

21 October 2020

Stephen O'Donoghue
Director Resource Assessments
Energy, Resources and Compliance – Planning and Assessment
Department of Planning, Industry & Environment

Dear Stephen,

TARRAWONGA LIFE OF MINE MODIFICATION – SUPPLEMENTARY RESPONSE

Please find enclosed a supplementary response to the comments received from the Environment Protection Authority, Resources Regulator, Narrabri Shire Council and the Department of Planning, Industry & Environment's Biodiversity Conservation Division in relation to the Tarrawonga Coal Mine Life of Mine Modification 7.

If you wish to discuss, please do not hesitate to contact Tony Dwyer on (02) 6741 9316.

Yours sincerely

A handwritten signature in black ink, appearing to read "Tony Dwyer".

Tony Dwyer

Group Manager - Approvals and Environment

Enclosure 1 – Response to Submissions

ENCLOSURE 1
RESPONSE TO SUBMISSIONS

**Table 1
Responses to Submissions**

#	Recommendation/Comment	Response
1	NSW DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT – BIODIVERSITY AND CONSERVATION DIVISION	
	Biodiversity Development Assessment Report	
1.1	<i>BCD accepts the changes that have been made in the calculations; however, the inconsistencies between the plot data presented in the BDAR and the data in the calculator have not been addressed. The assessor must ensure that the correct data is entered into the BAM calculator and that it reflects the data in the BDAR.</i>	<p>Table 3.2 of the Biodiversity Development Assessment Report (BDAR) has been amended to show a dash (-) where the stem size class is not relevant for the Plant Community Type (PCT) (i.e. the large tree diameter at breast height [DBH] threshold size is 30 centimetres [cm] for PCT 101, and 50 cm for PCT 847). The number of large trees has been assessed by counting all living stems with a DBH equal to or greater than the large tree threshold DBH for the PCT or vegetation class. This is consistent with the Biodiversity Assessment Method (BAM) (Office of Environment and Heritage, 2017), which states:</p> <p><i>Presence or absence of each tree stem size class from five centimetres DBH (diameter at breast height over bark measured at 1.3 metres above ground level) to the large tree threshold size is recorded and entered into the Calculator. For example, when the large tree threshold size is 50 centimetres, tree stem size classes are 5–9, 10–19, 20–29, 30–49 cm DBH.</i></p> <p><i>While only presence or absence data is required for a BAM assessment actual counts or estimates of the number of stems within each size class can be used to improve thinning thresholds and benchmark data within the BioNet Vegetation Classification.</i></p> <p><i>The number of large trees is assessed by counting all living stems with a DBH equal to or greater than the large tree threshold DBH for the PCT or vegetation class. Threshold size is located in the PCT description in the BioNet Vegetation Classification. The number of large trees is entered into the Calculator.</i></p> <p>In addition, the credit costs and ecosystem/species credits have been revised to be consistent with the submitted BAM Calculation. The revised BDAR (dated October 2020) is provided in Attachment 1. <u>There is no change to the BAM Calculation required.</u></p>
1.2	<i>Changes to this mapping may impact the percent native vegetation cover figure that has been entered into the calculator. The assessor must ensure that the correct data is entered into the BAM calculator and that it reflects the data in the BDAR.</i>	<p>The native vegetation layer has been revised in Figure 2.1 of the revised BDAR (Attachment 1) and is now consistent with the PCT vegetation mapping. The outcome is that the area of native vegetation in the buffer area has increased by 0.3 hectares, but does not result in a change to the overall percent (%) cover of native vegetation (i.e. it remains at 16.9%), <u>and therefore does not impact the BAM Calculation.</u></p>
2	NSW ENVIRONMENT PROTECTION AUTHORITY	
	Water	
2.1	<i>No further information is required regarding this issue.</i>	Noted.
	Waste	
2.2	<i>No further information is required for the purposes of the proposed modification.</i>	Noted.

