on Hera (all set within PCT103)	Hera Gold Mine	2013 to November 2018

An assessment of the likelihood of occurrence of threatened species with potential to occur was conducted using the criteria described in **Table 5-2**. The results of this assessment are also provided in **Section 5**:

- All species credit species assessed as having a moderate likelihood of occurring on the site were targeted in surveys of the site.
- Ecosystem credit species were also surveyed for, this is to inform credit calculations regarding presence or absence.

Table 5-2: Terms used to describe potentially occurring candidate species

Likelihood of Occurrence	Criteria
Unlikely	Species highly restricted to certain geographical areas not within the proposal footprint Species that have specific habitat requirements are not present in the study area
Low	Species that fit into one or more of the following criteria: • Have not been recorded previously in the study area / surrounds and for which the study area is beyond the current distribution range • Use specific habitats or resources not present in the study area • Are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded
Moderate	Species that fit one or more of the following criteria: • Have infrequently been recorded previously in the study area / surrounds • Use specific habitats or resources present in the study area but in a poor or modified condition • Are unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration • Are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded

Likelihood of Occurrence	Criteria
High	Species that fit one or more of the following criteria: • Have frequently been recorded previously in the study area / surrounds • Use habitat types or resources that are present in the study area that are abundance and/or in good condition within the study area • Are known or likely to maintain resident populations surrounding the study area • Are known or likely to visit the site during regular seasonal movements or migration

5.1 Ecosystem credit species associated with PCTs on the development site as outlined in Section 6.2 of BAM

The BAMCC assessment tool identified 11 threatened species reliably predicted to utilise the site (**Table 5-3**). No surveys are required for these species. Ecosystem credits apply to these species.

Table 5-3: threatened species reliably predicted to utilise 103-Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Ecosystem species)

Common Name	Scientific Name	Habitat constraints	Confirmed?	Sensitivity to gain class	NSW listing status	National listing status.
Diamond Firetail	*Stagonopleura guttata*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Inland Forest Bat	*Vespadelus baverstocki*	N/A	Yes	High Sensitivity to Potential Gain	Endangered	Not Listed
Little Pied Bat	*Chalinolobus picatus*	N/A	Yes	High Sensitivity to Potential Gain	Endangered	Not Listed
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Pied Honeyeater	*Certhionyx variegatus*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Spotted Harrier	*Circus assimilis*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Superb Parrot	*Polytelis swainsonii*	N/A	Yes	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	N/A	High Sensitivity to Potential Gain	Vulnerable	Not Listed	High Sensitivity to Potential Gain

Figure 5-1 and **Table 5-4** shows what flora and fauna have been recorded within 10 km of the study area.

Table 5-4: threatened species known within 10 km of the proposal

Kingdom Name	Class Name	Scientific Name	Common Name	NSW Status	Comm Status	Source	No of records
Fauna	Aves	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	VP		BioNet	5
Fauna	Aves	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	VP2		BioNet	3
Fauna	Aves	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	VP		BioNet	3
Fauna	Aves	*Merops ornatus*	Rainbow Bee-eater	P	J	BioNet	2
Fauna	Aves	*Chthonicola sagittata*	Speckled Warbler	VP		BioNet	2
Fauna	Aves	*Stagonopleura guttata*	Diamond Firetail	VP		BioNet	2
Fauna	Mammalia	*Chalinolobus picatus*	Little Pied Bat	VP		BioNet	2
Fauna	Aves	*Leipoa ocellata*	Malleefowl	E1P	V	BioNet	1
Fauna	Aves	*Circus assimilis*	Spotted Harrier	VP		BioNet	1
Fauna	Aves	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	VP		BioNet	1
Fauna	Aves	*Certhionyx variegatus*	Pied Honeyeater	VP		BioNet	1
Fauna	Aves	*Epthianura albifrons*	White-fronted Chat	VP		BioNet	1
Fauna	Aves	*Cinclosoma castanotum*	Chestnut Quail-thrush	VP		BioNet	1
Fauna	Aves	*Pachycephala inornata*	Gilbert's Whistler	VP		BioNet	1
Fauna	Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	VP		BioNet	1
Fauna	Mammalia	*Antechinomys laniger*	Kultarr	E1P		BioNet	1
Fauna	Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	VP	V	Aurelia Hera / Nymagee* monitoring reports	1
Fauna	Mammalia	*Miniopterus schreibersii oceansis*	Eastern Bentwing Bat	VP		Aurelia Hera / Nymagee* monitoring reports	1
Fauna	Mammalia	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	VP		Aurelia Hera / Nymagee* monitoring reports	1
Fauna	Mammalia	*Vespadelus baverstocki*	Inland Forest Bat	VP		Aurelia Hera / Nymagee* monitoring reports	1
Fauna	Mammalia	*Vespadelus troughtoni*	Eastern Cave Bat	VP		Aurelia Hera / Nymagee* monitoring reports	1

E = Endangered
V = Vulnerable
P = Protected

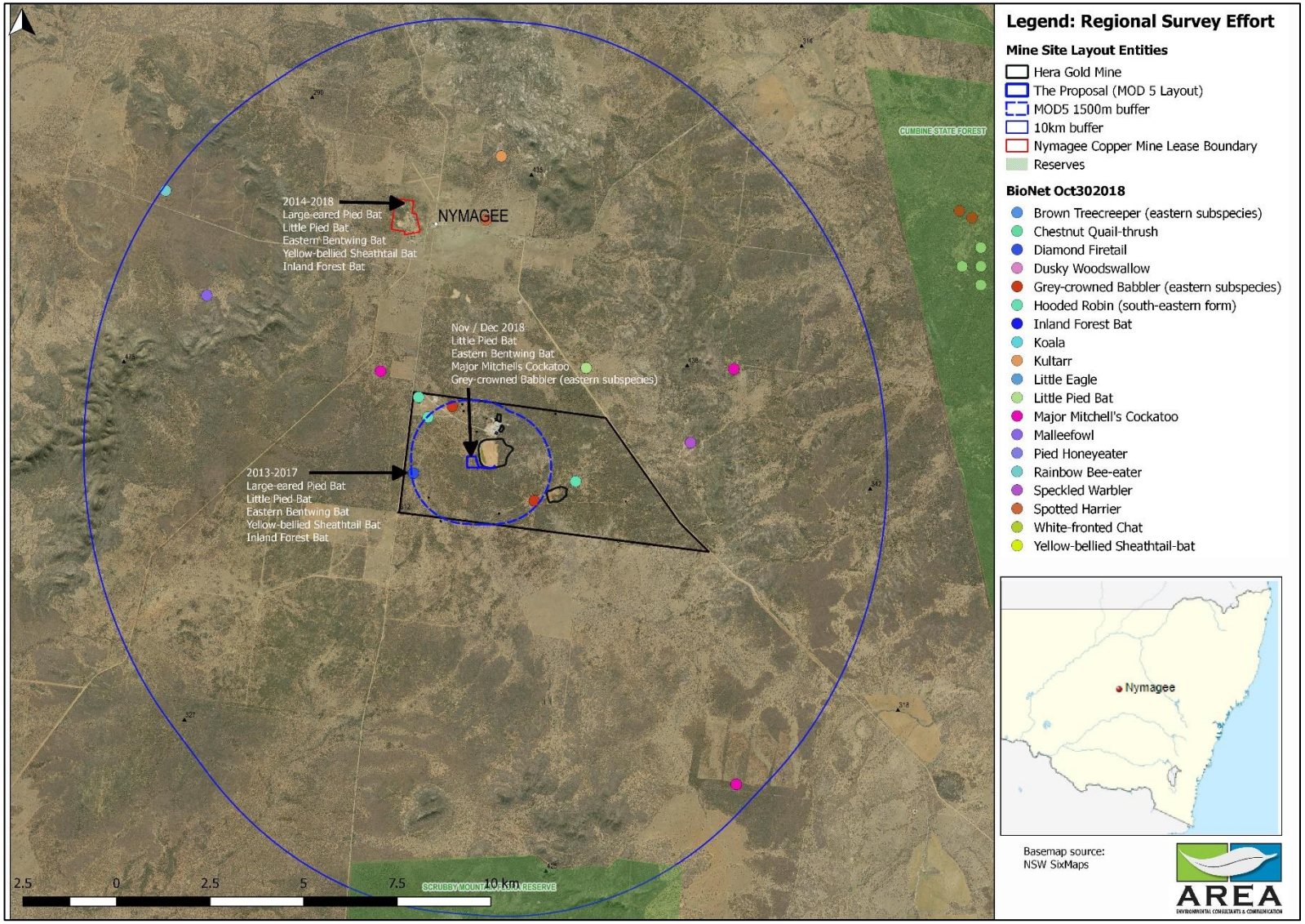
J = Japan bilateral agreement

*bat records from annual monitoring not on BioNet (now submitted)

5.1.1 List of ecosystem credit species derived

The likelihood of occurrence for each species has considered the presence of these predicted species, and the list of species included in the impact assessment is provided in **Table 5-3**. These species are subsequently assessed in conjunction with biodiversity values reported in **Chapter 6** and potential impacts in **Chapter 7**.

Figure 5-1: BioNet results within 10km of the proposal



5.1.2 Justification for exclusion of any ecosystem credit species predicted

Fourteen of the 25 ecosystem credit species on **Table 5-5** were identified as Unlikely to use habitat in the study area were excluded. Factors such as the structure, species composition and function of PCT103 in the Proposal and local knowledge from assessment of PCT103 in the same Zone on Hera (see Section 2.3.3) were used to inform the decision.

Local knowledge is derived from about eight years of environmental assessment on the property within PCT103 in the same condition on the Nymagee Copper Mine (within 10 km), Chelsea biodiversity offset area (20 km south) and Dominion (within 10km) in different employment capacities (all ecology roles many of them completing tarted threatened flora and fauna assessments).

Proximity to permanent water in the region results in more rabbits, cats, dogs and foxes. Experience from targeted ground dwelling mammal trapping in the region (where dunnarts, antechinus and Kultarr were captured) demonstrated a higher trapping success (Elliot's, pitfalls and funnel traps) in areas more distant to water, with higher floral biodiversity than on Hera usually after inundating rains, usually at the same time as or just after a mouse plague.

More details of why 14 ecosystem credit species were excluded have been provided on **Table 5-5**.

Table 5-5: Justification for exclusion of any ecosystem credit species predicted

Ecosystem Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the assessment. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018 (September, November, December and January assessments)
Antechinomys laniger	Kultarr	--	--	High Sensitivity to Potential Gain	Endangered	Not Listed	Not recorded on Hera despite high survey effort from 2013 to 2018. 18 nights of Elliot trapping (50 traps / night = 900 trap nights. 18 nights of pitfall trapping (5 pitfalls / night = 90 nights). 3 nights of funnel trapping. 75 trapping nights were in the study area as part of this BDAR, the rest (also 75 trapping nights) were 1km west near Petes Tank which is likely habitat for the species. Both assessed areas are in PCT103 in the same Zone (per EIS). The difference between the habitats is the microclimate – Pete's tank has a higher density of eucalypts and therefore deeper leaf litter which has more food resources for Kultarr.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera, no feeding habitat within study area.
Chthonicola sagittata	Speckled Warbler	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera, no feeding or breeding habitat within study area due to an absence of a grassy layer (even after

Ecosystem Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the assessment. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018 (September, November, December and January assessments)
							assessment on years following inundating rains)
Cinclosoma castanotum	Chestnut Quail-thrush	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera, no feeding or breeding habitat within study area due to an absence of a grassy layer (even after assessment on years following inundating rains)
Daphoenositta chrysoptera	Varied Sittella	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Falco hypoleucos	Grey Falcon	--	--	Moderate Sensitivity to Potential Gain	Endangered	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Grantiella picta	Painted Honeyeater	Mistletoes present at a density of greater than five mistletoes per hectare	--	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable	Species not observed on Hera (Dedicated bird transects and incidental observations). Mistletoe density lower than habitat constraint requirement.
Hamirostra melanosternon	Black-breasted Buzzard (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).

Ecosystem Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the assessment. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018 (September, November, December and January assessments)
Hieraaetus morphnoides	Little Eagle (Foraging)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Ninox connivens	Barking Owl (Foraging)	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Call playback and spotlighting).
Nyctophilus corbeni	Corben's Long-eared Bat	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	Species not recorded on Hera (Ultrasonic detection).
Pachycephala inornata	Gilbert's Whistler	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Phascolarctos cinereus	Koala (Foraging)	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	Species not observed on Hera (EPBC SAT, Call playback and spotlighting).

5.2 Identify species credit species in the study area

This section has BAMCC outputs showing which species credit species were present at the study area.

Table 5-6 shows 14 species credit species (13 species and one population) were considered as having potential to use habitat in the Proposal. None of these were identified as having potential to be affected by the proposal.

5.2.1 Justification for exclusion of any species credit species predicted

Other species listed in **Table 5-6** were excluded because:

- They were not recorded during the assessment despite more than adequate survey effort.
- Based on accumulative experience from 2010 to 2018, much of which is on Hera the Nymagee Cooper Mine, Chelsea the biodiversity offset area and a neighbouring property, many species were excluded because they were not observed or thought to have an association with PCT103 in the study area. Notwithstanding while its all Zone1 there are

More details of why these 14 species credit species (13 species and one population) were excluded have been provided on **Table 5-6**.

Table 5-6: species credit species on the proposal

Species Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the study area. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018.
Acacia curranii	Curly-bark Wattle	Rocky areas	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	The author has a lot of experience with this species and it was not recorded, nor considered to have habitat in the Proposal. This species is very easy to detect.
Austrostipa wakoolica	A spear-grass	--	--	Moderate Sensitivity to Potential Gain	Endangered	Endangered	This species is challenging to identify (but not hard to detect). It was not recorded in the study area, further the landform and microclimates including soil type are not suited for this species.
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs	--	High Sensitivity to Potential Gain	Endangered	Not Listed	Species not observed on Hera (Call playback and spotlighting).
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	All trees were assessed classified using the BAM Streamline Model. No hollows observed with a diameter greater than 20cm showed signs as breeding habitat. The assessment occurred at a time the species would be raising young.
Calyptorhynchus lathami - endangered population	Glossy Black-Cockatoo, Riverina population	--	Restricted to Cobar LGA	High Sensitivity to Potential Gain	Endangered Population	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Commersonia procumbens	*Commersonia procumbens*	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	The author has a lot of experience with this species and it was not recorded. Habitat exists for this species, but it

Species Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the study area. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018.
							was not detected. This species is very easy to detect.
Diuris tricolor	Pine Donkey Orchid	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Not detected during the assessment at a time an analogue population in the Central West LLS region was in flower. Not detected on Hera during a targeted orchid assessment in September 2014 after inundating rain in locations considered as possible habitat.
Hamirostra melanosternon	Black-breasted Buzzard (Breeding)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	The author has seen breeding habitat for this species near Broken Hill and it, nor its distinctive nest was not recorded.
Hieraaetus morphnoides	Little Eagle (Breeding)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations).
Lophochroa leadbeateri	Major Mitchell's Cockatoo (Breeding)	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	All trees were assessed classified using the BAM Streamline Model. No hollows observed with a diameter greater than 20cm showed signs as breeding habitat. The assessment occurred at a time the species would be raising young.

Species Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status.	Why excluded in the study area. Note: 3.5 days of targeted in the study area assessment per - NSW Guide to Surveying for Threatened Plants (2016) - NSW guidelines for Threatened Biodiversity Survey and Assessment (DEC, 2004) 27.2 days / 18 nights of assessment on Hera for the EIS and annual monitoring events from 2013 to 2018.
Ninox connivens	Barking Owl (Breeding)	--	--	High Sensitivity to Potential Gain	Vulnerable	Not Listed	Species not observed on Hera (Dedicated bird transects and incidental observations). All trees were assessed classified using the BAM Streamline Model. No hollows observed with a diameter greater than 20cm showed signs as breeding habitat. The assessment occurred at a time the species would be raising young.
Phascolarctos cinereus	Koala (Breeding)	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	Species not observed on Hera (EPBC SAT, Call playback and spotlighting).
Pterostylis cobarensis	Greenhood Orchid	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed	Not detected during the assessment at a time it should be in flower. Not detected on Hera during a targeted orchid assessment in September 2014 in locations considered as possible habitat.

5.2.2 List of candidate species

This section has BAMCC outputs showing what candidate species credits are assumed as present at the study area require survey (**Table 5-7**).

Table 5-6 provides a list of candidate species with a known association of habitats affected by the proposal or indirectly affected.

Table 5-7: List of candidate species credit species requiring survey

List of Species Requiring Survey
Name
Acacia curranii Curly-bark Wattle
Austrostipa wakoolica A spear-grass
Burhinus grallarius Bush Stone-curlew
Lophochroa leadbeateri Major Mitchell's Cockatoo
Calyptorhynchus lathami Glossy Black-Cockatoo
Diuris tricolor Pine Donkey Orchid
Hamirostra melanosternon Black-breasted Buzzard
Polytelis swainsonii Superb Parrot
Commersonia procumbens *Commersonia procumbens*
Ninox connivens Barking Owl
Phascolarctos cinereus Koala
Pterostylis cobarensis Greenhood Orchid
Hieraaetus morphnoides Little Eagle
Calyptorhynchus lathami - endangered population Glossy Black-Cockatoo, Riverina population

5.2.3 Justification for inclusions and exclusions based on habitat features

The candidate species listed in **Table 5-7** were given targeted assessment following requisite guidelines to detect them. Of those species on BAMCC none were recorded in the study area and one, *Polytelis swainsonii* Superb Parrot, is considered to have habitat within the study area as it has been recorded on Hera.

When candidate species were excluded based on habitat features, this is explained in **Table 5-6**.

5.2.4 Indication of listed flora or fauna presence based on targeted survey or expert report

Listed flora or fauna recorded in the Study Area includes:

- Grey-crowned Babbler eastern sub species (feeding and breeding habitat)
- Major Mitchell Cockatoo (feeding habitat)
- Three species of microbats (Inland Forest Bat, Little Pied Bat and Yellow-bellied Sheathtail-bat).

Table 5-8 provides additional listed threatened species not recorded but considered to use habitat affected b the proposal

Table 5-8: List of candidate species affected by the proposal

Common Name	Scientific Name	Type
Diamond Firetail	*Stagonopleura guttata*	Ecosystem credit species
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Ecosystem credit species
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Ecosystem credit species
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	Ecosystem credit species
Inland Forest Bat	*Vespadelus baverstocki*	Ecosystem credit species
Little Pied Bat	*Chalinolobus picatus*	Ecosystem credit species
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	Ecosystem credit species
Pied Honeyeater	*Certhionyx variegatus*	Ecosystem credit species
Spotted Harrier	*Circus assimilis*	Ecosystem credit species
Superb Parrot	*Polytelis swainsonii*	Species credit species
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Ecosystem credit species

5.2.5 Details of targeted survey technique, effort, timing and weather

Terrestrial flora surveys

27.2 days of targeted flora assessments has occurred on Hera since 2010, four of these were spent on the study area (three for the BDAR and one to do more species credit assessments when the design was move slightly east toward the existing Tailings Storage Facility).

Targeted flora surveys in the study area were undertaken for all identified candidate flora species following the methods described in *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft* (DEC 2004) and the *NSW Guide to Surveying for Threatened Plants* (OEH 2016). A combination of 10m to 20m transects in impact footprints, floristic plot surveys (per BAM 2017) and random meander surveys (Cropper 1993) further afield were undertaken to identify, search and record any candidate species. The assessment covered no less than 100 m from the study area boundary mainly in part to it being moved 50 m east, closer to the existing Tailings Storage Facility than the initial location assessed. A second field assessment was undertaken to cover the location shift with additional threatened species transects.

The *NSW Guide to Surveying for Threatened Plants* technique is more likely to detect threatened species (including fauna) than plot-based survey used in floristic surveys. This technique is considered preferable in terms of searching potential habitat in the study area and generally allows for greater area coverage than a plot-based survey. Random meander surveys are used to inspect an area with potential to provide habitat for a protected matter irrespective of its location.

As a general rule of thumb, PCT103 received transects no more than 10 to 15 m spacing due to its width in the study area. PCT103 varied mainly due to the density of White Cypress Pines with no to very little leaf litter and the location of residual eucalypts where deep litter was present. When potential feeding or breeding habitat was observed or habitat for the regions listed orchids was detected transects dropped to no more than 10 m but otherwise transects averaged between 15 to 20 m spacing.