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
2	NSW ENVIRONMENT PROTECTION AUTHORITY (Continued)	
	Noise	
2.3	<i>No further information is required regarding noise impacts from the proposal.</i>	Noted.
	Air Quality	
2.4	<p><i>The EPA has concerns over the transparency and the robustness of the emissions inventory, especially considering the high incremental concentrations and exceedances for 24-hour PM₁₀ impacts.</i></p> <p><i>The control measures for the project have been outlined by the proponent, including those that have been modelled, however, little information or discussion is provided to address the exceedances or additional measures proposed to reduce the impact of the modification.</i></p> <p><i>...EPA requests the proponent addresses the following points:</i></p> <ul style="list-style-type: none"> <i>Provide all the variables required to calculate the particulate emissions for each activity, including activity intensities, VKT, etc.</i> <i>Provide the emissions inventory for TSP</i> 	<p>The Modification is seeking to increase the maximum run-of-mine (ROM) coal extraction rate by 0.5 million tonnes per annum (Mtpa) during Modification Years 3 to 7 (i.e. from 3 to 3.5 Mtpa). It is noted that the Modification would result in a reduction in the total life-of-mine ROM coal mined by 5.1 million tonnes and a reduction in the mine footprint by approximately 87 hectares in the east of the mine (i.e. in the areas of the mine closest to privately-owned receivers).</p> <p>Air quality modelling undertaken for the Modification predicts:</p> <ul style="list-style-type: none"> no exceedances of the Modification-only and cumulative annual average PM₁₀, PM_{2.5} and total suspended particles concentrations and dust deposition level; no exceedances of the Modification-only and cumulative 24-hour average PM_{2.5} concentrations; no exceedances of the Modification-only 24-hour average PM₁₀ concentrations; and no receivers (i.e. dwellings) or vacant land requiring acquisition or mitigation in accordance with the <i>Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments Policy</i> (VLAMP) (DP&E, 2018). <p>For the assessment of cumulative 24-hour average PM₁₀ concentrations, modelling results are initially presented for existing mines plus background. The results show that without the contribution from the Tarrawonga Coal Mine (either the approved operations or the proposed Modification), exceedances are predicted across all receivers from existing nearby mines plus background. Furthermore, for many receivers, the maximum predicted cumulative 24-hour average PM₁₀ concentration does not increase with the addition of the Modification (refer Tables 6-2 and 6-3 of Appendix D of the Modification Report).</p> <p>The cumulative modelling (Modification plus existing mines plus background) shows that there are 14 receivers where no additional exceedances of the 24-hour average PM₁₀ impact assessment criterion are predicted. There are seven receivers where the cumulative modelling (Modification plus existing mines plus background) results in one additional exceedance (i.e. days where the 24-hour PM₁₀ criteria are exceeded) and four receivers where the cumulative modelling (Modification plus existing mines plus background) results in two additional exceedances.</p> <p>However, the additional days of exceedance are predicted in the absence of the implementation of real-time controls. The Tarrawonga Coal Mine Air Quality and Greenhouse Gas Management Plan (TCPL, 2015) and the BTM Complex Air Quality Management Strategy (Parsons Brinkerhoff, 2017) are used to proactively monitor and manage cumulative air quality impacts from the Tarrawonga Coal Mine. The BTM Complex Air Quality Management Strategy includes an integrated predictive (forecast meteorology and modelling) and reactive (real-time monitoring network) and is specifically designed to prevent short-term exceedances of the impact assessment criteria, such as those predicted for the Modification. It does this by applying proactive, reactive or corrective measures across the BTM Complex when potential short-term exceedances are predicted or detected.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
2	NSW ENVIRONMENT PROTECTION AUTHORITY (Continued)	
2.4 (Cont.)		<p>Air Quality Modelling Emissions Inventory</p> <p>Detailed emission inventories for each assessment scenario (i.e. Modification Years 3 and 7) are included in Attachment 2. These emission inventories include all assumptions made with regard to air quality modelling, such as wind erosion, haul lengths/loads and indicative fleet numbers consistent with the indicative general arrangements and mining schedule provided in Section 2 of the Modification Report.</p> <p>As noted within Ramboll (2019), some materials properties and control efficiencies have been sourced from two Australia Coal Association Research Project (ACARP) reports. The headings below respond to the Environment Protection Authority's (EPA's) comments regarding this.</p> <p>Use of ACARP 22027</p> <p>The EPA asserts that significant issues have been raised by the Commonwealth in a peer review of the ACARP 22027. The Air Quality and Greenhouse Gas Assessment for the Modification only references surface stabilisation control factors for wind erosion from ACARP 22027. It is noted that a 2020 peer review of the ACARP 22027 (Document reference ACARP 27062 [ERM Australia Pacific Pty Ltd, 2020]) reviewed surface stabilisation control factors for wind erosion from ACARP 22027 and made the following recommendations:</p> <p><i>Consistent with the findings within Section 3, the previously derived control efficiencies derived using CABG technique under (PE, 2015) show strong agreement with open bottom wind tunnel data, and are thus supported.