The study area received an adequate amount of flora survey effort cumulatively since 2010 (27.2 days on Hera, of these four days were within the study area). A summary of flora survey techniques employed is provided in **Table 5-9** and shown on **Figures 5-2 to 5-4.**

Table 5-9: Summary of flora survey timing, methods and survey effort

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
25 – 29 April 2010 for EIS	Heidi Kolkert Phil Cameron	Hera	Hera Project, via Nymagee – Ecology Assessment	OzArk Nov-11	Fauna • Targeted and incidental bird watching • Targeted and incidental assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night Flora • Plots / Transects • On foot assessment of impact areas using linear transects.	• 10.6km of linear driven transects with 13 x 100 m walked transects • Four stationary dawn bird surveys • Four stationary dusk bird surveys • Four stationary midday bird surveys • Opportunistic observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Four hours total (one hour per day) • Call playback (nocturnal) four nights / one hour per task (four hours) • Anabat assessment four nights (separate locations) suing two devices over four consecutive nights (8 nights) • Two hours spotlighting per evening over four nights (8 hours) • 200 Elliot trap nights (over four nights) • 16 cage trap nights (4 cages per night over four nights). • Five 20x20 plots (pre BioBanking days) • Targets threatened species transects in impact footprints	5 days / 4 nights
24-Oct-11	Phil Cameron	Hera	Letter Re: Cobar Greenhood Orchid, *Pterostylis*	OzArk Jul-12	Flora • On foot assessment using linear transects.	• One day assessment of impact footprint and likely areas of habitat	1 day

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
			cobarensis, (V) EPBC Act				
20-May-13	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Tailings Dam (Stage 1) and Workshop Area	OzArk May-13	Fauna • Targeted assessment of hollow bearing trees • Targeted assessment for listed fauna habitat in the impact footprint Flora • Targeted assessment for listed flora	• Linear transects.	1 day
3-Jun-13	Rowan Murphy	Hera	Letter Re: Pre-clearing Assessment for Workshop Area	OzArk Jul-13	Fauna • Targeted assessment of hollow bearing trees • Targeted assessment for listed fauna habitat in the impact footprint Flora • Targeted assessment for listed flora	• Linear transects.	1 day
14-Aug-13	Rowan Murphy	Hera	Re: Pre-clearing Assessment for Tailings Dam Stage II and III & Back Tank East	OzArk Aug-13	Fauna • Targeted assessment of hollow bearing trees • Targeted assessment for listed fauna habitat in the impact footprint Flora • Targeted assessment for listed flora	• Linear transects.	1 day
					Fauna • Targeted and incidental bird watching	• 10.6km of linear driven transects with 13 x 100 m walked transects • Four stationary dawn bird surveys	

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
4 – 8 November 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-13	• Targeted and incidental assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• Four stationary dusk bird surveys • Four stationary midday bird surveys • Opportunistic observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Four hours total (one hour per day) • Call playback (nocturnal) four nights / one hour per task (four hours) • Anabat assessment four nights (two separate locations) using two devices over four consecutive nights (8 nights) • 1.5 hours spotlighting per evening over four nights (6 hours) • 200 Elliot trap nights (over four nights) • 16 cage trap nights (4 cages per night over four nights). • 13 20x20m plots in 20x50m habitat plots (pre BioBanking days) • 3 LFA plots • Targets threatened species transects	5 days / 4 nights
14-Feb-14	Rowan Murphy	Hera	Pre-clearing survey of a small area for clay extraction	OzArk Feb-14	Fauna • Targeted assessment of hollow bearing trees • Targeted assessment for listed fauna habitat in the impact footprint Flora • Targeted assessment for listed flora	• Linear transects.	1 day

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
15 – 18 December 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-15	Fauna • Targeted and incidental bird watching • Targeted and incidental assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• 10.6km of linear driven transects with 13 x 100 m walked transects • Four stationary dawn bird surveys • Four stationary dusk bird surveys • Four stationary midday bird surveys • Opportunistic observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Four hours total (one hour per day) • Call playback (nocturnal) four nights / one hour per task (four hours) • Anabat assessment four nights (two separate locations) using two devices over four consecutive nights (8 nights) • 1.5 hours spotlighting per evening over four nights (6 hours) • 200 Elliot trap nights (over four nights) • 16 cage trap nights (4 cages per night over four nights). • 13 20x20m plots in 20x50m habitat plots (pre BioBanking days) • 3 LFA plots • Targets threatened species transects	5 days / 4 nights
6 – 7 July 2015	Phil Cameron	Hera	Framework for Biodiversity Assessment: Biodiversity Assessment Report - Hera Mine	OzArk 29-Jul-15	Fauna • Targeted and incidental bird watching • Targeted and incidental assessment • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects	• One stationary midday bird survey • Opportunistic observations • Flipping rocks / logs and searching for reptiles and amphibians. One-hour total	

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
			Modification 3 Pa10_0191		Flora • BioBanking plots & transects • On foot assessment using linear transects.	• 5 20x20m plots in 20x50m habitat plots (BioBanking) • 3 LFA plots • Targets threatened species transects	2 days / 1 night
6 – 7 July 2015	Phil Cameron	Hera	Ecology Field and Heritage Desktop Assessment: Proposed Air Vent at Hera Gold Mine	OzArk Oct-15	Fauna • Targeted and incidental bird watching • Targeted and incidental threatened fauna assessment • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects Flora • On foot assessment using linear transects.	• Opportunistic observations • Flipping rocks / logs and searching for reptiles and amphibians. 15 minutes total • Targets threatened species transects	0.2 day
11 – 13 January 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-16	Fauna • Targeted and incidental bird watching • Targeted and incidental assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night	• 10.6km of linear driven transects • Opportunistic bird observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Three hours total (one hour per day) • Call playback (nocturnal) two nights / one hour per task (two hours) • Anabat assessment two nights (two separate locations) using two devices (4 nights) • 1.5 hours spotlighting per evening over four nights (3 hours) • 100 Elliot trap nights (over two nights) • 8 cage trap nights (4 cages per night over two nights).	3 days / 2 nights

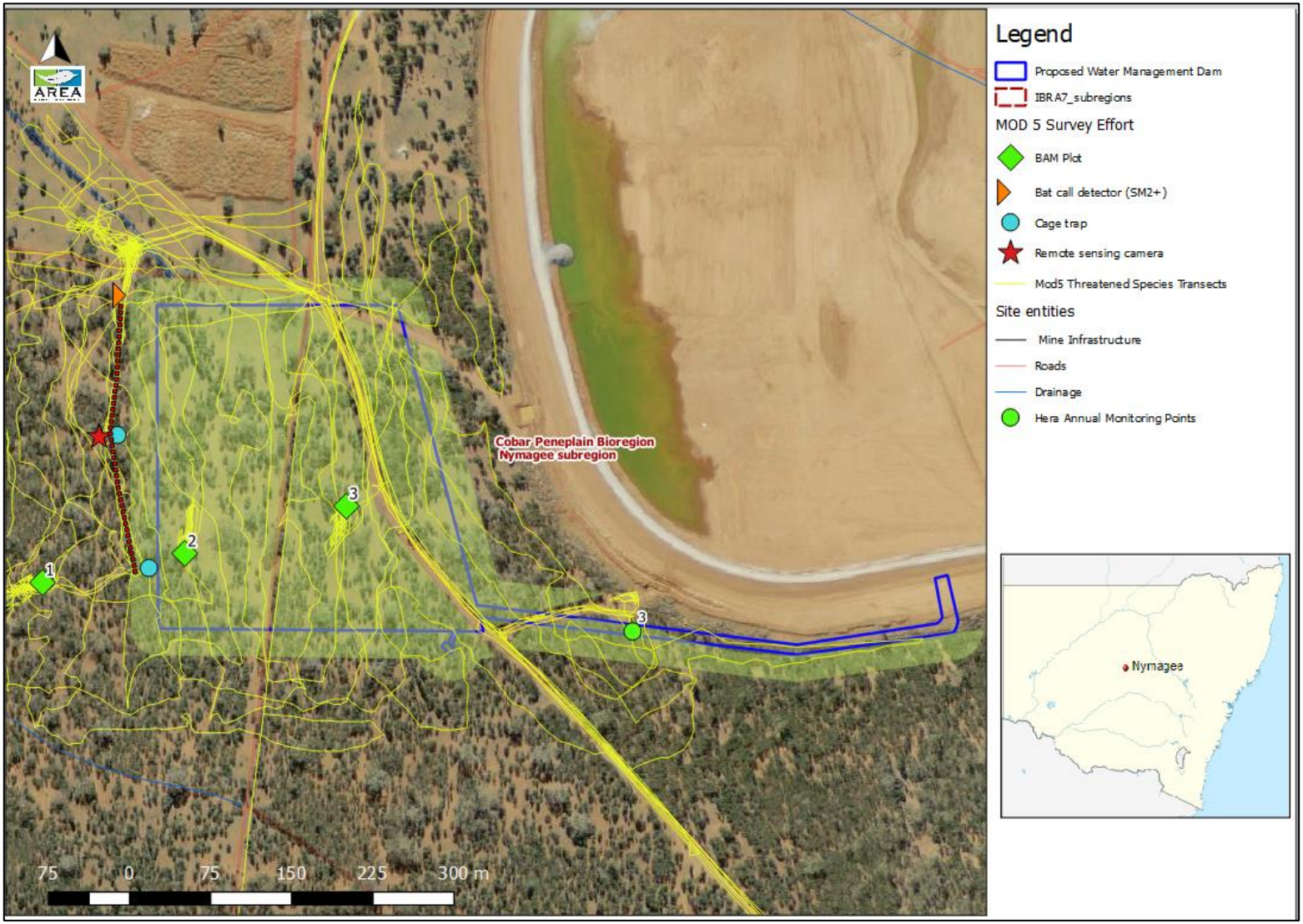
Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
					Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• 13 20x20m plots in 20x50m habitat plots (BioBanking) • 3 LFA plots • Targets threatened species transects	
6 – 12 January 2017	Rowan Murphy Nikki Allen Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report – Hera Mine and 'Chelsea' Biodiversity Offset Area, 2017	OzArk Aug-17	Fauna • Targeted and incidental bird watching • Targeted and incidental fauna assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• 10.6km of linear driven transects with 13 x 100 m walked transects • Opportunistic observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Three hours total (one hour per day) • Call playback (nocturnal) three nights / one hour per task (three hours) • Anabat assessment three nights (two separate locations) using two devices over three consecutive nights (9 nights) • 1.5 hours spotlighting per evening over three nights (3 hours) • 150 Elliot trap nights (over three nights) • 12 cage trap nights (4 cages per night over three nights). • 13 20x20m plots in 20x50m habitat plots (BioBanking) • 3 LFA plots • Targets threatened species transects	3 days / 3 nights
16-21 September 2018	Phillip Cameron Lynda Marshall Heidi Kolkert	Hera and Chelsea (Biodiversity Offset Area)	Flora and Fauna Monitoring Report –	AREA Env (in prep)	Fauna • Targeted and incidental bird watching	• 10.6km of linear driven transects with 13 x 100 m walked transects and two circa 500 to 800m bird transects at dawn	

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
			Hera Mine and 'Chelsea' Biodiversity Offset Area, 2019		• Targeted and incidental fauna assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 50 x Elliot traps / night in two groups of 25 traps • Cage traps x 4 per night • 2 x Camera traps Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• Opportunistic observations • Flipping rocks / logs and searching farm dams adlib for reptiles and amphibians. Three hours total (one hour per day) • Call playback (nocturnal) three nights / one hour per task (three hours) • Anabat assessment three nights (two separate locations) using two devices over three consecutive nights (9 nights) • 1.5 hours spotlighting per evening over three nights (3 hours) • 150 Elliot trap nights (over three nights) • Four cage trap nights (2 cages per night over 2 nights). • 13 20x20m plots in 20x50m habitat plots (BioBanking) • 3 LFA plots • Targets threatened species transects	3 days / 3 nights
22-25 September	Phillip Cameron Heidi Kolkert	**Hera MOD 5 SSD**	MOD 5 Biodiversity Assessment Development Assessment Report 2019	AREA Env (in prep)	Fauna • Targeted and incidental bird watching • Targeted and incidental fauna assessment • Targeted nocturnal surveys • Looking for signs of small mammal activity, i.e. diggings, scats or tracks along linear transects • Anabat assessment • 25 x Elliot traps / night • 2 x Cage traps per night	• 15-2-m linear transects walked over Proposal. • Opportunistic observations • Flipping rocks / logs and searching adlib for reptiles and amphibians. 1.5 hours total (0.5 hours per day) • Call playback (nocturnal) three nights / one hour per task (three hours) • Anabat assessment three nights using one device over three consecutive nights (3 nights)	3 days / 3 nights

Survey date	Survey personnel	Survey area	Report title	Company / Report date	Survey	Survey Effort	Number of survey days / nights on Hera
					• 1 x Camera trap Flora • Plots & transects / Landscape Function Analysis (LFA) points • On foot assessment using linear transects.	• 1.5 hours spotlighting per evening over three nights (3 hours) • 75 Elliot trap nights (over three nights) • Six cage trap nights (2 cages per night over 3 nights). • Three 20x20m plots in 20x50m habitat plots (BAM 2017) • Targets threatened species transects	
7 November 2018	Phillip Cameron	**Hera MOD 5 SSD –** slightly moved impact footprint	MOD 5 Biodiversity Assessment Development Assessment Report 2019	AREA Env (in prep)	Fauna • Targeted assessment of hollow bearing trees • Targeted assessment for listed fauna habitat in the impact footprint Flora • Targeted assessment for listed flora	• Linear transects.	1 day

Survey effort at the Nymagee Copper Mine, Chelsea the Biodiversity Offset Area and on Dominion has not been included on the Table above but their locations has been provided as **Figure 5-4**.

Figure 5-2: 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 5-3: Survey effort within 1500m

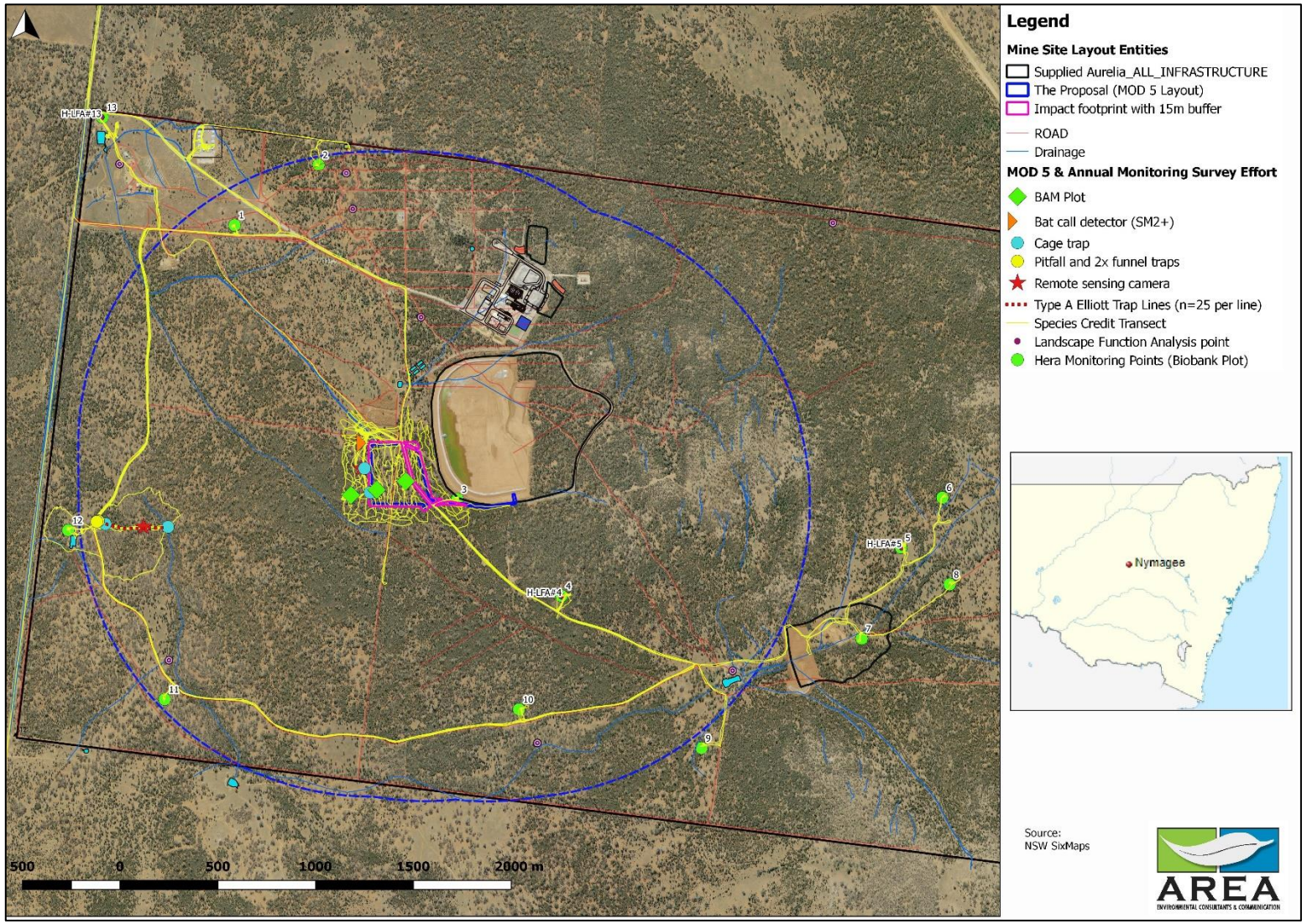
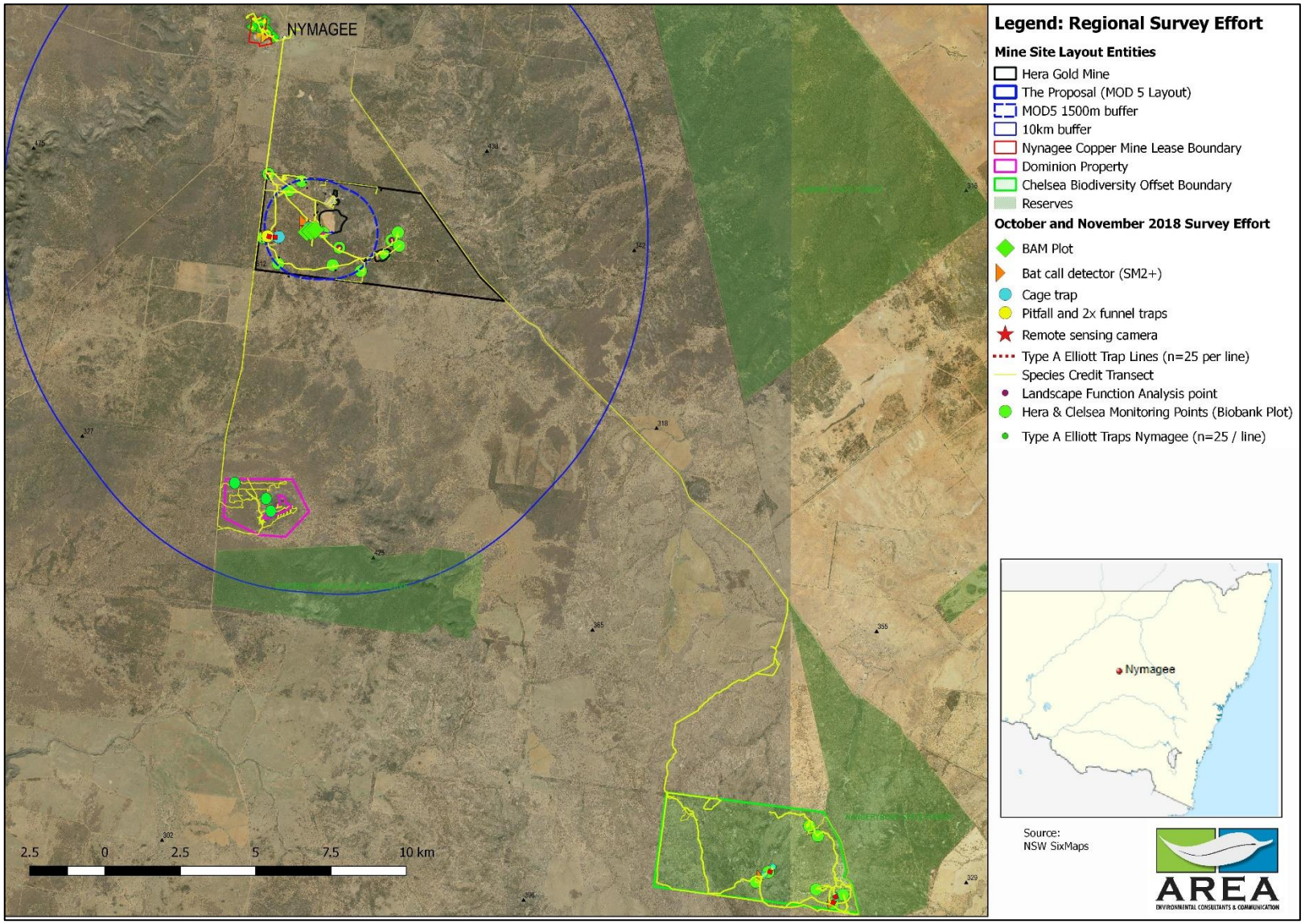


Figure 5-4: October and November 2018 Survey effort within the region



Terrestrial fauna surveys

Local experience, previous survey of the region, preliminary reporting and information held on government databases and archives were used to inform the assessment.

Cumulatively 27.2 days and 18 nights of survey effort was applied since 2010 on Hera, of which four days and three nights were located in the study area. The focus of the assessment was detecting threatened species fauna or their habitat. The survey time matrix produced by the assessment tool in the BAMCC and from review of the Threatened Species Profile Database (TPSD) is shown in **Table 5-10**.

Table 5-10: Species Requiring Survey time matrix (source BAM Calculator and TSPD)

List of Species Requiring Survey	Can be detected	September (spring) and November (summer) BDAR assessment adequacy
Name		
Acacia curranii Curly-bark Wattle	Anytime (flowers in summer)	Adequate
Austrostipa wakoolica A spear-grass	Flowers from October to December, mainly in response to rain.	Adequate
Burhinus grallarius Bush Stone-curlew	Anytime (breeds in spring)	Adequate
Lophochroa leadbeateri Major Mitchell's Cockatoo	Anytime (breeds in spring)	Adequate
Calyptorhynchus lathami Glossy Black-Cockatoo	Anytime (breeds in spring)	Adequate
Diuris tricolor Pine Donkey Orchid	Usually flowers between early September to late October.	Adequate
Hamirostra melanosternon Black-breasted Buzzard	Anytime (breeds in spring)	Adequate
Polytelis swainsonii Superb Parrot	Anytime (breeds in spring)	Adequate
Commersonia procumbens Commersonia procumbens	Anytime (fruiting period is summer to autumn. Flowers from August to December).	Adequate
Ninox connivens Barking Owl	Anytime (breeds in spring)	Adequate
Phascolarctos cinereus Koala	Anytime (breeds in spring)	Adequate
Pterostylis cobarensis Greenhood Orchid	Flowers from September to November. Vegetative reproduction is not common in this group of Greenhoods, but some species may form more than one dropper annually. Plants are deciduous and die back to the large, underground tubers after seed release. New rosettes are produced following soaking autumn and winter rains.	Adequate
Hieraaetus morphnoides Little Eagle	Anytime (breeds in spring)	Adequate
Calyptorhynchus lathami - endangered population Glossy Black-Cockatoo, Riverina population	Anytime (breeds in spring)	Adequate

Limitations

- There are very few limitations regarding the fauna survey effort given the extensive amount of survey (27.2 days and 18 nights) on Hera from 2010 to 2018 during times best suited to detect candidate threatened species. Notwithstanding, the environment is harsh and the boom and bust nature of many species may see additional threatened species detected in future.

- Adequate survey for threatened flora species credit species occurred in the MOD 5 study area and for the previous 2016 MOD3 and 2010 EIS assessments in their respective impact footprints. Threatened flora assessment in the annual monitoring are largely opportunistic while undertaking other tasks. This simply reflects the difference between 'core duties' of a Development Application assessment and implementing conditions of consent which are focussed on plot data.
- The survey timing for all threatened fauna and flora candidates was suitable, there were no limitations of the timing of the assessment.
- The severe drought was initially considered to be a limitation for the ground stratum layers for Plots 1 to 3 in the study area. The initial way to manage the drought was to convert three of the closest Biobanking Plots assessed (Plots 3, 4 and 10) annually, to BAM (2017) plots as local benchmarks and use 2016 data reflecting ground stratum results from an average rainfall period. Upon review of the plot data against the benchmark for PCT103, all 2018 BAM plots were within benchmark (being more than 25 per cent of its benchmark value). For these reasons, the data collected in 2018 was considered as representative. If plot data was below benchmark for the lower stratum then use of a local benchmark would be justified.
- A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (e.g. migratory birds) and require specific weather conditions for optimum detection (e.g. frogs, many listed forbs). This assessment received 17 field assessments since 2010 with all except one (undertaken in April - autumn) being in spring or summer. A winter assessment has not been undertaken.
- Handheld GPS' has a margin of error (allow up to five meters for any boundaries drawn / points taken).

The conclusions of this report are therefore based upon available data and 17 periods of field survey and are therefore indicative of the environmental condition at the time of the survey. It should be recognised that site conditions, including the presence of threatened species, can change with time especially in harsh environments such as on Hera. To address this limitation, the assessment has also aimed to identify the presence and suitability of the habitat for threatened species as discussed in the following sections.

5.2.6 Species polygons

Individual species habitat polygons requested by BAM have been provided as **Figure 4-1** in the Proposal and across Hera on **Figure 4-2.** All areas mapped as PCT103 on both figures are species polygons for:

- Diamond Firetail (*Stagonopleura guttata),* Ecosystem credit species
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus),* Ecosystem credit species
- Grey-crowned Babbler eastern subspecies (*Pomatostomus temporalis temporalis),* Ecosystem credit species
- Hooded Robin south-eastern form (*Melanodryas cucullata cucullata),* Ecosystem credit species
- Inland Forest Bat (*Vespadelus baverstocki),* Ecosystem credit species
- Little Pied Bat (*Chalinolobus picatus),* Ecosystem credit species
- Major Mitchell's Cockatoo (*Lophochroa leadbeateri),* Ecosystem credit species
- Pied Honeyeater (*Certhionyx variegatus*), Ecosystem credit species
- Spotted Harrier (*Circus assimilis*), Ecosystem credit species
- Superb Parrot (*Polytelis swainsonii*), Species credit species
- Yellow-bellied Sheathtail-bat (Saccolaimus flaviventris), Ecosystem credit species.

No species of listed flora was considered to remain undetected in the proposal.

5.2.7 Biodiversity risk weighting for the species

The biodiversity risk weighting is based on the combination of two components: sensitivity to loss score and sensitivity to potential gain score using the criteria listed in Appendix 7 of BAM (2017). Sensitivity to potential gain considers the ability of a species to respond to improvements in habitat condition at an offset site.

Risk weighting for each species listed in **Tables 5-5 and 5-6** was reviewed and showed:

- Seven species identified with High Sensitivity to Potential Gain (**Table 5-11**)
- Seven species with Moderate Sensitivity to Potential Gain (**Table 5-12**).

Table 5-11: Species identified with High Sensitivity to Potential Gain (source BAM Calculator)

Ecosystem Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status
Antechinomys laniger	Kultarr	--	--	High Sensitivity to Potential Gain	Endangered	Not Listed
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	--	--	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
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	Vulnerable
Phascolarctos cinereus	Koala (Foraging)	--	--	High Sensitivity to Potential Gain	Vulnerable	Vulnerable

Table 5-12: Species identified with Moderate Sensitivity to Potential Gain (source BAM Calculator)

Ecosystem Credit Species Sci Name	Common Name	Habitat constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	National listing status
Daphoenositta chrysoptera	Varied Sittella	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Falco hypoleucos	Grey Falcon	--	--	Moderate Sensitivity to Potential Gain	Endangered	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
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
Pachycephala inornata	Gilbert's Whistler	--	--	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed

5.2.8 Threatened species survey

The targeted threatened species assessment focused on listed species predicted to occur in PCT103 and those identified as requiring survey (**Table 5-10)** were completed following all requisite guidelines to detect these species in the proposal. Local experience, previous survey of the region, preliminary reporting and information held on government databases and archives were also used to inform the assessment.

Assessment in the study area occurred over four days, three in September 2018 and one in November (as a result of a minor shift of the location of the proposal toward to existing tailings storage facility) and three consecutive nights – all in September 2018 to detect threatened species flora and fauna or their habitats.

The timing for all threatened flora and fauna candidates was suitable during the spring summer survey period. The survey time matrix produced by the assessment tool in the BAMCC and from review of the TSPD is shown in **Table 5-10**. **Figure 5-2 and 5-3** show where the survey effort occurred.

5.3 Use of local data

Regional assessments detailed in **Table 5-9** have been used to inform listed fauna and flora assessments. The presence of threatened species recorded on Hera shown in **Appendix D** has been used as local data.

5.3.1 How is this local data relevant to the study area?

The cumulative experience from ecological assessments, research and work-related environmental assessments is relevant because:

- AREAs Principal Consultant was responsible for many of the ecological assessment in **Table 5-9**.
- PCT types in the Development Area have received a lot of targeted assessments between April 2010 to November 2018 (8.5 years).
- Due to the above, informed judgement calls based on evidence collected on site during the assessments were used in the BAMCC to determine what listed species have potential to be affected by the proposal based on the quality of habitat observed / recorded. Several species of listed microbat were added as ecosystem credit species as a result of these previous assessments.

5.4 Were expert reports used in place of targeted survey?

No expert reports were used.

AREAs Principal Consultant was nominated by OEH and participated in a three-day session as an expert in the OEH North West region review of the BAMCC habitat constraints for the following species relevant to this proposal:

- *Acacia curranii*
- *Commersonia procumbens*
- *Diuris tricolor* (Pine Donkey Orchid).

STAGE 2 BAM: IMPACT TO BIODIVERSITY VALUES

6 Matters of National Environmental Significance (MNES)

6.1 Threatened species

There are 11 MNES listed threatened species, seven listed migratory and 13 listed marine species with potential to occur in the study area (**Table 6-1, Appendix C**).

Table 6-1: MNES summary

MNES	Result
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	2
Great Barrier Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	2
Listed Threatened Species	9
Listed Migratory Species	7
Commonwealth Land	1
Commonwealth Heritage Places	None
Listed Marine Species	13
Whales and other Cetaceans	None
Critical Habitats	None
Australian Marine Parks	None
State and Territory Reserves	None
Forest Regional Agreements	None
Invasive Species	11
Nationally Important Wetlands	None

Three species of Commonwealth listed fauna (two birds and a microbat) are known to occur within 10km from the study area (**Table 6-2, Figure 6-1**). There are no records of Commonwealth listed threatened flora in proximity to the study area.

Table 6-2: Commonwealth listed flora and fauna within 10km

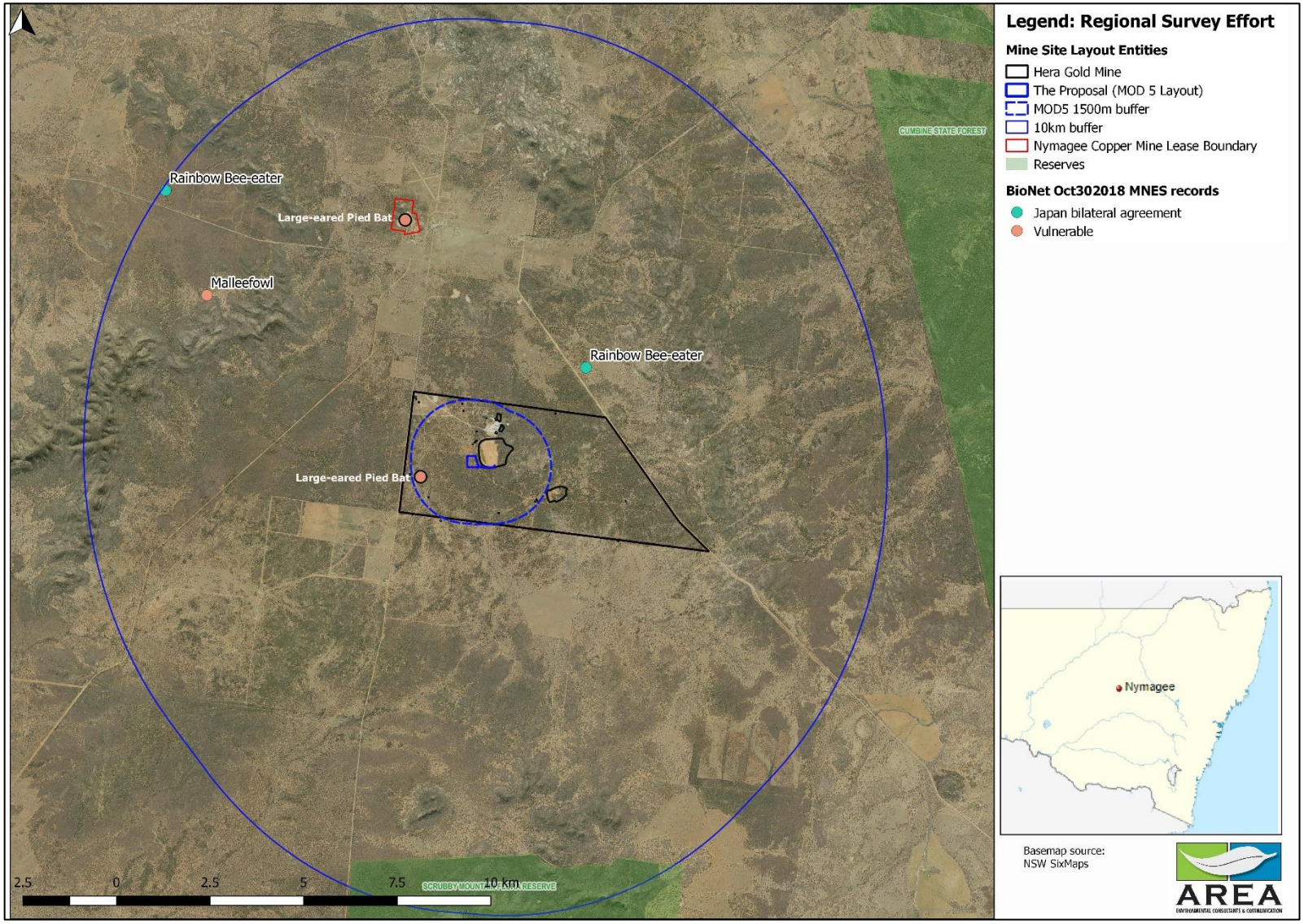
Kingdom Name	Class Name	Scientific Name	Common Name	NSW Status	Comm Status
Fauna	Aves	*Leipoa ocellata*	Malleefowl	E,P	V
Fauna	Aves	*Merops ornatus*	Rainbow Bee-eater	P	J
Fauna	Mammalia	Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V

E = Endangered, V= vulnerable, P = Protected, J = Japan bilateral agreement.

6.2 Migratory species

Seven migratory species listed under the EPBC Act may potentially occur within the study area. None of these are known to occur in the search area (EPBC Act Protected Matters Report) however Rainbow Bee-eater is considered likely to occur and remains to date undetected.

Figure 6-1: Commonwealth listed fauna within 10km of the study area



7 Minimise impacts

7.1 Demonstration of efforts to avoid and minimise impact on biodiversity values

This section has been completed in accordance with Chapter 8 of BAM (2017).

- The study area is 13.7 hectares and is the proposal impact footprint
- 11.4 hectares are mapped as native vegetation
- 2.3 hectares are mapped as Not Native vegetation (disturbed areas)
- One described Plant Community Type (PCT) occurs in the Proposal:
    - PCT103 Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion. This community is not listed as an endangered ecological community in NSW or nationally
        - PCT103 in the Proposal has one zone (meaning all vegetation within PCT103 is in the same condition / quality).

In November 2018 one minor change to impact footprint occurred where the size of the dam was reduced, and its location was moved closer to the existing Tailings Storage Facility. This resulted in fewer impacts to habitat for threatened species, populations and communities.

In February a second layout change occurred. The design and construction team concluded a 25m buffer around the Water Management Dam provided greater flexibility for set down points etc than a 15m buffer.

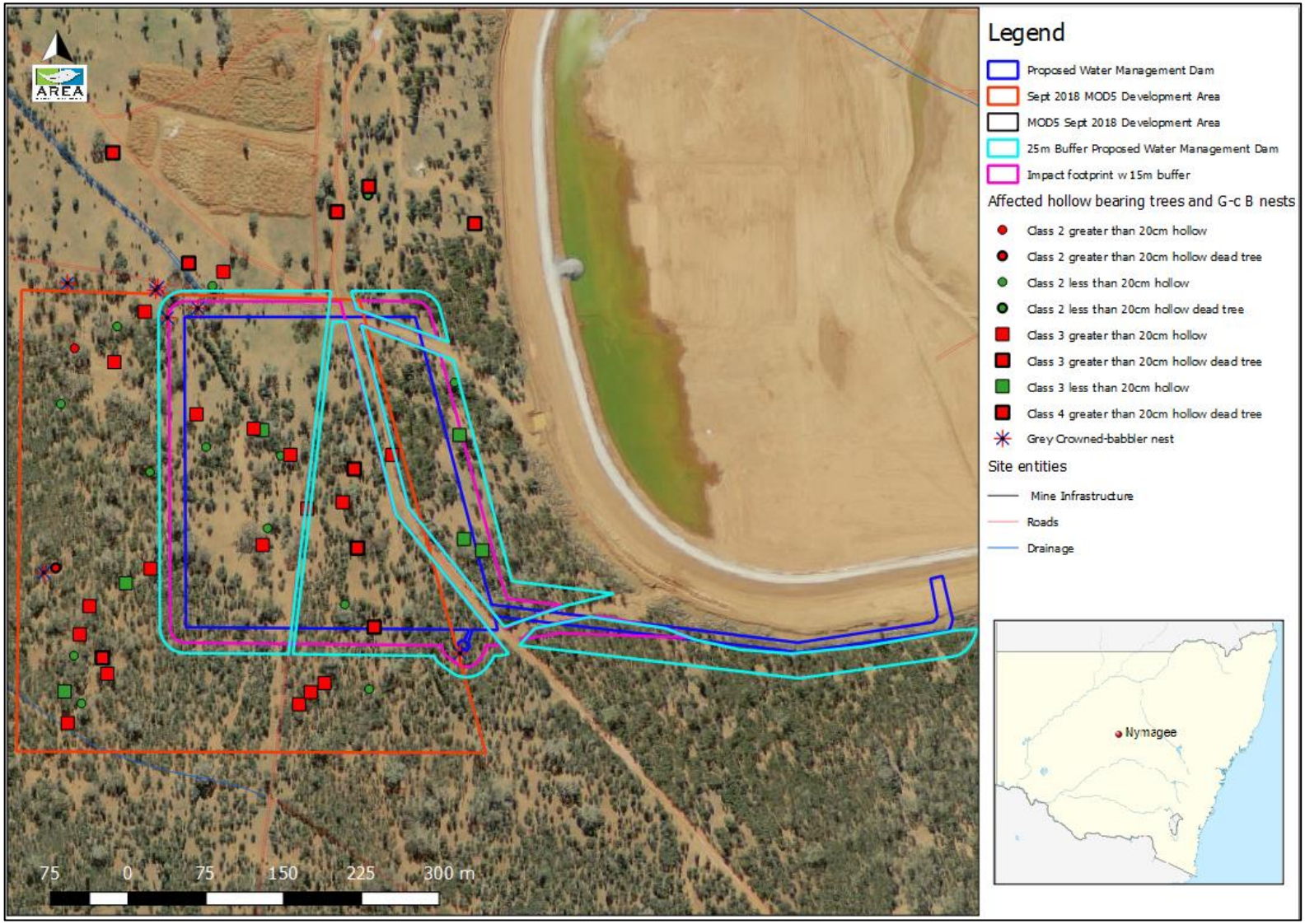
- **Layout Change in November 2018**: The location of the proposal was moved 150m east towards the existing tailings storage facility (**Figure 7-1**). This resulted in a reduction of impact to habitat trees possessing tree hollows (19 habitat trees were avoided) and one Grey-crowned Babbler nest (**Table 7-1**). One more Class 3 tree possessing at least one hollow less than 20cm diameter will be affected under this scenario. The size of the initial area assessed in September 2018 was 17 hectares.
- **Layout Change in February 2019**: The location of the proposal remained the same as the November 2018 design. The construction buffer surrounding the Water Management Dam was increased from 15m to 25m (the impact increased from 9.1 ha of PCT103 to 13.7 ha – 4.6 ha). This did not change impact to any tree size classes with tree hollows affected by the November 2018 design. The one change in the February 2019 design was one Greyer-more crowned Babbler nest would be affected (three are now affected), **Table 6-2**. This change is design retained all the environmental key habitat benefits gained from the November 2018 design, except the increase of impact to the Grey-crowned babbler (eastern sub species). Refer to the mitigation measures in **Section 8**.