</i></p> <p><i>It is recommended that the default control efficiencies detailed within Table 4.2 [i.e. 65-95% as used in the Modification modelling] are adopted in emission inventory development for Australian mines.</i></p> <p>Accordingly, the adopted surface stabilisation control factors of 65-95% for wind erosion are considered to be appropriate.</p> <p>Use of ACARP 22023</p> <p>The Air Quality and Greenhouse Gas Assessment for the Modification only references surface treatment control factors (specifically watering of haul roads) from ACARP 20023. ACARP 20023 (Cox & Laing, 2014) demonstrated that watering alone can achieve 85% to 95% control efficiency for unsealed roads. The EPA's submission stated the "90% control factor used for watering of roads is considered high and may not be consistently achievable".</p> <p>Subsequent to the NSW Coal Benchmarking Study (Katestone, 2011) and the National Pollutant Inventory (2012), the EPA's Dust Stop Pollution Reduction Program required all open cut coal mines in NSW to implement best practice measures to significantly reduce their dust emissions.</p> <p>The Dust Stop Pollution Reduction Program included a requirement for all mines to demonstrate at least 80% dust control was being achieved on active haul roads (i.e. greater than the EPA's recommendation for a 75% control factor).</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
2	NSW ENVIRONMENT PROTECTION AUTHORITY (Continued)	
2.4 (Cont.)		<p>As a result of the Dust Stop Pollution Reduction Program, all NSW open cut coal mines successfully demonstrated control efficiencies of 80% or more. Results with greater than or equal to 90% control efficiency were reported by many mines, including:</p> <ul style="list-style-type: none"> ■ Tarrawonga Coal Mine (92%). Tarrawonga Coal Mine PRP U1: Monitoring Results – Wheel Generated Dust, Pacific Environment Limited, 2014. ■ Maules Creek Coal Mine (92%). Maules Creek Coal Mine PRP E1: Monitoring Results – Wheel Generated Dust, Pacific Environment Limited, 2016. ■ Werris Creek Coal Mine (96%). Werris Creek Coal PRP U1: Monitoring Results – Wheel Generated Dust, Pacific Environment Limited, 2014. <p>As Whitehaven has demonstrated it can achieve greater than 90% control efficiency on unsealed haul roads at a number of its existing operations including the Tarrawonga Coal Mine, it is reasonable to expect that at least a 90% level of control can be achieved for the Modification.</p> <p>Whitehaven continues to assess the control efficiency at the Tarrawonga Coal Mine and reports the results in its Annual Reviews.</p>
2.5	<ul style="list-style-type: none"> • <i>Adopts an alternate and robust methodology of evaluating diesel emissions and nominates best practice diesel emission controls</i> 	<p>As discussed in Section 5.2 of Appendix D of the Modification Report, emissions of PM₁₀ and PM_{2.5} from diesel combustion in mining equipment are assumed to be included in the total emissions for each relevant source and are not explicitly modelled as a separate emission source. However, adjustments have been made to account for the fact that emission reductions applied to the inventory (i.e. watering) are not relevant to control of diesel exhaust emissions.</p> <p>Diesel consumption for the Modification is estimated based on the reported FY2017 diesel consumption and scaled for the projected ROM coal and waste rock production for Year 3 and Year 7. The majority of mine site diesel (97%) is consumed in haul trucks (62%), excavators (19%) and dozers/loaders (15%) (NSW EPA, 2014). The emissions inventory applies no controls for dozers/loaders and excavators, therefore the adjustments for diesel emissions are only needed for haul road controls.</p> <p>It was assumed, therefore, that 62% of the total site diesel consumption is used for hauling and the total emissions are allocated to coal haul and waste haul pro-rata, based on the total tonnage hauled along each route. The estimated diesel emissions for hauling are subtracted from the uncontrolled haul road emissions to derive the wheel-generated component of emissions for each haul road. The control for watering is then applied to the wheel-generated component only, and the diesel emissions are then added back to derive the final emission estimate from haul trucks.</p> <p>As described in Section 2 of the Modification Report, the ROM coal stockpile area and associated infrastructure will be relocated to the east to improve ROM coal haulage efficiency. The improved haulage efficiency would reduce diesel consumption per ROM coal mined compared to the approved Project. In addition, the Modification mine planning minimises haulage distances for overburden emplacement.</p> <p>Other control measures used to reduce diesel consumption include (refer to Section 8 of Appendix D of the Modification Report):</p> <ul style="list-style-type: none"> ■ Direct placement of waste rock and soil where possible, reducing the double handling of material, potential for wind erosion and haulage distances. ■ Minimising the double handling of material, wherever practicable (i.e. direct movement of ROM coal to the ROM hopper).