Table 7-1: Comparison of September and November 2018 layout impacts

Subject	Sep-18	Nov-18	Feb-2019
Class 2 greater than 20cm hollow	1	0	0
Class 2 greater than 20cm hollow dead tree	1	0	0
Class 2 less than 20cm hollow	10	4	4
Class 3 greater than 20cm hollow	17	7	7
Class 3 greater than 20cm hollow dead tree	4	3	3
Class 3 less than 20cm hollow	3	4	4
Class 3 no hollows	1	0	0
Grey Crowned-babbler nest	3	2	3

Based on Sept 2018 design: Green fill = reduction of impact, Red fill = increase of impact, No fill = No change

Figure 7-1: Comparison of September and November 2018 layout impacts



7.2 Assessment of direct and indirect impacts unable to be avoided at the development site

This section has been completed in accordance with Sections 9.1 and 9.2 of BAM (2017). The assessment includes but is not limited to: type, frequency, intensity, duration and consequence of impact.

7.2.1 Removal of native vegetation (residual impact)

Direct impacts to PCTs are assessed for vegetation and habitat removal. Direct impact includes removal of 11.4 hectares of PCT103. Heavy machinery will remove these areas of native vegetation which will result in destruction of all its habitat values.

This loss represents a 1.4 per cent loss of PCT103 patch size within 1500m of the study area ([11.4/807.09] x 100 = 1.4).

PCT103 is 10 per cent cleared in the Western LLS region.

Table 7-2: Residual impact to native vegetation

Zone	PCT ID	Formation	Class	Plant Community Type (PCT) Name	Ha in study area	Ha of native veg in affected areas (incl 25m buffer)	EEC (VIS)	EEC name	EEC on site?	Patch Size (ha) of native veg within 1500 m
1	103	Semi-arid Woodlands (Shrubby sub-formation)	Western Peneplain Woodlands	Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	13.7	11.4	No	N/A	No	807.09

	ha	%
Impact to native vegetation	11.4	83.2
Impact to not native vegetation	2.3	16.7
Proposal	**13.7**	100.00

7.2.2 Removal of habitat for threatened fauna species

The potential impact to threatened fauna and their habitat would occur during clearing of habitat in the short-term and over the long-term through reduction in availability of habitat for sedentary and transient local populations, and possibly movements of species through the landscape.

The proposal would reduce the number of tree hollows and reduce the availability of perching/ resting/ shelter resources.

7.2.3 Loss of food resources

The loss of habitat would reduce the availability of nectar resources and has low potential to affect threatened nectar feeding birds, microbats and birds of prey mostly associate with PCT103.

Woodland possesses different bark types and canopy structures of which are a source of multiple food resources such as seeds, lerps and gum / resin and attract a diversity of invertebrates, again mostly associated with PCT103.

Impact to this habitat would reduce foraging habitat for birds, microchiropteran bats, and raptors by reducing prey (ground-dwelling, arboreal mammals, birds and reptiles).

7.2.4 Loss of tree hollows and woody debris (sheltering and breeding habitat)

A total of 18 trees with hollows will be removed by the Proposal (**Table 6-2**). Of these removed:

- Four are Class 2 trees (>20cm dbh) with at least one tree hollow less than 20cm diameter
- Four are Class 3 trees (>20cm dbh) with at least one tree hollow less than 20cm diameter
- Seven are Class 3 trees (>20cm dbh) with at least one tree hollow greater than 20cm diameter
- Three are dead Class 3 trees (>20cm dbh) with at least one tree hollow greater than 20cm diameter.

Loss of tree hollows is Key Threatening Process listed under the BC Act.

Ground logs benchmark for PCT103 is 26m. In a 20x50 m area in the study area, an average of 15.8m of logs greater than 10cm diameter were recorded. As this is above 25 per cent of the benchmark it is considered within the benchmark.

7.2.5 Loss of dams (breeding and foraging habitat for wetland dependent species)

No dams will be removed by the proposal. Noise and activity during construction will scare away birds which use the existing Tailings Storage Facility.

There is no ‘critical habitat’ as listed under the BC Act identified in the study area for threatened wetland dependent biota.

7.2.6 Removal of threatened plants

The targeted surveys confirmed no threatened plant species are present on the study area.

7.3 Assessment of indirect impacts

7.3.1 Aquatic impacts

There no natural drainage lines in the study area (see **Section 3**). There is a small potential for construction works to increase sedimentation and erosion along drainage lines and has been considered for mitigation in **Chapter 8**.

7.3.2 Groundwater dependent ecosystems

The desktop review identified low potential for terrestrial groundwater dependent ecosystems on the study area. The proposal is not expected to impact or change groundwater flows.

7.3.3 Changes to hydrology

The proposal will change surface drainage. The proposal is unlikely to negatively impact on present surface or groundwater hydrology, given the lack of major rivers or streams on the study area. Additional runoff from hard surfaces (and bare ground) will result however, this effect is not likely to be much greater than current management of the land.

7.3.4 Fragmentation of identified biodiversity links and habitat corridors

Existing habitat will not be fragmented as connection through Hera will be maintained as residual native vegetation within PCT103. Habitat linkages surrounding the study area and some areas of habitat within the site will remain and may still be utilised by listed fauna.

7.3.5 Edge effects on adjacent native vegetation and habitat

Edge effects will occur within residual native vegetation on Hera. These effects will require management as part of the existing Biodiversity Management Plan for the property.

7.3.6 Injury and mortality of fauna

Clearing may result in fauna injury and /or mortality during construction and operation. The fauna most at risk of harm are those that have refuge habitat in hollow bearing trees e.g. microbats, reptiles and frogs and do not have a fine-tuned flight (fleeing / escaping) mechanism as seen in birds.

All other fauna would have a chance to evade vegetation clearing and would likely seek refuge in adjacent habitat.

7.3.7 Weeds of national significance

No problem weeds or weeds of national significance were identified in the study area, nor are they a wider issue on Hera (2010 EIS 2011 to 2018 annual monitoring data). Weeds are managed through the existing Biodiversity Management Plan for the property.

7.3.8 Invasion and spread of pests

Animal pests, particularly cats and foxes, already exist in the study area. Predation by feral cats and foxes has a high potential on site and is listed a Key Threatening Process under both the EPBC Act and the BC Act. Pests are managed through the existing Biodiversity Management Plan for the property.

7.3.9 Invasion and spread of pathogens and disease

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. Three pathogens are considered a negligible risk to the study area due to the low rainfall of the area. These are listed as key threatening processes under the EPBC Act and/or BC Act including:

- Dieback caused by Phytophthora (EPBC Act and BC Act).
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act).
- Infection by Psittacine Circoviral (beak and feather) (EPBC Act and BC Act).

There is a low to negligible likelihood for the potential risk of pathogens on the study area during construction given its location and dry climate and they have not been detected on site. A Pathogen Management Plan is not needed.

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 that 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 that may be spread because of handling frogs or through cross contamination of water bodies by vehicles and workers.

7.3.10 Noise, light, dust and vibration

During the construction and operation of the proposal, effects of increased noise, dust and vibration may result in indirect impacts to biodiversity values. Construction work, including increased traffic and operation of heavy machinery, will occur only during daylight hours and would increase noise, dust and vibration effects over the construction phase but would be temporary.

7.3.11 Cumulative impact

Construction and operation of the proposal will have cumulative contribution to the impacts on biodiversity in the locality.

Cumulative impact on the 1,532.45-hectare Hera property includes:

- 2010 EIS approved impact 77.3 hectares of native vegetation (71.9 hectares were PCT103, the PCTs area of occupancy was 1332.62 hectares)
- 2015 MOD3 was approved to impact 6.6 hectares of native vegetation (2.55 hectares were PCT103)

Cumulative impact to PCT103 on the Hera property (2010 EIS and MOD3) represents a 5.8 per cent reduction in the area of occupancy for this Plant Community Type (based on its area of occupancy of 1332.62 hectares pre-2010 EIS).

Cumulative impact to PCT103 on the Hera property after approval of MOD5 ([71.9+2.55] 74.45 ha + 11.4 = 85.85 ha) will represent a 6.44 per cent reduction ([85.85/1332.62] x100 = 6.84) in the area of occupancy for PCT103 on the Hera property based on its pre-2010 EIS area of occupancy of 1332.62 hectares.

Before 2010 the Hera property possessed 1,487.52 hectares of native vegetation. Cumulative impact to date has seen this reduced by 81.8 hectares (5.5 per cent) and with MOD 5 (the proposal) approvals there will be a further 11.4 hectares removed totalling 93.2 hectares (6.3 per cent).

Other habitat features removed as a result of the proposal include:

- Loss of 18 tree possessing hollows (which can be salvaged and installed elsewhere in PCT103), **Table 6-2**
- Habitat for 11 threatened ecosystem and species credit species, **Table 5-8**.

The impact to 11.4 hectares of PCT103 was not considered locally important however impact to habitat for potentially occurring threatened species has been addressed through the NSW Biodiversity Offsetting Scheme.

On a positive side the cumulative impact from mining on Hera has probably (meaning we do not have a scientific level of certainty, but professional judgement based on annual monitoring data indicates):

- a greater diversity of birds and microbats on the property likely due to the presence of water and night lighting within a large area of remnant native vegetation
- early indications in the data show removal of sheep in 2013 and effective goat control over the past two to three years despite the severe drought (worst since European settlement in the region) will result in a higher species composition score (biodiversity) in the lower stratum than seen in the 2010 EIS.

In summary, while the cumulative effect to area of native vegetation and the associated habitat vales has worsened, it is likely removal of sheep and goats and management of the property under a Biodiversity Management Plan (not approved but in place) has been a positive outcome for biodiversity.

Table 7-3: Cumulative impact to native vegetation (2010 EIS, MOD3 and proposed impact for MOD5)

Plant Community Type Name	PCTID	Approximate hectares on the Hera property	Approximate ha within 1500m (GIS) (ha)	Approved for impact 2010 EIS (ha)	Approved for impact MOD3 (ha)	Seeking approval for impact MOD5 (ha)	Total impact (ha) to native vegetation (approved)	% cleared on Hera under Approvals based on pre EIS area of occupancy	Total impact (ha) to native vegetation including MOD5	% cleared on Hera under Approvals + MOD5 based on pre EIS area of occupancy
Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion	PCT103	1332.62	807.09	71.9	2.55	11.4	**74.45**	5.59	85.85	6.44
Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	PCT180	70.06	64.49	0.1	0	0	**0.1**	0.14	0.1	0.14
Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	PCT174	84.84	71.76	3.2	0	0	**3.2**	3.77	3.2	3.77
Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion	PCT184	??	NIL	0	4.05	0	**4.05**	N/A	4.05	N/A
Cleared Grassland / Shrubland / Disturbed		44.93	61.93	2.1	1.2	0.24	**3.3**	7.34	3.54	7.88
Size of area		**1532.45**	**1005.27**	**77.3**	**7.8**	**13.7**				
Native vegetation affected				**75.2**	**6.6**	**11.4**	**90.9**	**9.50**	**93.2**	**10.36**

?? = Further work required to reassess PCT180 on Hera (as PCT184 is likely within the current mapped area of occupancy)

7.4 Areas not requiring assessment

All areas in the study area (native vegetation and those mapped as Not Native) were assessed using requisite species credit species guidelines and BAM (2017). Disturbed and cleared areas may provide habitat for a suite of listed predicted flora i.e. *Commersonia procumbens*, *Diuris tricolor* and some fauna i.e. birds of prey.

7.5 Matters for further consideration and assessments of significance

The following 11 matters require further assessment through an assessment of significance under the BC Act (**Table 7-4**). Of these, Grey-crowned Babbler eastern sub species (feeding and breeding habitat) and Major Mitchell Cockatoo (feeding habitat) and three species of microbats (Inland Forest Bat, Little Pied Bat and Yellow-bellied Sheathtail-bat) were recorded in the study area:

Only one MNES matter, the Super Parrot recorded on Hera in 2015 requires further assessment through an assessment of significance under the EPBC Act.

Expected impact of the proposal on MNES are summarised on **Table 7-5**.

Table 7-4: Summary of potential impacts to BC Act vulnerable species

Common Name	Scientific Name	Type	Status BC Act	Status EPBC Act	Recorded in the study area	Year recorded on Hera 2010 (EIS), 2013-2018 (annual monitoring)
Diamond Firetail	*Stagonopleura guttata*	Ecosystem credit species	Vulnerable	Not listed	No	2010, 2017
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Ecosystem credit species	Vulnerable	Not listed	No	2010, 2013-2015
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Ecosystem credit species	Vulnerable	Not listed	Yes (feeding, breeding)	2010, 2013-2015, 2017-2018
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	Ecosystem credit species	Vulnerable	Not listed	No	2010, 2013, 2014, 2017, 2018
Inland Forest Bat	*Vespadelus baverstocki*	Ecosystem credit species	Vulnerable	Not listed	Yes	2013-2015, 2017
Little Pied Bat	*Chalinolobus picatus*	Ecosystem credit species	Vulnerable	Not listed	Yes	2010, 2013-2018
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	Ecosystem credit species	Vulnerable	Not listed	Yes (feeding)	2010, 2017, 2018
Pied Honeyeater	*Certhionyx variegatus*	Ecosystem credit species	Vulnerable	Not listed	No	2013, 2014
Spotted Harrier	*Circus assimilis*	Ecosystem credit species	Vulnerable	Not listed	No	2010
Superb Parrot	*Polytelis swainsonii*	Species credit species	Vulnerable	Vulnerable	No	2015
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Ecosystem credit species	Vulnerable	Not listed	Yes	2010, 2013-2017

The BAMCC process has not identified any additional matters for further considerations for impacts to landscape features, native vegetation and / or species and populations.

7.6 Matters of National Environmental Significance (EPBC Act)

7.6.1 Assessment of Significance MNES

Consideration of candidate species and communities with a moderate to high likelihood of occurring in the study area was undertaken (**Section 5.2.2**).

An assessment of significance was conducted for those identified under **Section 7.5**. No MNES threatened flora or ecological communities were identified in the study area. The assessments concluded the proposal is unlikely to have a significant impact on a MNES.

7.6.2 Listed Threatened Species

Table 7-5: Summary of potential impacts to EPBC vulnerable species – Superb Parrot

Vulnerable species significant impact criteria	Superb Parrot – recorded during annual monitoring in 2015
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
• Lead to a long-term decrease in the size of an important population of a species	An important population is not within the study area.
• Reduce the area of occupancy of an important population	An important population is not within the study area.
• Fragment an existing important population into two or more populations	An important population is not within the study area.
• Adversely affect habitat critical to the survival of a species	Habitat critical for the survival of the species will not be affected by the proposal.
• Disrupt the breeding cycle of an important population	An important population is not within the study area.
• Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
• Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal will not result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
• Introduce disease that may cause the species to decline, or	The proposal will not introduce a disease that may cause the species to decline
• Interfere substantially with the recovery of the species.	The proposal will not interfere with the recovery of the species.
Summary: Superb Parrot will not be significantly affected by the proposal and a referral is not required.	
What is a population of a species? A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations, or • a population, or collection of local populations, that occurs within a particular bioregion.	
What is an invasive species? An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.	
What is habitat critical to the survival of a species or ecological community? 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary: • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community. Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.	

7.7 Assessments of significance (BC Act)

7.7.1 The Assessment of significance

Consideration of candidate species and communities with a moderate to high likelihood of occurring on the study area was undertaken (**Section 5.2.2**).

As a result, seven threatened species of fauna were identified as requiring an assessment of significance (**Section 7.5**). No threatened flora or ecological communities were identified on the site.

The assessment has concluded the proposal is unlikely to have a significant impact on a species, population or community listed in the BC Act (**Tables 7-6 to 7-5**).

7.7.2 Listed Threatened Species

Table 7-6: Summary of potential impacts to BC Act listed raptors

BC Act Threatened Species Test of Significance for raptors: • **Spotted Harrier (*Circus assimilis*) – recorded on Hera in 2010**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Statement	**Response**
Adverse effects on the life cycle of a species • (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will not affect the life cycle this species therefore there will be no decline in a population.
Adverse effects on ecological communities • (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: ○ (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ○ (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	Not applicable
Adverse effects on habitats • (c) in relation to the habitat of a threatened species or ecological community: ○ (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ○ (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and ○ (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will remove 11.4 ha of habitat in a modified environment. It will not fragment an existing population into two or more populations or isolate a population. The importance of habitat affected is limited. Its removal will not result in the decline or local extinction of any protected matter. Creation of an additional body of water will create more feeding opportunities for this species.

BC Act Threatened Species Test of Significance for raptors: • **Spotted Harrier (*Circus assimilis*) – recorded on Hera in 2010**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Adverse effects on areas of outstanding biodiversity value • (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes • (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	
Summary statement: The Proposal will not result in a significant impact to • Spotted Harrier (*Circus assimilis*)	
In determining the nature and magnitude of an impact, this assessment of significance has considered matters such as: • pre-construction, construction and occupation/maintenance phases • all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones • all direct and indirect impacts • the frequency and duration of each known or likely impact/action • the total impact which can be attributed to that action over the entire geographic area affected, and over time • the sensitivity of the receiving environment • the degree of confidence with which the impacts of the action are known and understood. All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker	

Table 7-7: Summary of potential impacts to BC Act listed microbats

BC Act Threatened Species Test of Significance for bats: • **Little Pied Bat (*Chalinolobus picatus*) – Recorded in the study area. Recorded on Hera 2010, 2013-2018. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.** • **Inland Forest Bat (*Vespadelus baverstocki*) – Recorded in the study area. Recorded on Hera 2013-2015, 2017. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.** • **Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) – Recorded in the study area. Recorded on Hera 2010, 2013-2017. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows cracks in dry clay and under slabs of sandstone.**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Statement	**Response**
Adverse effects on the life cycle of a species • (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will not affect the life cycle of this species therefore there will be no decline in a population.
Adverse effects on ecological communities • (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: ○ (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ○ (ii) is likely to substantially and adversely modify the	Not applicable

BC Act Threatened Species Test of Significance for bats: • **Little Pied Bat (*Chalinolobus picatus*) – Recorded in the study area. Recorded on Hera 2010, 2013-2018. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.** • **Inland Forest Bat (*Vespadelus baverstocki*) – Recorded in the study area. Recorded on Hera 2013-2015, 2017. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.** • **Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) – Recorded in the study area. Recorded on Hera 2010, 2013-2017. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows cracks in dry clay and under slabs of sandstone.**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
Adverse effects on habitats • (c) in relation to the habitat of a threatened species or ecological community: ○ (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ○ (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and ○ (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will remove 9.1ha of habitat including 18 hollow bearing trees. It will not fragment an existing population into two or more populations or isolate a population. The importance of habitat affected is limited within an 807ha patch size of the same PCT. Its removal will not result in the decline or local extinction of any protected matter. The rock lined drains constructed will provide new additional habitat for this species.
Adverse effects on areas of outstanding biodiversity value • (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes • (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove 18 hollow bearing trees and have a negligible contribution to human made climate change.
Summary statement: The proposal will not result in a significant impact to • Little Pied Bat (*Chalinolobus picatus*) • Inland Forest Bat (*Vespadelus baverstocki*). • Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).	
In determining the nature and magnitude of an impact, matters were considered such as: • pre-construction, construction and occupation/maintenance phases • all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones • all direct and indirect impacts • the frequency and duration of each known or likely impact/action • the total impact which can be attributed to that action over the entire geographic area affected, and over time • the sensitivity of the receiving environment • the degree of confidence with which the impacts of the action are known and understood. All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker	

Table 7-8: Summary of potential impacts to BC Act listed parrots

BC Act Threatened Species Test of Significance for bats: • **Superb Parrot *Polytelis swainsonii*. Recorded on Hera in 2015** • **Major Mitchell's Cockatoo *Lophochroa leadbeateri*. Recorded on Hera 2010, 2017. Observed next to the study area in 2018**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Statement	**Response**
Adverse effects on the life cycle of a species • (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal will not affect the life cycle of these species therefore there will be no decline in a population. Hollow trees affected were not used as breeding habitat by the species.
Adverse effects on ecological communities • (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: ○ (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ○ (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	Not applicable
Adverse effects on habitats • (c) in relation to the habitat of a threatened species or ecological community: ○ (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ○ (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and ○ (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will remove 9.1ha of habitat including seven hollow bearing trees with a diameter greater than 20cm diameter. It will not fragment an existing population into two or more populations or isolate a population. The importance of habitat affected is limited within an 807ha patch size of the same PCT. Its removal will not result in the decline or local extinction of any protected matter.
Adverse effects on areas of outstanding biodiversity value • (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes • (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove 18 hollow bearing trees and have a negligible contribution to human made climate change.
Summary statement: The proposal will not result in a significant impact to	

BC Act Threatened Species Test of Significance for bats: • **Superb Parrot *Polytelis swainsonii*. Recorded on Hera in 2015** • **Major Mitchell's Cockatoo *Lophochroa leadbeateri*. Recorded on Hera 2010, 2017. Observed next to the study area in 2018**
Significant impact criteria
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:
• Superb Parrot *Polytelis swainsonii*. • Major Mitchell's Cockatoo *Lophochroa leadbeateri*
In determining the nature and magnitude of an impact, matters were considered such as: • pre-construction, construction and occupation/maintenance phases • all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones • all direct and indirect impacts • the frequency and duration of each known or likely impact/action • the total impact which can be attributed to that action over the entire geographic area affected, and over time • the sensitivity of the receiving environment • the degree of confidence with which the impacts of the action are known and understood. All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker

Table 7-9: Summary of potential impacts to BC Act listed passerines (perching birds)

BC Act Threatened Species Test of Significance for Passerines: • **Diamond Firetail *Stagonopleura guttata*. Recorded in Hera 2010 & 2017** • **Dusky Woodswallow *Artamus cyanopterus cyanopterus*. Recorded on Hera 2010, 2013-2015.** • **Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*. Recorded in the study area in 2018 - two nests affected and recorded on Hera 2010, 2013-2015, 2017-2018.** • **Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*. Recorded on Hera 2010, 2013, 2014, 2017, 2018.** • **Pied Honeyeater *Certhionyx variegatus*. Recorded on Hera 2013, 2014.**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
Statement	**Response**
Adverse effects on the life cycle of a species • (a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	All species except Grey-crowned Babbler: The proposal will not affect the life cycle of these species therefore there will be no decline in a population. Hollow trees affected were not used as breeding habitat by the species. Grey crowned Babbler - The proposal will remove habitat for a local population including two nests. Having a great deal of experience with these species and knowledge of the Hera property, the proposal will not affect the life cycle of the local population as it is one of several nesting locations on the property they rotate between. There will be no decline in a local population. While breeding habitat is affected by the species it was not considered significant as they rotate the location of active nests annually and there are still several alternate options including vacant habitat left available to them.
Adverse effects on ecological communities • (b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed	Not applicable

BC Act Threatened Species Test of Significance for Passerines: • **Diamond Firetail *Stagonopleura guttata*. Recorded in Hera 2010 & 2017** • **Dusky Woodswallow *Artamus cyanopterus cyanopterus*. Recorded on Hera 2010, 2013-2015.** • **Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*. Recorded in the study area in 2018 - two nests affected and recorded on Hera 2010, 2013-2015, 2017-2018.** • **Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*. Recorded on Hera 2010, 2013, 2014, 2017, 2018.** • **Pied Honeyeater *Certhionyx variegatus*. Recorded on Hera 2013, 2014.**	
Significant impact criteria	
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:	
development or activity: ○ (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ○ (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
Adverse effects on habitats • (c) in relation to the habitat of a threatened species or ecological community: ○ (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ○ (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and ○ (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality	The proposal will remove 9.1ha of habitat including seven hollow bearing trees with a diameter greater than 20cm diameter. It will not fragment an existing population into two or more populations or isolate a population. The importance of habitat affected is limited within an 807ha patch size of the same PCT. Its removal will not result in the decline or local extinction of any protected matter.
Adverse effects on areas of outstanding biodiversity value • (d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	The proposal will not have an adverse effect on any declared area of outstanding biodiversity value.
Key threatening processes • (e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process	The proposal will exacerbate removal of native vegetation, remove 18 hollow bearing trees and have a negligible contribution to human made climate change.
Summary statement: The proposal will not result in a significant impact to • Diamond Firetail *Stagonopleura guttata*. • Dusky Woodswallow *Artamus cyanopterus cyanopterus*. • Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*. • Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*. • Pied Honeyeater *Certhionyx variegatus*.	
In determining the nature and magnitude of an impact, matters were considered such as: • pre-construction, construction and occupation/maintenance phases • all on-site and off-site impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones	

BC Act Threatened Species Test of Significance for Passerines:
• **Diamond Firetail *Stagonopleura guttata*. Recorded in Hera 2010 & 2017** • **Dusky Woodswallow *Artamus cyanopterus cyanopterus*. Recorded on Hera 2010, 2013-2015.** • **Grey-crowned Babbler (eastern subspecies) *Pomatostomus temporalis temporalis*. Recorded in the study area in 2018 - two nests affected and recorded on Hera 2010, 2013-2015, 2017-2018.** • **Hooded Robin (south-eastern form) *Melanodryas cucullata cucullata*. Recorded on Hera 2010, 2013, 2014, 2017, 2018.** • **Pied Honeyeater *Certhionyx variegatus*. Recorded on Hera 2013, 2014.**
Significant impact criteria
An action is likely to have a significant impact on a protected matter if there is a real chance or possibility that it will have:
• all direct and indirect impacts • the frequency and duration of each known or likely impact/action • the total impact which can be attributed to that action over the entire geographic area affected, and over time • the sensitivity of the receiving environment • the degree of confidence with which the impacts of the action are known and understood. All factors should be considered as well as any other information considered relevant to the test. Sources and currency of data and information are to be documented and referenced. Limitations, uncertainties and known gaps in information are also to be documented to inform the decision-maker

7.8 Serious and Irreversible Impacts (SAII)

The BAMCC Credit Summary 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 B**).

7.9 Impact summary

This section summarises all anticipated impacts requiring assessment under the BAM and other impacts not covered in BAM (refer **Table 7-10**). A summary of proposed mitigation is also included to demonstrate how impacts intend to be mitigated, with further details on mitigation provided in **Chapter 8**.

Table 7-10: Summary of impacts and proposed mitigation

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
Removal of native vegetation	11.4 ha of PCT 103 (including 25m buffer on impact footprint) will be affected	Direct	Site based	Long term	• Loss of hollow-bearing trees (BC Act) • Clearing of native vegetation (BC Act) • Removal of dead wood and dead trees (BC Act)	• Retain in other areas around facility.	Yes
Removal of threatened fauna species habitat and habitat features	Hollow bearing trees and dead standing trees: • Micro bats • Wood land birds	Direct	Site based	Long term	• Clearing of native vegetation (BC Act) • Land clearance (EPBC Act) • Loss of hollow-bearing trees (BC Act) • Removal of dead wood and dead trees (BC Act)	• Minor landscaping around drains, embankments and ponds will be required. • No significant modification to landscaping is required for the remainder of the site. • Salvage and relocate trees hollows during removal	Yes
Removal of threatened fauna species habitat and habitat features	Nectar and gum producing Mulga and plants for honeyeaters and microbats	Direct	Site based	Long term	• Clearing of native vegetation (BC Act) • Land clearance (EPBC Act)	• Retain in other areas around facility.	Yes
Removal of threatened fauna species habitat and habitat features	Two Grey-crowned Babbler nests	Direct	Site based	Long term	• Clearing of native vegetation (BC Act) • Land clearance (EPBC Act)	• Relocate Grey-crowned Babbler nests	Yes
Removal of threatened plants	None	N/A	N/A	N/A	• N/A	• N/A	No
Aquatic impacts	None	N/A	N/A	N/A	• N/A	• N/A	No
Groundwater	None	N/A	N/A	N/A	• N/A	• N/A	No

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
dependent ecosystems							
Changes to hydrology	Dam soaks and drainage lines	Indirect	Local	Short / pre- and during construction	• Alteration to the natural flow regime of rivers and streams and their floodplains and wetlands	• Minor landscaping around drains, embankments and ponds will be required.	No
Fragmentation of identified biodiversity links and habitat corridors	None	N/A	N/A	N/A	N/A	• N/A	No
Edge effects on adjacent native vegetation and habitat	Plant Community Types	Indirect	Local	Short term	N/A	• Minor landscaping around drains, embankments and ponds will be required.	No
Injury and mortality of fauna	Birds, bats frogs, reptiles that can use tree hollows	Direct / Indirect	Local	Short term / pre, during or post construction	N/A	• Pre-clearing and clearing process to minimise impacts to fauna	No
Invasion and spread of weeds	Disturbed soils	Indirect	Site	Short term / pre, during or post construction	• Invasion of native plant communities by exotic perennial grasses (BC Act)	• Weed control during construction and operation during operation already implemented within a Biodiversity Management Plan	No
Invasion and spread of pests	PCTs and native fauna	Indirect	Site	Short term / pre, during or post construction	• Competition and grazing by the feral European rabbit (Oryctolagus cuniculus) (BC Act) • Predation and hybridisation of feral dogs (Canis lupus familiaris) (BC Act) • Predation by the European red fox (Vulpes vulpes) (BC Act) • Predation by the feral cat (Felis catus) (BC Act)	• Pest control during operation already implemented within a Biodiversity Management Plan	No

Impact	Biodiversity values	Nature of impact Direct / indirect	Extent of impact Site based / local / regional / state / national	Duration Short or long term / pre, during or post construction	Relevant key threatening process	Proposed mitigation (refer detail in Chapter 8)	Requires offset?
					• Predation by Plague Minnow or Mosquito Fish (Gambusia holbrooki) (BC Act) • Predation, habitat • degradation, competition and disease transmission by feral pigs (Sus scrofa) (BC Act)		
Invasion and spread of pathogens and disease	None	N/A	N/A	N/A	• N/A	• N/A	No
Noise, light and vibration	PCTs and native fauna	Direct/ indirect	Site	Short term / pre, during or post construction	• N/A	• Construction during daylight hours only	No

8 Mitigation measures

Mitigation measures are required to further avoid and minimise impacts to biodiversity. These measures have been designed to address the potential negligible impacts identified in **Chapter 7** being:

- Loss of vegetation and habitat for threatened species.
- Potential fauna mortality during construction.
- Edge effects and weed invasion.

A list of recommended mitigation measures is summarised in **Table 8-1**. These are designed to provide guidance on recommended measures to further avoid and mitigate impact to biodiversity. These measures are to be outlined in the EIS which will form part of a Construction Environmental Management Plan (CEMP).

Table 8-1: Recommended mitigation measures

<table>
<tr><th>Item</th><th>Timing</th><th>Recommended mitigation measures</th></tr>
<tr><td>Site personnel induction</td><td>Pre-construction</td><td>Ensure all construction staff working on the proposal are inducted on:
Site environmental procedures (i.e. vegetation management, sediment and erosion control, protective fencing, noxious weeds, hygiene protocols, ethical procedures for handling fauna displaced on the site).
What to do in case of environmental emergency (chemical spills, fire, injured fauna).
Key contacts in case of environmental emergency.</td></tr>
<tr><td>Site planning</td><td>Pre-construction</td><td>Locate temporary infrastructure (set down areas, access tracks etc.) in cleared areas away from vegetation to minimise vegetation removal and indirect effects.</td></tr>
<tr><td>Identification of clearing limits</td><td>Pre-construction</td><td>Accurately and clearly mark out the limits of clearing (where appropriate) and the vegetation to be retained outside of the construction footprint and / or used for post landscaping.
Regular inspections should be undertaken to ensure all retained vegetation/fauna habitat is clearly marked and that fencing is in place, where appropriate.
Only clear each stage of the proposal as required so that vegetation will be retained in the buffer area until future stages commence.</td></tr>
<tr><td>Protection of fauna during clearing of vegetation</td><td>Pre-construction and during clearing works</td><td>Avoid clearing native vegetation in Spring.
The pre-clearing work is recommended to:
Relocate two Grey-crowned Babbler nests affected by the proposal and search for other drays not recorded in the proposal and manage them accordingly.
Salvage and relocate tree hollows in 18 trees affected by the proposal (detailed provided on this Table on the next page).
The location in GDAz55 of the three Grey-crowned Babbler nests is provided below<table><tr><th>GDAz55 East</th><th>GDAz55 North</th><th>Attribute</th></tr><tr><td>436533</td><td>6445666</td><td>Grey Crowned-babbler nest</td></tr><tr><td>436280</td><td>6445999</td><td>Grey Crowned-babbler nest</td></tr><tr><td>436250</td><td>6445989</td><td>Grey Crowned-babbler nest</td></tr></table></td></tr>
<tr><td>Management of erosion and sediment control</td><td>Pre-and during construction</td><td>Provide sediment and erosion controls to manage exposed soil surfaces and stockpiles to prevent sediment discharge into waterways, vegetation and fauna habitat.
Clearly identify stockpile and storage locations and provide erosion and sediment controls around stockpiles.</td></tr>
<tr><td>Wetland areas</td><td>Pre-and during construction</td><td>Minimise the area of disturbance in and near drainage lines or dams, clearly mark out work zones in these areas, where appropriate.
Ensure all work within proximity to aquatic habitats have adequate sediment and erosion control.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Timing</th><th>Recommended mitigation measures</th></tr>
<tr><td>Weed management</td><td>Pre-and during construction</td><td>• Ensure that any machinery arriving on site be inspected for any foreign soil or plant matter/weed material and be washed down before entering the site.
• Weeds should be controlled within the work area according to the requirements of the Biosecurity Act 2016
• Any noxious weeds which are identified as part of the proposal must be disposed of appropriately.</td></tr>
<tr><td>Impacts from introduction and spread of pathogen and diseases</td><td>Construction</td><td>• NIL</td></tr>
<tr><td>Revegetation and landscaping</td><td>Operation</td><td>• Minor landscaping around drains, embankments and ponds will be required.
• No significant modification to landscaping is required for the remainder of the site.</td></tr>
<tr><td>Loss of hollow bearing trees</td><td>Pre-and during construction</td><td>• The pre-clearing work is recommended to:
○ Salvage and relocate tree hollows in 18 trees affected by the proposal.

The location in GDAz55 of trees with hollows is provided below
<table>
<tr><th>GDAz55 East</th><th>GDAz55 North</th><th>Attribute</th></tr>
<tr><td>436288</td><td>6445865</td><td>Class 2 less than 20cm hollow</td></tr>
<tr><td>436422</td><td>6445713</td><td>Class 2 less than 20cm hollow</td></tr>
<tr><td>436347</td><td>6445787</td><td>Class 2 less than 20cm hollow</td></tr>
<tr><td>436360</td><td>6445857</td><td>Class 2 less than 20cm hollow</td></tr>
<tr><td>436386</td><td>6445806</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436420</td><td>6445812</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436468</td><td>6445858</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436369</td><td>6445858</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436334</td><td>6445883</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436279</td><td>6445897</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436343</td><td>6445771</td><td>Class 3 greater than 20cm hollow</td></tr>
<tr><td>436450</td><td>6445691</td><td>Class 3 greater than 20cm hollow dead tree</td></tr>
<tr><td>436434</td><td>6445768</td><td>Class 3 greater than 20cm hollow dead tree</td></tr>
<tr><td>436431</td><td>6445844</td><td>Class 3 greater than 20cm hollow dead tree</td></tr>
<tr><td>436555</td><td>6445765</td><td>Class 3 less than 20cm hollow</td></tr>
<tr><td>436342</td><td>6445882</td><td>Class 3 less than 20cm hollow</td></tr>
<tr><td>436533</td><td>6445877</td><td>Class 3 less than 20cm hollow</td></tr>
<tr><td>436537</td><td>6445776</td><td>Class 3 less than 20cm hollow</td></tr>
</table></td></tr>
<tr><td>Monitor and review</td><td>All stages</td><td>• A review of mitigation measures (including a checklist) should be developed to ensure that all measures proposed have been undertaken.</td></tr>
</table>

9 Biodiversity offsets

9.1 BAMCC offsetting requirement

The process of site selection and documented mitigation strategy has aimed at avoiding and minimising impacts to biodiversity in the first instance.

As the proposal is a State Significant Development and the vegetation integrity score of the PCT affected is >17 (as habitat for threatened species was recorded) a requirement for offsetting following the NSW Biodiversity Offsetting Scheme has been triggered.

The proposal will not result in a significant impact to species protected under the EPBC, BC or FM Acts (see **Section 7.6 and 7.7**). Offsetting beyond an associated ecosystem credit species requirement incorporated into the BAMCC output has not been triggered.

The offsetting requirement for impact to native vegetation (ecosystem credit classes) by the proposal is shown on **Table 9-1** (Source BAM Calculator: November 2018). **Table 9-2** provides like for like options to achieve the offsetting requirement per BAMCC.

No species credit species were identified on the BAMCC as requiring offsetting (**Appendix B**).

Table 9-1: Ecosystem credit summary from BAMCC

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion								
1	103_Mod_Good	60.1	11.4	0.25	High Sensitivity to Potential Gain	1.75	No	300
							Subtotal	**300**
							Total	**300**

Table 9-2: Ecosystem credit summary – like for like offsetting options PCT130 from BAMCC

Credit classes for PCT 70 (Like-for-like options)			
Any PCT in the below class	**And in any of below trading groups**	**Containing Hollow Bearing Trees**	**In the below IBRA subregions (See Figure 9-1)**
Western Peneplain Woodlands (including PCT's 103, 135, 145)	Western Peneplain Woodlands - cleared group (including Tier 6 or higher).	Yes	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.

9.2 Biodiversity Stewardship Site

The proponent owns and manages a Biodiversity Offset Area (BOA), “Chelsea’ under a Biodiversity Management Plan (BMP). The proponent is in the process of commissioning a Biodiversity Stewardship Site Assessment Report (BSSAR) to establish a Biodiversity Stewardship Site on ‘Chelsea’ Lot1752 DP763624 (**Figure 9-2**).

The credits generated by all residual native vegetation protected in perpetuity on Chelsea, in part will be used to meet the offsetting obligation generated in this BDAR for MOD5 as well as former Development Approvals associated with:

- The Hera Gold Mine 2011 EIS
- MOD2 (2014) powerline between the Hera Mine and Hera Village. This was built in an area mapped as Not Native vegetation and did not trigger a need for offsetting
- MOD3 (2015) to expand the approved Run-of-Mine (ROM) Pad, construct an additional non-acid forming waste rock emplacement to the north of the current waste rock emplacement, inclusion of an additional hardstand area for a laydown yard, extend the existing carpark and update of the EIS approved to reflect the as-constructed layout of the Mine.

The residual offsetting requirement will be achieved following other approved mechanisms under the BC Act (**Figure 9-3**). **Table 9-3** provides an overview of BioBanking offsetting requirements and those under BAM (2017) for this BDAR and indicative ability to achieve offsetting on Chelsea. Please note: BioBanking and BAM are different, further assessment under a BSSAR will determine the quantum of ecosystem credits available on Chelsea and therefore its ability to meet offsetting requirements on all cumulative projects seeking or with an approved DA on Hera.

Figure 9-1: Proposed Biodiversity Stewardship Site (Source BMP 2016)

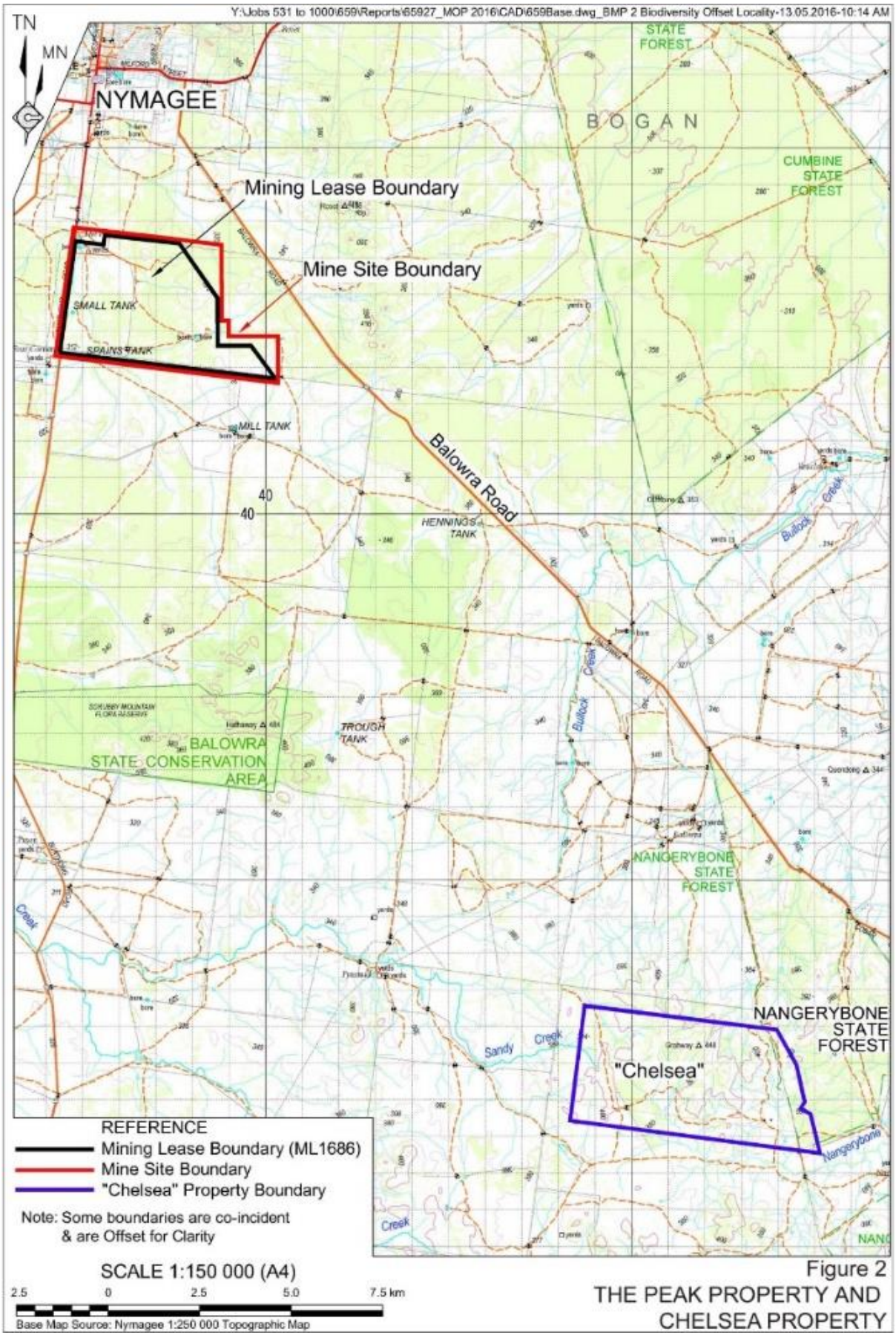


Figure 9 2: Plant community types (in draft) and vegetation monitoring sites at Chelsea BOA.