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
2	NSW ENVIRONMENT PROTECTION AUTHORITY (Continued)	
2.6	<ul style="list-style-type: none"> <i>Provide further information to evaluate the contemporaneous assessments for receptors with exceedances and cumulative concentrations resulting from both background and incremental with the associated time/date and corresponding background, incremental and other mine contributions.</i> 	<p>As described in Section 4.2 of Appendix D of the Modification Report, monitoring data collected between 2013 and 2017 have been analysed and used to describe baseline concentrations of PM₁₀ and PM_{2.5} for use in the cumulative assessment. The daily varying 24-hour PM₁₀ and PM_{2.5} concentrations for 2017 are paired with each daily modelling prediction for cumulative assessment.</p> <p>Cumulative impacts were assessed using a combination of modelled emissions from other local mining operations and a background derived from monitoring data to account for all other sources. A conservative approach was used by assuming the worst-case emission scenarios for each mine, irrespective of the nominal mining year and whether it corresponds with the Modification scenario year. Further conservatism is added for cumulative assessment through the addition of background data for 2017, which will include some contribution from existing operations at Tarrawonga, Boggabri and Maules Creek Coal Mines during 2017.</p>
2.7	<ul style="list-style-type: none"> <i>Undertake a source apportionment assessment of particulates to quantify the contribution of the multiple mining operations to the air quality impacts at private residences. The proponent should consider in the source apportionment, the individual activities that significantly contribute to identify where control measures may be most effective.</i> 	<p>Tables 6-2 and 6-3 of Appendix D of the Modification Report provide breakdowns of the Modification's contribution to the concentrations at private receivers versus the background and other mining operations. However, the results in these tables do not account for any proactive or reactive operational controls (e.g. shutdown or relocation of fleet during adverse conditions) and therefore are conservative. It is also noted that for many receivers, the maximum predicted cumulative 24-hour average concentration does not increase with the addition of the Modification (i.e. the Modification contribution to concentrations at the receiver is minimal).</p> <p>A breakdown of the contributions of modelled sources to the total Modification emissions is provided in Section 5.1 of Appendix D of the Modification Report and Attachment 2.</p> <p>The most significant contribution is from hauling of overburden to emplacement areas (i.e. accounts for one third of total estimated emissions). As described in the Response to Item 2.4 above, Whitehaven proposes a 90% control efficiency on unsealed haul roads to reduce the contribution from this source.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
2	NSW ENVIRONMENT PROTECTION AUTHORITY (Continued)	
2.8	<ul style="list-style-type: none"> <i>With consideration of the above, the proponent should discuss additional actions and measures aimed at ensuring impacts do not exceed EPA's air quality criterion. Further, the proponent must provide detailed commitments about the implementation of the proposed mitigation and management measures to ensure the assumed high level of control efficiency is realised in practise.</i> 	<p>The air quality modelling results incorporate a material level of conservatism through a number of assumptions applied in the model input data and model settings, including:</p> <ul style="list-style-type: none"> ■ The dust emission estimates do not account for natural mitigation due to rainfall. ■ The model does not incorporate wet deposition (removal of particles due to rainfall). ■ The background adopted for assessment will include some contribution from existing mining operations, therefore there will be some double counting when modelled concentrations are added to background without adjustment ■ For cumulative assessment, modelling for other mines is based on maximum approved or proposed production, and therefore likely to be higher than what would eventuate. <p>The last two points are relevant to the predicted additional days of cumulative 24-hour average PM₁₀ exceedances (Section 6.2 of Appendix D of the Modification Report). It is noted that these additional days are predicted in the absence of the implementation of real-time controls.</p> <p>However, the BTM Complex Air Quality Management Strategy (Idemitsu and Whitehaven, 2017) is specifically designed to prevent short-term exceedances, by applying proactive, reactive or corrective measures across the BTM Complex when potential short-term exceedances are predicted or detected.</p> <p>The dust control and management measures outlined in the Modification Report are considered to be appropriate and consistent with the requirements of the Project Approval 11_0047.</p> <p>TCPL continues to assess and report performance of dust control efficiencies and air quality monitoring results for the Tarrawonga Coal Mine on an annual basis as part of its Annual Review.</p>