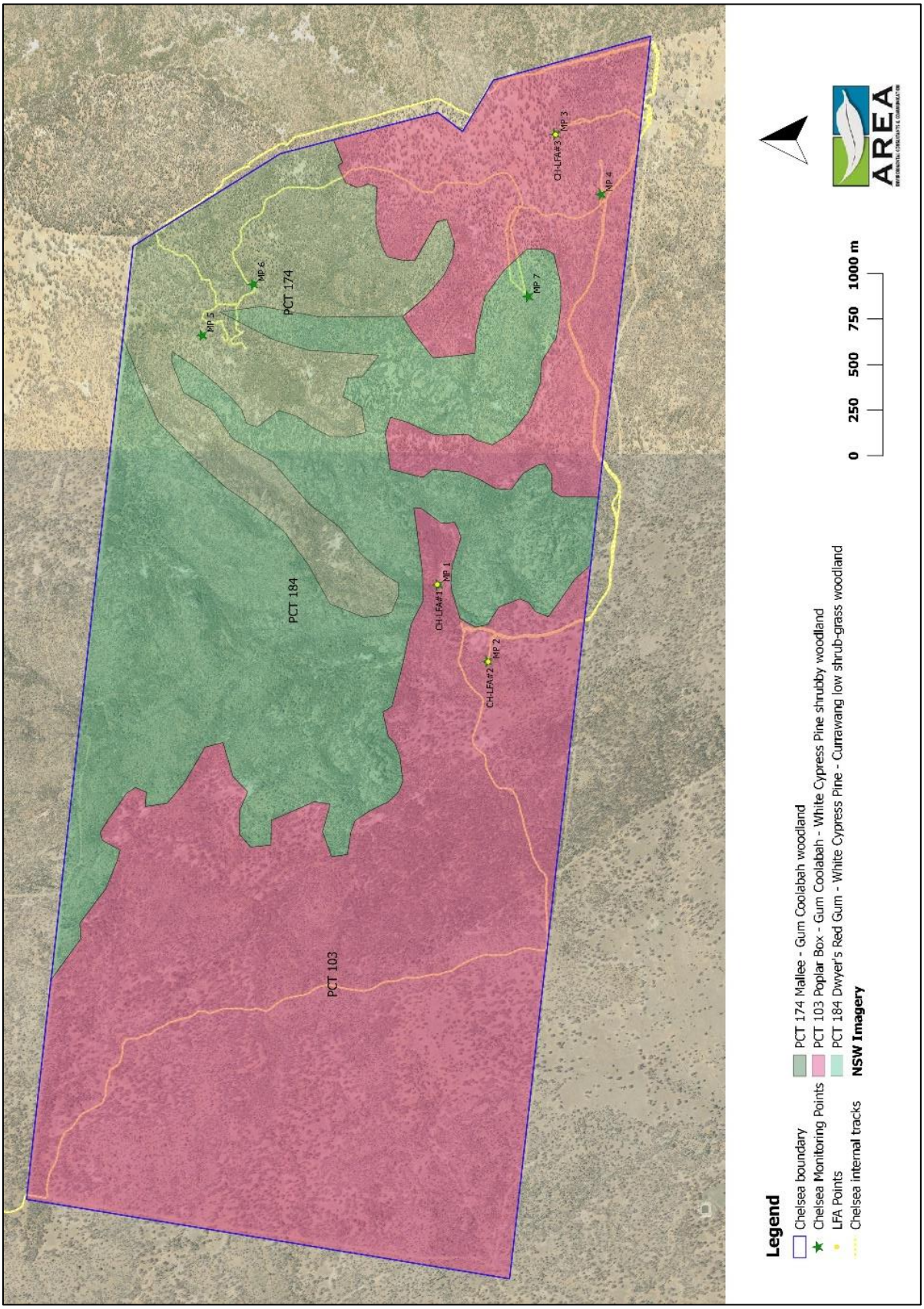


Table 9-3: BioBanking and BAM Ecosystem credit summary – like for like offsetting options

	The Development Area (1532 ha / 1478 ha of native vegetation pre 2010)											The Offset Area (approx 2,307.4 ha of native vegetation)							
	Vegetation Type	Area Impacted (ha) 2010 EIS	BioBanking Credits Required 2010 EIS	Area Impacted (ha) MOD 3	BioBanking Credits Required (MOD3	Cumulative Biobanking ecosystem credits required	Cumulative ha affected (Biobanking)	Cumulative Biobanking ecosystem credits required / ha	Area Impacted (ha) MOD5 (BAM)	BAM Credits Required (MOD5)	BAM ecosystem credits required / ha	Allowable Vegetation Types	Community ecosystem credit summary	Available ha in Offset Area	Number of BioBanking Credits Generated based on average / ha	No. BioBanking Credits Generated/ ha (Offset Credits generated / ha in Offset)	No. of hectares required to offset (Offset BioBanking Credits generated / Development Credits required)	Surplus (black) deficit (red) BioBanking credits to offset	Surplus (black) hectares	Can offsetting be achieved?
PCT 103	Benson 103 Poplar Box - Gum-barked Coolibah	73.70	3928.00	2.55	74.00	**4002.00**	**76.25**	52.49	11.4	300	26.31	PCT's 103, 135, 145	Benson 103 Poplar Box - Gum-barked Coolibah	1496.4	9,936	6.64	602.71	**5,934.10**	893.69	**YES**
PCT 184	Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion	0.00	0.00	4.05	81.00	**81.00**	**4.05**	20.00	0.00	0.00	0.00	PCTs 104, 106, 122, 175, 176, 180, 184, 218, 256, 257, 258.	Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion	572.1	4,468	7.81	10.37	**4,387.10**	561.73	**YES**
PCT 174	Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	3.20	205.00	0.00	0.00	**205.00**	**3.20**	64.06	0.00	0.00	0.00	PCT 174	Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion	238.9	2,016	8.44	24.29	**1,811.32**	214.61	**YES**

	The Development Area (1532 ha / 1478 ha of native vegetation pre 2010)											The Offset Area (approx 2,307.4 ha of native vegetation)							
	Vegetation Type	**Area Impacted (ha) 2010 EIS**	**BioBanking Credits Required 2010 EIS**	**Area Impacted (ha) MOD 3**	**BioBanking Credits Required (MOD3**	**Cumulative Biobanking ecosystem credits required**	**Cumulative ha affected (Biobanking)**	**Cumulative Biobanking ecosystem credits required / ha**	**Area Impacted (ha) MOD5 (BAM)**	**BAM Credits Required (MOD5)**	**BAM ecosystem credits required / ha**	**Allowable Vegetation Types**	**Community ecosystem credit summary**	**Available ha in Offset Area**	**Number of BioBanking Credits Generated based on average / ha**	**No. BioBanking Credits Generated/ ha (Offset Credits generated / ha in Offset)**	**No. of hectares required to offset (Offset BioBanking Credits generated / Development Credits required)**	**Surplus (black) deficit (red) BioBanking credits to offset**	**Surplus (black) hectares**	**Can offsetting be achieved?**
PCT 180	Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	0.10	9.00	0.00	0.00	**9.00**	**0.10**	90.00	0.00	0.00	0.00	PCTs **184**, 185	Grey Mallee - White Cypress Pine woodland on rocky hills of the eastern Cobar Peneplain Bioregion	0	0	0.00	1.1* *Note: PCT184 can be used to offset PCT180 (1.1 ha in BioBanking)	**-9.00**		**YES**
	Total	77.00		**6.60**	**155.00**				**9.10**					**2,068.50**	**14,404**	**N/A**	**613.08**			
	Species credits summary	**Sci Name**	**Extent of individuals**									**Sp credits created**	**Species credits summary**	**Sci Name**	**Extent of individuals**	**Sp credits created**				

10 Conclusions and recommendations

10.1 Conclusions

The Biodiversity Assessment Report (BDAR) has been prepared to meet the requirements of the Biodiversity Assessment Method (OEH 2017) and the *NSW Biodiversity Conservation Act 2017.* This has involved an assessment of the landscape values on the site and surrounding assessment area, the vegetation communities present and their condition relative to benchmark scores, and the known or potential presence of threatened flora or fauna species.

The study area is a well vegetated area within a rural landscape with past land-uses for mining and agricultural settlement. Native vegetation in the study area has to some degree been historically cleared however, the re growth of PCT103 affected by the proposal is within benchmark. All remaining vegetation in the study area will be retained, and no State or Nationally listed threatened ecological communities would be impacted by the proposal.

The site for the proposal was selected to avoid impacts to remnant vegetation as much as possible. Despite this, the proposal would result in some loss of remnant vegetation and impacts are described in the BDAR along with measures to further avoid and mitigate potential impacts to biodiversity.

The BDAR has identified matters which are relevant to the assessment of impacts to threatened species, populations and ecological communities including direct and indirect impacts. The 13.7-hectare proposal would require the clearing of 11.4 ha of PCT103 Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion, this will include habitat for 11 known and potentially occurring threatened species.

The direct loss of vegetation will not result in a significant impact to species protected under the EPBC, BC or FM Acts (see **Section 7.6 and 7.7**). Biodiversity offsetting has been triggered and will be implemented to meet the Proposals offsetting obligation.

10.2 Recommendations

In summary, the following recommendations are made regarding the proposal:

1) No further ecological assessment is required.
2) Implement mitigation measures recommended on **Table 8-1.**
3) The Applicant confirms that any residual offsetting requirements unable to be secured using BAM credits would be achieved using approved mechanisms under the Biodiversity Conservation Act.

11 References

Australia, B. (2016). *Find a Bird (online)*. Retrieved from Birdlife Australia: http://www.birdsaustralia.com.au/search/birds

Benson, J. (2009). *New South Wales Vegetation Classification and Assessment, NSWVCA batabase.* Sydney: NSW DEC.

BoM. (2016, May 26). *Climate Statistics for Australian Locations: Walgett Council Depot*. Retrieved from http://www.bom.gov.au/climate/averages/tables/cw_052026.shtml

Cropper, S. (1993). *Management of endangered plants.* Melbourne: CSIRO Publications.

DEC. (2004). *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities.* Sydney, NSW: NSW Government Department of Environment and Conservation.

DEC. (2009). *Biobanking Assessment Methodology and Credict Calculator Operation Manual .* Sydney: Department of Environment and Climate Change.

Department of Environment and Climate Change. (2009). *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians.* Sydney: Department of Environment and Climate Change.

Department of Environment and Conservation . (2004). *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft).* Hurstville: Department of Environment and Conservation .

Department of Environment, Water, Heritage and the Arts . (2010b). *Survey Guidelines for Australia's Threatened Birds.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts . (2011a). *Survey Guidelines for Australia's Threatened Reptiles.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts . (2011b). *Survey Guidelines for Australia's Threatened Mammals.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts .

Department of Environment, Water, Heritage and the Arts. (2010a). *Survey Guidelines for Australia's Threatened Bats.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts.

Department of Environment, Water, Heritage and the Arts. (2010c). *Survey Guidelines for Australia's Threatened Frogs.* Commonwealth Government: Department of Environment, Water, Heritage and the Arts.

Department of Primary Industries . (2017b). *Listed threatened species, populations and ecological communities (online).* Retrieved from Listed threatened species, populations and ecological communities (online).: http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what-current#Key- threatening-processes

Department of Primary Industries. (2017). *Threatened & protected species - records viewer (online)*. Retrieved from Threatened & protected species - records viewer (online): http://www.dpi.nsw.gov.au/fisheries/species-protection/records/viewer

Department of the Environment . (2013). *Commonwealth Significant Impact guidelines.* ACT: Commonwealth Government.

DoE. (2013). *Matters of National Environmental Significance - Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999.* Department of the Environment. Canberra, ACT: Commonwealth of Australia . Retrieved April 2015, from http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Environment Australia. (2001). *A Directory of Important Wetlands in Australia, Third Edition.* ACT: Environment Australia.

Environment, D. o. (2017). *Protected Matters Search Tool (online)*. Retrieved from http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-

Environment, D. o. (2017). *Species Profiles and Threats Database (SPRAT), (online)*. Retrieved from Species Profiles and Threats Database (SPRAT), (online): http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Fairfull, S. a. (2003). *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings.* Cronulla: NSW Fisheries.

Kuginis L., Byrne G., Serov P, Williams J.P. (2012). *Risk assessment guidelines for groundwater dependent ecosystems, Volume 3 – Identification of high probability groundwater dependent ecosystems on the coastal plains of NSW and their ecological value.* Sydney: NSW Department of Primary Industries, Office of Water.

NSW Department of Primary Industries. (2017a). *NSW WeedWise (online)*. Retrieved from NSW WeedWise (online): http://weeds.dpi.nsw.gov.au/

Office of Environment and Heritage. (2014). *Framework for Biodiversity Assessment.* Sydney: NSW Government.

Office of Environment and Heritage. (2014). *Major Projects Offsets Policy.* Sydney: NSW Government.

Office of Environment and Heritage. (2017). *Atlas of NSW Wildlife (online)*. Retrieved from Atlas of NSW Wildlife (online): http://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ReturnUrl=%2fAtlasApp%2fDefault.aspx

Office of Environment and Heritage. (2017). *Threatened Species Profile Database (online)*. Retrieved from Threatened Species Profile Database (online): http://www.environment.nsw.gov.au/asmslightprofileapp/account/login?ForceLogin=1

Office of Environment and Heritage. (2017). *Vegetation Information System (online)*. Retrieved from Vegetation Information System (online): http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx

Resource and Conservation Division. (2001). *Comprehensive Regional Assessment Floristic Types Information (CRAFTI).*

Royal Botanic Gardens and Domain Trust, Sydney (online). (2017). *PlantNET (The NSW Plant Information Network System)*. Retrieved from PlantNET (The NSW Plant Information Network System): http://plantnet.rbgsyd.nsw.gov.au

Thackway, R. a. (1995). *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.0.* ACT: Australian Nature Conservation Agency.

Appendix A: **BAM FIELDWORK DATA SHEETS**

BAM (2017) Sheets

Appendix B: **BAMCC REPORTS**

Appendix C: **OEH AND EPBC DATABASE SEARCH RESULTS**

OEH BioNet dataset

Kingdom Name	Class Name	Family Name	Scientific	Common Name	NSW Status	Comm Status	No of records
Flora	Flora	Fabaceae (Mimosoideae)	Acacia curranii	Curly-bark Wattle	V,P	V	35
Fauna	Mammalia	Dasyuridae	Antechinomys laniger	Kultarr	E1,P		3
Fauna	Aves	Artamidae	Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P		11
Flora	Flora	Poaceae	Austrostipa wakoolica	A spear-grass	E1,P	E	11
Fauna	Aves	Scolopacidae	Calidris acuminata	Sharp-tailed Sandpiper	P	C,J,K	1
Fauna	Aves	Cacatuidae	Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2		3
Fauna	Aves	Meliphagidae	Certhionyx variegatus	Pied Honeyeater	V,P		7
Fauna	Mammalia	Vespertilionidae	Chalinolobus picatus	Little Pied Bat	V,P		39
Fauna	Aves	Acanthizidae	Chthonicola sagittata	Speckled Warbler	V,P		28
Fauna	Aves	Psophodidae	Cinclosoma castanotum	Chestnut Quail-thrush	V,P		6
Fauna	Aves	Accipitridae	Circus assimilis	Spotted Harrier	V,P		3
Fauna	Aves	Climacteridae	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V,P		36
Flora	Flora	Malvaceae	Commersonia procumbens		V,P	V	6
Fauna	Aves	Neosittidae	Daphoenositta chrysoptera	Varied Sittella	V,P		22
Flora	Flora	Orchidaceae	Diuris tricolor	Pine Donkey Orchid	V,P,2		7
Fauna	Aves	Petroicidae	Drymodes brunneopygia	Southern Scrub-robin	V,P		11
Flora	Flora	Cyperaceae	Eleocharis obicis	Spike-Rush	V,P	V	2
Fauna	Aves	Meliphagidae	Epthianura albifrons	White-fronted Chat	V,P		5
Fauna	Aves	Falconidae	Falco hypoleucos	Grey Falcon	E1,P,2		2
Fauna	Aves	Falconidae	Falco subniger	Black Falcon	V,P		3
Fauna	Aves	Meliphagidae	Grantiella picta	Painted Honeyeater	V,P	V	3
Fauna	Aves	Gruidae	Grus rubicunda	Brolga	V,P		3
Fauna	Aves	Accipitridae	Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C	1
Fauna	Aves	Accipitridae	Hieraaetus morphnoides	Little Eagle	V,P		10
Fauna	Aves	Apodidae	Hirundapus caudacutus	White-throated Needletail	P	C,J,K	3
Fauna	Aves	Acanthizidae	Hylacola cautus	Shy Heathwren	V,P		14
Fauna	Aves	Psittacidae	Lathamus discolor	Swift Parrot	E1,P,3	CE	1
Fauna	Aves	Megapodiidae	Leipoa ocellata	Malleefowl	E1,P	V	30
Flora	Flora	Brassicaceae	Lepidium monoplocoides	Winged Peppercress	E1,P	E	1
Fauna	Aves	Cacatuidae	Lophochroa leadbeateri	Major Mitchell's Cockatoo	V,P,2		83
Fauna	Aves	Petroicidae	Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V,P		70
Fauna	Aves	Meliphagidae	Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Fauna	Aves	Meropidae	Merops ornatus	Rainbow Bee-eater	P	J	59
Flora	Flora	Euphorbiaceae	Monotaxis macrophylla	Large-leafed Monotaxis	E1,P		4
Fauna	Mammalia	Dasyuridae	Ningaui yvonneae	Southern Ningaui	V,P		1
Fauna	Aves	Strigidae	Ninox connivens	Barking Owl	V,P,3		3
Fauna	Mammalia	Vespertilionidae	Nyctophilus corbeni	Corben's Long-eared Bat	V,P	V	9
Fauna	Aves	Pachycephalidae	Pachycephala inornata	Gilbert's Whistler	V,P		22
Fauna	Aves	Pachycephalidae	Pachycephala rufogularis	Red-lored Whistler	E4A,P	V	1
Fauna	Mammalia	Phascolarctidae	Phascolarctos cinereus	Koala	V,P	V	1
Fauna	Aves	Threskiornithidae	Plegadis falcinellus	Glossy Ibis	P	C	1
Fauna	Aves	Psittacidae	Polytelis swainsonii	Superb Parrot	V,P,3	V	72
Fauna	Aves	Pomatostomidae	Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V,P		169
Flora	Flora	Orchidaceae	Pterostylis cobarensis	Greenhood Orchid	V,P,2		2
Fauna	Mammalia	Emballonuridae	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P		27
Fauna	Aves	Estrildidae	Stagonopleura guttata	Diamond Firetail	V,P		11
Flora	Flora	Fabaceae (Faboideae)	Swainsona sericea	Silky Swainson-pea	V,P		1
Fauna	Aves	Scolopacidae	Tringa nebularia	Common Greenshank	P	C,J,K	1
Fauna	Mammalia	Vespertilionidae	Vespadelus baverstocki	Inland Forest Bat	V,P		3

Kingdom Name	Class Name	Family Name	Scientific	Common Name	NSW Status	Comm Status	No of records
							848

Threatened Species Search (Bioregion and subregion)

Scientific name	Common Name	Type of Species	NSW Status	Occurrence
Acacia curranii	Curly-bark Wattle	Plant > Shrubs	Vulnerable	Known
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Antechinomys laniger	Kultarr	Animal > Marsupials	Endangered	Known
Anthropogenic Climate Change	Human-caused Climate Change	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Ardeotis australis	Australian Bustard	Animal > Birds	Endangered	Predicted
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Animal > Birds	Vulnerable	Known
Atriplex infrequens	A saltbush	Plant > Herbs and Forbs	Vulnerable	Predicted
Austrostipa wakoolica	A spear-grass	Plant > Herbs and Forbs	Endangered	Known
Botaurus poiciloptilus	Australasian Bittern	Animal > Birds	Endangered	Predicted
Burhinus grallarius	Bush Stone-curlew	Animal > Birds	Endangered	Predicted
Bushrock removal	Bushrock Removal	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Calyptorhynchus lathami	Glossy Black-Cockatoo	Animal > Birds	Vulnerable	Known
Calyptorhynchus lathami - endangered population	Glossy Black-Cockatoo, Riverina population	Animal > Birds	Endangered Population	Known
Certhionyx variegatus	Pied Honeyeater	Animal > Birds	Vulnerable	Known
Chalinolobus picatus	Little Pied Bat	Animal > Bats	Vulnerable	Known
Chthonicola sagittata	Speckled Warbler	Animal > Birds	Vulnerable	Known
Cinclosoma castanotum	Chestnut Quail-thrush	Animal > Birds	Vulnerable	Known
Circus assimilis	Spotted Harrier	Animal > Birds	Vulnerable	Known
Clearing of native vegetation	Clearing of native vegetation	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Animal > Birds	Vulnerable	Known
Commersonia procumbens	Commersonia procumbens	Plant > Shrubs	Vulnerable	Known
Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	Competition and grazing by the feral European rabbit	Threat > Pest Animal	Key Threatening Process	Predicted
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	Threat > Pest Animal	Key Threatening Process	Predicted
Competition from feral honey bees, Apis mellifera L.	Competition from feral honeybees	Threat > Pest Animal	Key Threatening Process	Predicted
Crinia sloanei	Sloane's Froglet	Animal > Amphibians	Vulnerable	Predicted
Daphoenositta chrysoptera	Varied Sittella	Animal > Birds	Vulnerable	Known
Dasyurus maculatus	Spotted-tailed Quoll	Animal > Marsupials	Vulnerable	Predicted
Delma australis	Marble-faced Delma	Animal > Reptiles	Endangered	Known
Diuris tricolor	Pine Donkey Orchid	Plant > Orchids	Vulnerable	Known
Drymodes brunneopygia	Southern Scrub-robin	Animal > Birds	Vulnerable	Known
Eleocharis obicis	Spike-Rush	Plant > Herbs and Forbs	Vulnerable	Known
Epthianura albifrons	White-fronted Chat	Animal > Birds	Vulnerable	Known
Falco hypoleucos	Grey Falcon	Animal > Birds	Endangered	Known

Scientific name	Common Name	Type of Species	NSW Status	Occurrence
Falco subniger	Black Falcon	Animal > Birds	Vulnerable	Known
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	Threat > Other Threat	Key Threatening Process	Predicted
Grantiella picta	Painted Honeyeater	Animal > Birds	Vulnerable	Known
Grevillea ilicifolia subsp. ilicifolia	Holly-leaf Grevillea	Plant > Shrubs	Critically Endangered	Predicted
Grus rubicunda	Brolga	Animal > Birds	Vulnerable	Known
Haliaeetus leucogaster	White-bellied Sea-Eagle	Animal > Birds	Vulnerable	Known
Hamirostra melanosternon	Black-breasted Buzzard	Animal > Birds	Vulnerable	Known
Herbivory and environmental degradation caused by feral deer	Herbivory and environmental degradation caused by feral deer	Threat > Pest Animal	Key Threatening Process	Predicted
Hieraaetus morphnoides	Little Eagle	Animal > Birds	Vulnerable	Known
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	Ecological consequences of high frequency fires	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Hylacola cautus	Shy Heathwren	Animal > Birds	Vulnerable	Known
Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	Importation of red imported fire ants into NSW	Threat > Pest Animal	Key Threatening Process	Predicted
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species	Threat > Disease	Key Threatening Process	Predicted
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Threat > Disease	Key Threatening Process	Predicted
Infection of native plants by Phytophthora cinnamomi	Infection of native plants by Phytophthora cinnamomi	Threat > Disease	Key Threatening Process	Predicted
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Community > Threatened Ecological Communities	Endangered Ecological Community	Known
Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	Introduction of the large earth bumblebee (Bombus terrestris)	Threat > Pest Animal	Key Threatening Process	Predicted
Invasion and establishment of exotic vines and scramblers	Invasion and establishment of exotic vines and scramblers	Threat > Weed	Key Threatening Process	Predicted
Invasion and establishment of Scotch Broom (Cytisus scoparius)	Invasion and establishment of Scotch Broom (Cytisus scoparius)	Threat > Weed	Key Threatening Process	Predicted
Invasion and establishment of the Cane Toad (Bufo marinus)	Invasion and establishment of the Cane Toad	Threat > Pest Animal	Key Threatening Process	Predicted
Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.	Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.	Threat > Weed	Key Threatening Process	Predicted
Invasion of native plant communities by Chrysanthemoides monilifera	Invasion of native plant communities by bitou bush & boneseed	Threat > Weed	Key Threatening Process	Predicted
Invasion of native plant communities by exotic perennial grasses	Invasion of native plant communities by exotic perennial grasses	Threat > Weed	Key Threatening Process	Predicted
Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	Invasion of the yellow crazy ant (Anoplolepis gracilipes) into NSW	Threat > Pest Animal	Key Threatening Process	Predicted
Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)	Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)	Threat > Weed	Key Threatening Process	Predicted
Lathamus discolor	Swift Parrot	Animal > Birds	Endangered	Known
Leipoa ocellata	Malleefowl	Animal > Birds	Endangered	Known

Scientific name	Common Name	Type of Species	NSW Status	Occurrence
Lepidium monoplocoides	Winged Peppercress	Plant > Herbs and Forbs	Endangered	Known
Limosa limosa	Black-tailed Godwit	Animal > Birds	Vulnerable	Predicted
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Animal > Birds	Vulnerable	Known
Lophoictinia isura	Square-tailed Kite	Animal > Birds	Vulnerable	Predicted
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	Threat > Weed	Key Threatening Process	Predicted
Loss of Hollow-bearing Trees	Loss of Hollow-bearing Trees	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Loss or degradation (or both) of sites used for hill-topping by butterflies	Loss and/or degradation of sites used for hill-topping by butterflies	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Animal > Birds	Vulnerable	Known
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Animal > Birds	Vulnerable	Known
Monotaxis macrophylla	Large-leafed Monotaxis	Plant > Herbs and Forbs	Endangered	Known
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Community > Threatened Ecological Communities	Endangered Ecological Community	Known
Neophema pulchella	Turquoise Parrot	Animal > Birds	Vulnerable	Known
Ningaui yvonneae	Southern Ningaui	Animal > Marsupials	Vulnerable	Known
Ninox connivens	Barking Owl	Animal > Birds	Vulnerable	Known
Nyctophilus corbeni	Corben's Long-eared Bat	Animal > Bats	Vulnerable	Known
Oxyura australis	Blue-billed Duck	Animal > Birds	Vulnerable	Predicted
Pachycephala inornata	Gilbert's Whistler	Animal > Birds	Vulnerable	Known
Pachycephala rufogularis	Red-lored Whistler	Animal > Birds	Critically Endangered	Known
Petroica phoenicea	Flame Robin	Animal > Birds	Vulnerable	Predicted
Phascogale tapoatafa	Brush-tailed Phascogale	Animal > Marsupials	Vulnerable	Predicted
Phascolarctos cinereus	Koala	Animal > Marsupials	Vulnerable	Known
Polytelis swainsonii	Superb Parrot	Animal > Birds	Vulnerable	Known
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Animal > Birds	Vulnerable	Known
Predation and hybridisation by Feral Dogs, Canis lupus familiaris	Predation and hybridisation by Feral Dogs, Canis lupus familiaris	Threat > Pest Animal	Key Threatening Process	Predicted
Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	Predation by the Plague Minnow (Gambusia holbrooki)	Threat > Pest Animal	Key Threatening Process	Predicted
Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	Predation by the European Red Fox	Threat > Pest Animal	Key Threatening Process	Predicted
Predation by the Feral Cat Felis catus (Linnaeus, 1758)	Predation by feral cats	Threat > Pest Animal	Key Threatening Process	Predicted
Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	Predation, habitat degradation, competition and disease transmission by Feral Pigs (Sus scrofa)	Threat > Pest Animal	Key Threatening Process	Predicted
Pterostylis cobarensis	Greenhood Orchid	Plant > Orchids	Vulnerable	Known
Pyrrholaemus brunneus	Redthroat	Animal > Birds	Vulnerable	Predicted
Removal of dead wood and dead trees	Removal of dead wood and dead trees	Threat > Habitat Loss/Change	Key Threatening Process	Predicted
Rostratula australis	Australian Painted Snipe	Animal > Birds	Endangered	Predicted

Scientific name	Common Name	Type of Species	NSW Status	Occurrence
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Animal > Bats	Vulnerable	Known
Sminthopsis macroura	Stripe-faced Dunnart	Animal > Marsupials	Vulnerable	Predicted
Stagonopleura guttata	Diamond Firetail	Animal > Birds	Vulnerable	Known
Stictonetta naevosa	Freckled Duck	Animal > Birds	Vulnerable	Predicted
Swainsona sericea	Silky Swainson-pea	Plant > Herbs and Forbs	Vulnerable	Known
Tiliqua occipitalis	Western Blue-tongued Lizard	Animal > Reptiles	Vulnerable	Predicted
Tyto novaehollandiae	Masked Owl	Animal > Birds	Vulnerable	Predicted
Vespadelus baverstocki	Inland Forest Bat	Animal > Bats	Vulnerable	Known

EPBC MNES

Australian Government
Department of the Environment and Energy

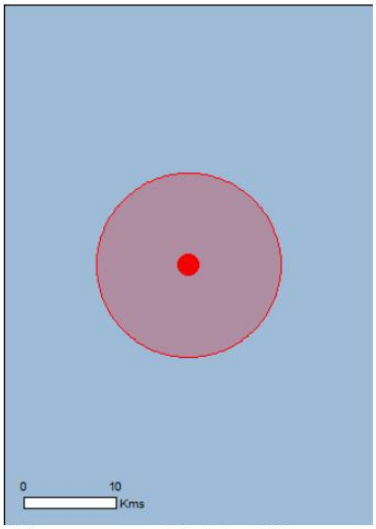
EPBC Act Protected Matters Report

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.

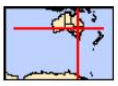
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 19/10/18 11:25:22



Coordinates
Buffer: 10.0Km



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:	2
Listed Threatened Species:	9
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:	1
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:	None
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock 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
Weeping Myall Woodlands	Endangered	Community may occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to 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
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat may 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 may occur within area
Plants		

Name	Status	Type of Presence
Austrostipa metatoris [66704]	Vulnerable	Species or species habitat may 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

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

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 alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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
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 may occur within area

Extra Information

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

Name	Status	Type of Presence within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		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

-32.06164 146.30322

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.

Appendix D: **SPECIES RECORDED ON HERA 2010 TO 2018**

FAUNA SURVEY RESULTS 2010 TO 2018 (EIS AND ANNUAL MONITORING)

Hera fauna results

Class	Scientific Name	Common name	BC Act	EPBC Act	Bio-indicator	Hera 2010	Hera 2013	Hera 2014	Hera 2015	Hera 2016	Hera 2017	Hera 2018
Amphibians	*Limnodynastes dumerilii*	Eastern Banjo Frog						X				
Amphibians	*Litoria caerulea*	Green Tree Frog						X				
Amphibians	*Litoria latopalmata*	Broad Palmed Frog				X		X				
Amphibians	*Litoria peronii*	Peron's Tree Frog				X		X	X			
Amphibians	*Notaden bennettii*	Crucifix Frog				X						
Amphibians												0
Bats	*Austronomus australis*	White-striped Freetail Bat							X	X	X	
Bats	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V				X	X		X	
Bats	*Chalinolobus gouldii*	Gould's Wattled Bat				X	X	X	X	X	X	X
Bats	*Chalinolobus morio*	Chocolate Wattled Bat				X	X					X
Bats	*Chalinolobus picatus*	Little Pied Bat	V			X	X	X	X	X	X	X
Bats	*Miniopterus schreibersii oceansis*	Eastern Bentwing Bat	V				X		X		X	X
Bats	*Mormopterus petersi (M. sp. 3*	Inland Freetail Bat				X		X	X	X	X	
Bats	*Mormopterus planiceps (M. sp 3/4)*	Southern Freetail Bat				X	X	X	X	X	X	
Bats	*Mormopterus sp. 4*	Western / Southern Freetail Bat				X	X					
Bats	*Nyctophilus geofroyii*	Lesser Long-eared Bat								X		
Bats	*Nyctophilus sp.*	Large-eared Bat sp					X	X			X	X
Bats	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V			X	X	X	X	X	X	
Bats	*Scotorepens balstoni*	Western / Inland broad-nosed bat					X	X	X	X	X	X
Bats	*Scotorepens greyii*	Little Broad-nosed Bat				X	X	X	X	X		X
Bats	*Tadarida australis*	White-striped free-tailed bat				X	X	X				
Bats	*Vespadelus baverstocki*	Inland Forest Bat	V				X	X	X		X	
Bats	*Vespadelus darlintoni*	Large Forest Bat							X		X	
Bats	*Vespadelus regulus*	Southern Forest Bat							X		X	
Bats	*Vespadelus troughtoni*	Eastern Cave Bat	V				X					
Bats	*Vespadelus vulturnus*	Little Forest Bat				X	X	X	X	X	X	X
Bats												8
Birds	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater				X	X	X	X	X	X	X
Birds	*Acanthiza apicalis*	Inland Thornbill				X	X	X			X	X
Birds	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill				X	X	X	X		X	
Birds	*Acanthiza nana*	Yellow Thornbill				X	X	X	X			X
Birds	*Acanthiza reguloides*	Buff-rumped Thornbill				X						
Birds	*Acanthiza uropygialis*	Chestnut-rumped Thornbill				X	X	X				
Birds	*Anas castanea*	Chestnut Teal						X				
Birds	*Anas gracillis*	Grey Teal							X			
Birds	*Anthochaera carunculata*	Red Wattlebird							X			
Birds	*Anthus novaeseelandiae*	Australian Pipit				X	X	X	X			
Birds	*Anthus richardi*	Richards Pipit				X	X	X				X
Birds	*Aphelocephala leucopsis*	Southern Whiteface				X	X	X				X
Birds	*Aquila audax*	Wedge-tailed Eagle				X	X	X	X			
Birds	*Ardea pacifica*	White-necked Heron						X				
Birds	*Artamus cinereus*	Black-faced Woodswallow				X	X	X		X	X	
Birds	*Artamus cyanopterus*	Dusky Woodswallow				X	X	X				
Birds	*Artamus leucorynchus*	White-breasted Woodswallow				X	X	X	X		X	X
Birds	*Artamus personatus*	Masked Woodswallow									X	

Class	Scientific Name	Common name	BC Act	EPBC Act	Bio-indicator	Hera 2010	Hera 2013	Hera 2014	Hera 2015	Hera 2016	Hera 2017	Hera 2018
Birds	*Artamus superciliosus*	White-Browed Woodswallow				X	X	X	X	X		
Birds	*Barnardius zonarius barnardi*	Mallee Ringneck				X	X	X	X		X	X
Birds	*Cacatua galerita*	Sulphur-crested Cockatoo							X			
Birds	*Cacatua leadbeateri*	Major Mitchells Cockatoo	V		Y	X					X	X
Birds	*Cacatua sanguinea*	Little Corella				X	X	X				
Birds	*Certhionyx niger*	Black Honeyeater							X			X
Birds	*Certhionyx variegatus*	Pied Honeyeater	V				X	X				
Birds	*Ceyx azureus*	Azure Kingfisher								X	X	
Birds	*Chenonetta jubata*	Australian Wood Duck				X	X	X			X	
Birds	*Cincloramphus cruralis*	Brown Songlark				X		X				
Birds	*Cincloramphus mathewsi*	Rufous Songlark				X						
Birds	*Circus assimilis*	Spotted Harrier	V			X						
Birds	*Climacteris affinis*	White-browed Treecreeper	V								X	
Birds	*Colluricincla harmonica*	Grey Shrike-thrush				X	X	X	X			
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike				X	X	X	X			
Birds	*Corcorax melanorhamphos*	White-winged Chough				X			X	X	X	
Birds	*Corvus coronoides*	Australian Raven				X	X	X	X	X	X	X
Birds	*Coturnix ypsilophora*	Brown Quail								X		
Birds	*Cracticus nigrogularis*	Pied Butcherbird				X	X	X	X		X	
Birds	*Cracticus tibicen*	Australian Magpie				X	X	X	X	X	X	X
Birds	*Cracticus torquatus*	Grey Butcherbird				X	X	X			X	
Birds	*Dacelo novaeguineae*	Laughing Kookaburra				X	X	X	X	X	X	
Birds	Dicaeum hirundinaceum	Mistletoebird										X
Birds	*Dromaius novaehollandiae*	Emu				X	X	X	X	X	X	
Birds	*Entomyzon cyanotis*	Blue-faced Honeyeater				X					X	
Birds	*Eolophus roseicapillus*	Galah				X	X	X	X	X	X	X
Birds	*Eopsaltria australis*	Eastern Yellow Robin			Y	X				X	X	X
Birds	*Erythrogonys cinctus*	Red-kneed Dotterel						X				
Birds	*Falco cenchroides*	Nankeen Kestrel							X		X	
Birds	*Fulica atra*	Eurasian Coot						X				
Birds	*Gerygone fusca*	Western Gerygone				X	X	X	X			
Birds	*Grallina cyanoleuca*	Magpie-lark				X	X	X	X	X	X	X
Birds	*Himantopus himantopus*	Black-winged Stilt						X				
Birds	*Hirundo neoxena*	Welcome Swallow				X	X	X			X	X
Birds	*Lalage sueurii*	White-winged Triller				X						
Birds	*Lichenostomus leucotis*	White-eared Honeyeater				X	X	X				
Birds	*Lichenostomus ornatus*	Yellow-plumed Honeyeater				X	X	X			X	X
Birds	*Lichenostomus penicillatus*	White-plumed Honeyeater				X			X	X	X	X
Birds	*Lichenostomus virescens*	Singing Honeyeater				X	X	X				X
Birds	*Malurus cyaneus*	Superb Fairy-wren				X	X	X	X			
Birds	*Malurus splendens*	Splendid Fairy-wren				X	X	X	X	X	X	
Birds	*Manorina flavigula*	Yellow-throated Miner				X						
Birds	*Manorina melanocephala*	Noisy Miner				X	X	X	X	X	X	X
Birds	*Melanodryas cucullata*	Hooded Robin	V		Y	X	X	X			X	X
Birds	*Melithreptus validirostris*	Brown-headed Honeyeater										X
Birds	*Melopsittacus undulatus*	Budgerigar				X						
Birds	*Merops ornatus*	Rainbow Bee-eater									X	X
Birds	*Microeca fascinans*	Jacky Winter			Y	X				X		X
Birds	*Myiagra inquieta*	Restless Flycatcher				X	X	X	X			
Birds	*Neophema pulchella*	Turquoise Parrot	V			X						