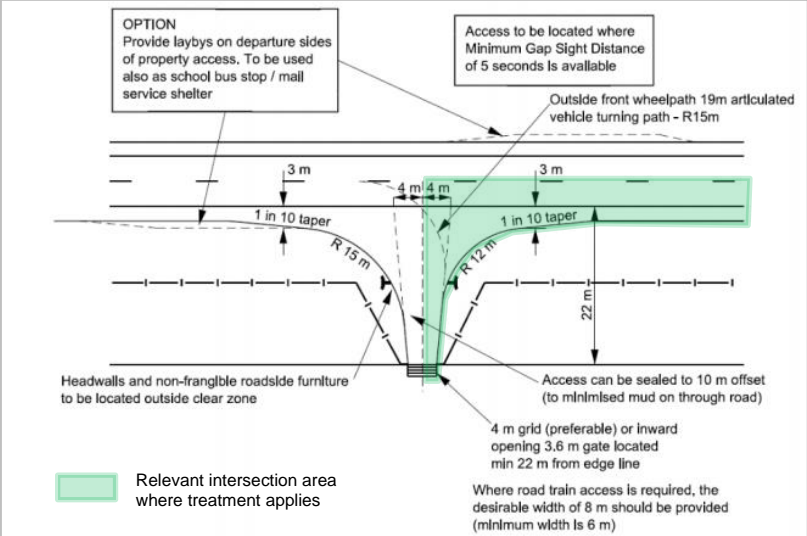
**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
3	NARRABRI SHIRE COUNCIL	
<i>Water Transfer Pipeline (submission dated 7 September 2020)</i>		
3.1	<p><i>In order to be able to determine the impacts of the pipeline, the following additional information was required to be provided, and in Council's opinion remains outstanding:</i></p> <ul style="list-style-type: none"> - <i>Details of the proposed pipeline itself. Including diameter, materials, construction methods. Ideally a cross section would be provided to illustrate its size, height above ground and typical footing to be used.</i> - <i>Details and plans are to provided for the proposed methods of crossing the public roads and any other works required within Council's road reserves.</i> - <i>A further opportunity is requested to review the additional documentation outlined above and to provide further comments, in particular to enable Council to assess the impacts on its land ownership and assets.</i> 	<p>TCPL would seek and obtain approval under section 138 of the NSW <i>Roads Act, 1993</i> for the construction of the pipeline. The details requested by Narrabri Shire Council (NSC) would be provided as part of the section 138 application.</p> <p>Whitehaven will provide NSC an opportunity to discuss the design of the pipeline prior to the lodgement of the section 138 application.</p> <p>Ultimately, the section 138 application would be developed and sent to NSC for approval.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
3	NARRABRI SHIRE COUNCIL (continued)	
<i>Traffic (letter dated 4 June 2020)</i>		
3.2	<p><i>The Traffic Assessment provided with the application states that existing roads have a posted speed limit of 80km/h. The public Roads in the area of the application (including Goonbri Road) have a posted speed limit of 100km/h. Assessment considerations need to be revised to incorporate this speed limit.</i></p> <p><i>The modification is proposing to provide a new access to the Tarrawonga Mine. This is located approximately 1.4km to the east of the existing site access and requires vehicles to now traverse a 1.4km section of Goonbri Road. The application proposes an upgrade of this portion of Goonbri Road between the existing private haul road and the proposed new access road. The only details provided of the upgrade works is:</i></p> <p><i>...upgraded and sealed to a standard consistent with the requirements of the Guide to Road Design Part 3: Geometric Design (Austroads, 2016). Works would be undertaken in consultation with the NSC.</i></p> <p><i>Further details of the proposed road upgrade works, including concept plans, are to be provided in order to enable an understanding of the extent of works required and to consider the impacts of the upgrade works. These details and considerations are not appropriate to be left to any future section 138 application.</i></p>	<p>Goonbri Road is unsealed east of the approved mine access road and provides for local property access and limited connectivity to the surrounding road network.</p> <p>As part of the Modification, Whitehaven is proposing to seal a 1.4 kilometre section of Goonbri Road between the Whitehaven Private Haul Road and the proposed new site access. It is proposed that a posted speed limit of 80 kilometres per hour would apply along the sealed section of the Goonbri Road. Goonbri Road would be constructed to a standard consistent with the requirements of Austroads (2016). As described in the Road Transport Assessment (Appendix E of the Modification Report), the general standard of Goonbri Road would include two 3.5 metres (m) travel lanes, and a total 1.5 m wide shoulder on each side (including minimum 0.5 m wide sealed shoulder). The sealing of Goonbri Road would be completed at Whitehaven’s cost.</p> <p>Condition 53, Schedule 3 of Project Approval 11_0047 requires that the construction of the approved Goonbri Road realignments be undertaken to the satisfaction of the NSC. It is anticipated that conditions for the Modification would also require the sealing of Goonbri Road to be completed <u>to the satisfaction of the NSC</u>.</p> <p>In addition, the road works proposed for the Modification would require authorisation under section 138 of the NSW <i>Roads Act, 1993</i> prior to construction. Accordingly, all details requested by the NSC will be provided with the section 138 application, to the satisfaction of the NSC.</p> <p>Whitehaven will consult with NSC regarding all design aspects of Goonbri Road upgrade prior to the lodgement of the section 138 application.</p> <p>Ultimately, the section 138 application would be developed and sent to NSC for approval.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
3	NARRABRI SHIRE COUNCIL (continued)	
3.3	<p><i>The application proposes to construct a new private access road off Goonbri Road, approximately 1.4km to the east of the intersection with the private haul road. It is proposed that the intersection would be constructed to a BAL treatment for the left hand turn from Goonbri Road into the site. No treatment is proposed for the right hand turn into the site. Further information is required to be submitted in relation to this proposed intersection, including:</i></p> <ul style="list-style-type: none"> <i>(i) Demonstration that the proposed intersection can achieve the Safe Intersection Sight Distances required by Section 3.2.2 of Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections.</i> <i>(ii) A concept design for the proposed property access road is to be provided. The design is to be in accordance with Section 7.2 of Austroads Guide to Road Design Part 4: Intersections and Crossings – General. The design is to demonstrate that:</i> <ul style="list-style-type: none"> <i>(A) It accommodates the largest vehicle required to access the site (including provide of swept path drawings),</i> <i>(B) It caters for the largest vehicle turning left into the site without crossing the centre line of Goonbri Road,</i> <i>(C) The access driveway leg of the intersection is to provide a minimum storage length of 22m, measured from the edge of the road back into the property and clear of any access gates,</i> <i>(D) Includes a BAL treatment, and</i> <i>(E) Is generally consistent with Figure 7.4, except as required above.</i> <p><i>A further opportunity is requested to review the additional documentation outlined above and to provide further comments, in particular to enable Council to assess the impacts on its land ownership and assets.</i></p>	<p>A new intersection would be constructed on Goonbri Road at the proposed new site access. At the proposed intersection, an average of 20 haulage trucks would turn left from Goonbri Road each hour, and 20 haulage trucks would turn right onto Goonbri Road (exiting the site) each hour. Through volumes on Goonbri Road past the intersection (i.e. travelling east) would be low, with a maximum of 11 vehicles per hour forecast in the longer term. At the proposed intersection, there would be no demand for right turn movement from Goonbri Road or left turn movements on to Goonbri Road (therefore, no intersection treatment for these turns are proposed).</p> <p>Austrroads (2017) sets out requirements for major road turn treatments for basic treatments at rural intersections. The requirements focus on safety performance, while operational performance may require a higher level treatment, although this is not considered to be the situation at the proposed new site access intersection. Comparing the forecast volumes at the intersection with the Austrroads requirements, the intersection would require the general minimum preferred left turn treatment in Goonbri Road, being the Basic Auxiliary Left (BAL) treatment. The rural BAL treatment on the major road has a widened shoulder, which assists turning vehicles to move further off the through carriageway, making it easier for through vehicles to pass a vehicle turning left into the minor road.</p> <p>It is proposed that the left turn into the new site access would cater for the largest vehicle required, include BAL treatment, provide a minimum storage length of 22 m, and otherwise be designed as per Section 7.2 and Figure 7.4 of Austrroads (2017) (refer below).</p>  <p>Figure 7.4: Example of a Rural Property Access Specifically Designed for Articulated Vehicles</p> <p>As noted in Response 3.2, Whitehaven will consult with NSC regarding all design aspects of Goonbri Road upgrade prior to the lodgement of the section 138 application.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
3	NARRABRI SHIRE COUNCIL (continued)	
3.4	<p><i>The application proposes to alter the haul route, with vehicles turning right onto Goonbri Road instead of travelling straight through the intersection. Further information is required to be submitted to determine whether any upgrade works are required to this intersection in order to cater for the proposed turning movements associated with the modification. In particular it needs to be demonstrated that:</i></p> <p><i>(i) The intersection accommodates the largest vehicle required to access the site (including provide of swept path drawings),</i></p> <p><i>(ii) The intersection caters for the largest vehicle turning left from Goonbri Road without crossing the centre line of the haul road,</i></p> <p><i>Should works be required to the intersection to accommodate the above requirements, concept plans are to be provided in order to enable an understanding of the extent of works required and to consider the impacts of the upgrade works. These details and considerations are not appropriate to be left to any future section 138 application.</i></p> <p><i>A further opportunity is requested to review the additional documentation outlined above and to provide further comments, in particular to enable Council to assess the impacts on its land ownership and assets.</i></p>	<p>An average of 20 ROM coal haulage trucks per hour would turn right from the Whitehaven Private Haul Road onto Goonbri Road, and 20 ROM coal haulage trucks per hour would turn left from Goonbri Road to the Whitehaven Private Haul Road to travel to the Whitehaven coal handling and preparation plant.</p> <p>The existing intersection design will be reviewed to ensure the swept path of the ROM coal trucks can be accommodated, notably that a ROM coal haulage truck can turn left from Goonbri Road into the Whitehaven Private Haul Road without crossing the centreline of the Whitehaven Private Haul Road.</p> <p>If an upgrade to this intersection is required, a section 138 application with the relevant details will be prepared and submitted to NSC for approval.</p>
3.5	<p><i>It is requested that the Road Maintenance Agreement with Council be updated to reflect the additional public roads included in the haul route.</i></p>	<p>The existing road maintenance agreement (Schedule 3, Condition 55) with NSC for the Tarrawonga Coal Mine will be reviewed and amended as required to accommodate the proposed Modification, including haulage of ROM coal along Goonbri Road.</p>