Class	Scientific Name	Common name	BC Act	EPBC Act	Bio-indicator	Hera 2010	Hera 2013	Hera 2014	Hera 2015	Hera 2016	Hera 2017	Hera 2018
Birds	*Northiella haematogaster*	Blue Bonnet				X	X	X		X	X	
Birds	*Nymphicus hollandicus*	Cockatiel				X	X	X				
Birds	*Ocyphaps lophotes*	Crested Pigeon				X	X	X	X	X	X	X
Birds	*Oreoica gutturalis*	Crested Bellbird				X						
Birds	*Pachycephala rufiventris*	Rufous Whistler				X	X	X			X	X
Birds	*Pachycephala inornata*	Gilberts Whistler	V									X
Birds	*Pardalotus striatus*	Striated Pardalote				X	X	X			X	X
Birds	*Passer domesticus**	House Sparrow				X	X	X		X		
Birds	*Petrochelidon ariel*	Fairy Martin				X	X	X				X
Birds	*Petroica goodenovii*	Red-capped Robin			Y	X	X	X	X	X	X	X
Birds	Phalacrocorax carbo	Little Black Cormorant										X
Birds	*Phaps chalcoptera*	Common Bronzewing				X	X	X		X	X	X
Birds	*Philemon citreogularis*	Little Friarbird							X			
Birds	*Philemon corniculatus*	Noisy Friarbird				X	X	X	X	X		
Birds	*Platycercus eximius*	Eastern Rosella				X			X			
Birds	*Plectorhyncha lanceolata*	Striped Honeyeater				X	X	X				
Birds	*Podargus strigoides*	Tawny Frogmouth				X						
Birds	*Poliocephalus poliocephalus*	Hoary-headed Grebe						X				
Birds	*Polytelis swainsonii*	Superb Parrot							X			
Birds	*Pomatostomus ruficeps*	Chestnut-crowned Babbler				X						
Birds	*Pomatostomus superciliosus*	White-browed Babbler				X		X			X	X
Birds	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V		Y	X	X	X			X	X
Birds	*Psephotus haematonotus*	Red-rumped Parrot				X	X	X	X	X	X	X
Birds	*Psephotus varius*	Mulga Parrot				X	X	X	X		X	X
Birds	*Ptilonorhynchus maculatus*	Spotted Bowerbird			Y	X						X
Birds	*Purnella albifrons*	White-fronted Honeyeater				X						
Birds	*Rhipidura albiscapa*	Grey Fantail				X	X	X	X			
Birds	*Rhipidura leucophrys*	Willie Wagtail				X	X	X	X	X	X	X
Birds	*Smicrornis brevirostris*	Weebill				X	X	X				
Birds	*Stagonopleura guttata*	Diamond Firetail	V			X					X	
Birds	*Struthidea cinerea*	Apostle bird				X	X	X	X	X	X	X
Birds	*Sturnus vulgaris*	Common Starling									X	
Birds	*Taeniopygia bichenovii*	Double-barred Finch							X			
Birds	*Taeniopygia guttata*	Zebra Finch									X	
Birds	*Tyto alba*	Eastern Barn Owl			Y							
Birds	*Tyto novaehollandiae*	Masked Owl	V						X			
Birds												38
Mammals*	*Capra hircus**	Goat				X	X	X	X	X	X	X
Mammals*	*Felis catus**	Cat				X			X	X		X
Mammals*	*Oryctolagus cuniculus**	Rabbit				X	X	X	X	X	X	X
Mammals*	*Sus scrofa**	Pig				X					X	X
Mammals*	*Vulpes vulpes**	Fox				X			X	X	X	X
Mammals*												5
Marsupials	*Macropus giganteus*	Eastern Grey Kangaroo				X	X	X	X	X	X	X
Marsupials	*Macropus robustus*	Common Wallaroo				X	X	X				X
Marsupials	*Macropus rufus*	Red Kangaroo									X	
Marsupials	*Tachyglossus aculeatus*	Echidna					X	X			X	
Marsupials	*Antechinus flavipes*	Yellow-footed Antechinus										X
Marsupials												3

Class	Scientific Name	Common name	BC Act	EPBC Act	Bio-indicator	Hera 2010	Hera 2013	Hera 2014	Hera 2015	Hera 2016	Hera 2017	Hera 2018
Reptiles	*Cryptoblepharus spp.*	Snake-eyed Skinks				X						
Reptiles	*Ctenotus atlas*	Southern Mallee Ctenotus				X						
Reptiles	*Morethia boulengeri*	Tree Skink				X			X			
Reptiles	*Gehyra versicolor*	Variable Dtella										
Reptiles	*Rhynchoedura ornata*	Beaked Gecko								X		
Reptiles	*Diporiphora nobbi*	Common Nobbi Dragon					X	X				
Reptiles	*Pogona vitticeps*	Central Bearded Dragon					X	X	X		X	
Reptiles	*Tiliqua rugosa*	Shingle-back				X	X	X	X	X	X	
Reptiles	*Varanus gouldii*	Sand Goanna							X		X	
Reptiles	*Varanus varius*	Lace Monitor				X				X		
Reptiles	*Pseudonaja nuchalis*	Western Brown Snake										
Reptiles												0
					Total	101	77	87	66	44	69	54

Hera fauna results (2010 EIS to 2018 annual monitoring at 13 plots)

Hera Mine Site (2018)													
Plot ID	1	2	3	4	5	6	7	8	9	10	11	12	13
GPS Zone	55	55	55	55	55	55	55	55	55	55	55	55	55
GDA N	6447115	6445740	6445713	6445218	6445465	6445721	6445000	6445277	6444447	6444638	644554	6445549	6447576
GDA E	435567	436724	436706	437239	438975	439186	438773	439223	437956	437021	434716	434714	434957
Size	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m	20 x 20 m
Notes	Hera	Hera	Hera Tailings Dam	Stake in woodland	Open Plain	Hera	Hera	Hera	Hera	Hera	Hera	Hera	Hera Blue Grass
Dominant Stratum	Mid	Upper	Mid	Mid	Lower	Mid	Upper	Mid	Mid	Upper	Upper	Upper	Low
Dominant Stratum % Cover	15	10	5	25	5	40	10	30	20	10	5	2	2
Landscape Position and Mitchell Landscape	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats	Flats
	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs	Nymagee Downs
Health	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy
Condition (Biobanking)	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good	Moderate to Good
Plant Community Type	103	103	103	103	103	103	103	103	103	103	103	103	103

Hera Mine Site (2018)													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Biometric Vegetation Name	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion [Benson 103]
EEC?	No	No	No	No	No	No	No	No	No	No	No	No	No
Over Cleared Vegetation Type? >90% in CMA	No	No	No	No	No	No	No	No	No	No	No	No	No
Highly Cleared Vegetation Type? >70% in CMA	No	No	No	No	No	No	No	No	No	No	No	No	No
Upper Stratum % cover	>5	10	5	2	12	0	10	0	0	2	2	5	0
Mid Stratum % Cover	15	>1	40	25	0	40	5	30	20	2	2	2	0.5
Lower Stratum % Cover	15	10	1	1	5	5	1	1	1	1	0	1	30
Upper Stratum height (m)	8	4	10	12	10	11	10	0	0	13	13	12	0
Mid Stratum height (m)	2	1	6	7	0	8	8	8	6	8	8	4	0
Lower Stratum height (m)	0.1	0.2	0.1	0.3	0.4	0.1	0.05	0.05	0.04	0.1	0.2	0.2	2
% Bare Ground	85	80	25	60	90	70	85	80	70	95	95	90	40
% Rocks	0	0	0	0	0	0	0	0	0	0	0	0	0
Ground logs 20x50m >10cm diameter	0	2	2	8	0	2	0	0	0	2	5	0	0
Tree Hollows 20 x 20m area													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Very Large	0	0	0	0	0	0	0	0	0	0	0	0	0
Large	0	0	0	0	0	1	0	0	0	1	0	0	0
Medium	0	0	0	0	0	0	0	0	0	0	0	0	0
Small	0	0	0	0	0	1	2	0	0	0	0	0	0
Stratum Details													
No of Upper Stratum sp	0	1	2	1	1	0	1	0	0	1	1	1	0
No of Mid Stratum sp	2	1	1	3	0	2	1	1	2	3	2	1	2
No of Lower Stratum sp	7	2	2	4	6	3	6	2	3	3	7	6	6
No of Native sp	9	4	5	8	7	5	8	3	5	7	10	8	8
No of exotic species	0	0	0	0	0	0	0	0	0	0	0	0	0
% Native sp	100	100	100	100	100	100	100	100	100	100	100	100	100
Biodiversity links? (State, Regional, Local?)	N/A	N/A											
Terrestrial habitat													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**

Hera Mine Site (2018)													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Habitat features	Microbat habitat (low)	Microbat habitat (low)	Cleared vegetation stockpile	Occasional hollow, rare eucalypt, WCP woodland, leaf litter and mistletoe	Grassland heavily grazed by goats	Dead standing timber, fallen logs, native grasses	near expanded back tank, tree hollows, clumps of leaf litter	Ground logs, microbat habitat (low)	Native grass layer	Native grass layer, decorative bark, tree hollows	Eucalypt dominated area, tree hollows, ground logs	Leaf litter, native grass layer, dam water	Fenced Grassland Native
Upper Stratum spp													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1 (Dominant species)		White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	Gum-barked Coolibah (*Eucalyptus intertexta*)	White Cypress Pine (*Callitris glaucophylla*)		White Cypress Pine (*Callitris glaucophylla*)			Poplar Box (*Eucalyptus populnea*)	Poplar Box (Eucalyptus populnea)	Poplar Box (Eucalyptus populnea)	
2 (Sub dominant 1)			Gum-barked Coolibah (*Eucalyptus intertexta*)										
3 (Sub dominant 2)													
White Cypress Pine (*Callitris glaucophylla*)	0.5	0.1	0.1		0.5		0.5						
Poplar Box (*Eucalyptus populnea*)							0.1				0.1	0.1	
Gum-barked Coolibah (*Eucalyptus intertexta*)			0.1	0.1						0.1			
Mid Stratum spp													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	13
1 (Dominant species)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)		White Cypress Pine (*Callitris glaucophylla*)	Gumbarked Coolibah (E. intertexta)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	Poplar Box (*Eucalyptus populnea*)
2 (Sub dominant 1)	Turpentine (*Eremophila sturtii*)			Turpentine (*Eremophila sturtii)*		Turpentine (*Eremophila sturtii*)			Budda (*Eremophila mitchellii*)	Budda (*Eremophila mitchellii*)	Poplar Box (*Eucalyptus populnea*)		White Cypress Pine (*Callitris glaucophylla*)
3 (Sub dominant 2)				Eremopholia mitchelii						Gumbarked Coolibah (E. intertexta)			
Turpentine (*Eremophila sturtii*)	0.1			1		0.1							
Budda (*Eremophila mitchellii*)				1					0.1	0.1			
Gum-barked Coolibah (Eucalyptus intertexta)							0.1			0.1			
Poplar Box (*Eucalyptus populnea*)											1		0.5
White Cypress Pine (*Callitris glaucophylla*)	0.5	1	2	2		2	0.5	3	2	2	2	0.1	1
Lower Stratum spp													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1 (Dominant species)	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*	*Rough Speargrass (Austrostipa Scabra)*
2 (Sub dominant 1)	Curly Windmill Grass *(Enteropogon acicularis)*	White Cypress Pine (*Callitris glaucophylla*)	*Sclerolaeana spp.*	Tar Bush (*Eremophila glabra*)	Tar Bush (*Eremophila glabra*)	White Cypress Pine (*Callitris glaucophylla*)	Curly Windmill Grass *(Enteropogon acicularis)*	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	Budda (*Eremophila mitchellii*)	Creeping Saltbush *(Atriplex semibaccata)*	Bottle Fissure Weed (*Maireana excavata*)	Bottle Fissure Weed (*Maireana excavata*)
3 (Sub dominant 2)	*Sclerolaeana spp.*			Turpentine (*Eremophila sturtii*)	Curly Windmill Grass (*Enteropogon acicularis*)	Turpentine (*Eremophila sturtii*)	White Cypress Pine (*Callitris glaucophylla*)		Budda (*Eremophila mitchellii*)	Turpentine (*Eremophila sturtii*)	*Sclerolaeana spp.*	Curly Windmill Grass *(Enteropogon acicularis)*	Turpentine (*Eremophila sturtii*)

Hera Mine Site (2018)													
Plot ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Budda (*Eremophila mitchellii*)									0.1	1			
Bottle Fissure Weed (*Maireana excavata*)												1	1
Tar Bush (*Eremophila glabra*)				1	1								
Caustic weed (*Euphorbia drummondii*)							0.1						
Climbing Saltbush *(Einadia nutans)*			1										
Creeping Saltbush *(Atriplex semibaccata)*											1		1
Curly Windmill Grass (*Enteropogon acicularis)*	1											1	
Eastern Cotton Bush *(Maireana microphylla)*	0.1				1						0.1		
Galvanised burr *(Scleroleana birchii)*												1	
Gum-barked Coolibah (*Eucalyptus intertexta*)		1					0.1						
Purple Burr Daisy *(Calotis cunefolia)*							0.1						
Purple Love Grass (*Eragrostis lacunaria*)							1						
Rough Speargrass (Austrostipa Scabra)	1	1	1	1	1	1	1	1	1	1	1	1	1
Sclerolaeana spp.	1										1		
Serrate Gooodenia *(Goodenia cycloptera)*					0.1						0.1		
Tar Vine (*Boerhavia diffusa*)					1								
Thorny Saltbush (*Rhagodia spinescens*)													0.1
Turpentine (*Eremophila sturtii*)	0.1			1		1				0.1			1
White Cypress Pine *(Callitris glaucophylla)*	1			1	1	1	1	1	1		0.5	0.1	0.1

Chelsea BOA

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
GPS Zone	55	55	55	55 - 40*	55 - 230*	55- East	55 - North
GDA N	6424499	6424172	6423745	6423449	6426032	6425698	6423916
GDA E	451479	451055	453952	453623	452841	453119	453062
Study Area	Eroded Area Main Creek	Bank of drainage line	Confluence of watercourse	Tractor Shed	Uplsope of drainage line	Creek Crossing Track	Base of outcrop
Details							
	1	**2**	**3**	**4**	**5**	**6**	**7**
Dominant Stratum	Upper	Mid	Upper	Mid	Mid	Upper	Lower
Dominant Stratum % Cover	2	30	30	5	15	10	0.01
Landscape Position and Mitchell Landscape	Nangarybone Hills - Creek Bank/Bed	Nangarybone Hills - Creek Bank	Nangarybone Hills - Creek Bank	Nangarybone Hills - Gentle Slope		Nangarybone Hills - Creek Bank | Gentle Rise	
Health	Drought stressed	Drought stressed	Drought stressed	Drought stressed	Drought stressed	Drought stressed	Drought stressed
Condition (Biobanking)	Mod_Good	Mod_Good	Mod_Good	Mod_Good	Mod_Good	Mod_Good	Mod_Good
Plant Community Type (PCT)	103	103	103	103	174	174	184
Biometric Vegetation Name	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103)	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103)	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103)	Poplar Box - Gum-barked Coolibah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion (Benson 103)	Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion [Benson 103]	Mallee - Gum Coolabah woodland on red earth flats of the eastern Cobar Peneplain Bioregion [Benson 103]	Dwyer's Red Gum - White Cypress Pine - Currawang low shrub-grass woodland of the Cobar Peneplain Bioregion (Benson 184)
EEC?	no	no	no	no	no	no	no

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
Over Cleared Vegetation Type? >90% in CMA	no	no	no	no	no	no	no
Highly Cleared Vegetation Type? >70% in CMA	no	no	no	no	no	no	no
Upper Stratum % cover	2	5	30	0	0	10	0
Mid Stratum % Cover	2	30	30	5	15	30	0
Lower Stratum % Cover	0	0	0	1	0	1	0.01
Upper Stratum height (m)	14	0	16	10	0	15	0
Mid Stratum height (m)	6	8	2.5	2.5	8	8	0
Lower Stratum height (m)	0	0	0	0.05	0.01	0.01	0.03
% Bare Ground	75	30	20	95	95	10	60
% Rocks	0	0	0	0	0	0	40
Ground logs 20x20m >10cm diameter	14m	2m	2m	2m	4m	7m	10m
Tree Hollows 20x50m area							
Hollows	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Very Large	0	0	0	0	0	0	0
Large	0	0	0	0	0	0	0
Medium	0	1	1	0	0	0	0
Small	5	1	3	0	0	0	0
Stratum Details							
No of Upper Stratum sp	1	1	4	0	0	2	0
No of Mid Stratum sp	1	1	2	1	2	1	0

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
No of Lower Stratum sp	10	6	12	8	3	3	10
Native plant species richness	8	7	15	6			
No of exotic species	1		1	2			
Biodiversity links ? (State, Regional, Local?)							
Terrestrial habitat							
Plot number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Habitat features, including feeding, prey species, nesting, rocky habitat and refuge resources, including non-native hollow bearing trees	Creek line, mixture of three ecotones, alluvial and rocky area	Near ephemeral creek, decorating bark, forms hollows	Fallen logs, hollows, riparian	Grassy Layer	Riparian, logs	Creek Crossing Track	Logs, hollows, rocks
Upper Stratum spp	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1 (Dominant species)	White Cypress Pine (*Callitris glaucophylla*)	Dwyers Red Gum (Eucalyptus dwyeri)	White Cypress Pine (*Callitris glaucophylla*)			White Cypress Pine (*Callitris glaucophylla*)	
2 (Sub dominant 1)			Blakely's Red Gum (*Eucalyptus blakelyii*)			Kurrajong (*Brachychiton populneus*)	
3 (Sub dominant 2)			Inland Grey Box (Eucalyptus microcarpa)				
Blakelys Red Gum (*Eucalyptus blakelyii*)			0.1				
Dwyers Red Gum (*Eucalyptus dwyeri*)		0.1					

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
Gum-barked Coolibah (*Eucalyptus intertexta*)			0.1				
Inland Grey Box (*Eucalyptus microcarpa*)						0.1	
Poplar Box (*Eucalyptus populnea*)			0.1				
White Cypress Pine (*Callitris glaucophylla*)	0.1		0.1			0.5	
Mid Stratum spp	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1 (Dominant species)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	Dwyers Red Gum (Eucalyptus dwyeri)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	
2 (Sub dominant 1)			Kurrajong (Brachichiton populneus)		Poplar Box (Eucalyptus populnea subsp. bimbil)		
3 (Sub dominant 2)							
Dwyers Red Gum (*Eucalyptus dwyeri)*				0.1			
Kurrajong (*Brachichiton populneus)*			0.1				
Poplar Box (*Eucalyptus populnea*)					0.5		
White Cypress Pine (*Callitris glaucophylla*)	1	1	1		1	1	
Lower Stratum	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1 (Dominant species)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)	Rough Speargrass (*Austrostipa scabra* subsp. *scabra*)

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
2 (Sub dominant 1)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	White Cypress Pine (*Callitris glaucophylla*)	Sunray Daisy (*Helipterum spp*)
3 (Sub dominant 2)	Serrated Goodenia (*Goodenia cycloptera*)	Poison Rock Fern (Cheilanthes sieberi subsp. sieberi)	Copper Burr (*Scleroleana spp)*	Serrated Goodenia (*Goodenia cycloptera*)	Poplar Box (Eucalyptus populnea subsp. bimbil)	Slender Dock (*Rumex brownii*)	Common Cranesbill (*Geranium retrorsum*)
Climbing Saltbush *(Einadia nutans)*	0.5		0.5				
Common Cranesbill (*Geranium retrorsum*)		1		1			1
Copper Burr (*Scleroleana spp)*	1		1				
Cress (*Lepidium spp*)	0.1						
Daisy (*Brachycome spp)*							1
Five Minute Grass (*Tripogon loliiformis)*	0.5						0.5
Groundheads (*Chthonocephalus pseudevax*)							0.5
Pink Fingers (Caledina canea)			0.5				
Poison Rock Fern (*Cheilanthes sieber*)		1	1	1			1
Rough speargrass (*Austrostipa scabra)*	1	1	1	1	1	1	1
Saltbush (*Atriplex spp)*	0.5		1				
Scarlet pimpernel (			1				
Serrated Goodenia (*Goodenia cycloptera*)	1	1	0.5	1			

Chelsea Biodiversity Offset Area (2018)							
20x20m Plot ID	**CH-MP #1**	**CH-MP #2**	**CH-MP #3**	**CH-MP #4**	**CH-MP #5**	**CH-MP #6**	**CH-MP #7**
Slender Dock (*Rumex brownii*)			1			0.1	
Small Purslane (*Calandrinia eremaea*)							0.1
Sunray Daisy (*Helipterum spp*)	1	1					1
Windmill grass (*Chloris truncata*)				1			1
White Cypress Pine (*Callitris glaucophylla*)	1	1	1	1	1	1	
Dwyers Red Gum (Eucalyptus dwyeri)							0.1
Poplar Box (Eucalyptus populnea subsp. bimbil)					0.5		
Exotic/Weed Species	1	2	3	4	5	6	7
Yellow wood sorrel (*Oxalis corniculata*)			0.5				
Hares foot clover (*Trifolium arvense*)	0.5			1			
Burr medic (*Medicargo polymorpha*)			0.5	1			