**Table 1 (Continued)
Responses to Submissions**

#	Recommendation/Comment	Response
4 RESOURCES REGULATOR		
<i>Final Void</i>		
4.1	<p>As outlined in the Regulator's original advice (LETT0004569) the material for the batter of the final void is sodic and the modification report states that the void will take time to fill to equilibrium. In light of Whitehaven's response, the Regulator remains concerned about the long term stability of the void and that without a revegetation strategy there is a risk of sterilisation of land as there are limited options for beneficial post mining land uses.</p>	<p>With respect to the final void, Condition 61, Schedule 3 of Project Approval 11_0047 requires the following:</p> <ul style="list-style-type: none"> <i>Minimise the size and depth of the final void as far as is reasonable and feasible</i> <i>Minimise the drainage catchment of the final void as far as is reasonable and feasible</i> <i>Negligible high wall instability risk</i> <i>Minimise risk of flood interaction for all flood events up to and including the Probable Maximum Flood level</i> <p>There is no requirement to establish vegetation in the final void domain. Furthermore, Condition 61 includes a rehabilitation objective to restore ecosystem function for 'all land – excluding the 210 ha of agricultural land and the final void'.</p> <p>Notwithstanding, Whitehaven is required to submit a final version of the Final Void and Mine Closure Plan (FVMCP) under Condition 65, Schedule 3 of Project Approval 11_0047 by the end of December 2024. The FVMCP must demonstrate that the relevant objectives in Condition 61 are satisfied. The FVMCP must also identify and consider predicted stability of the proposed landforms.</p> <p>The Resources Regulator as the approval authority for mining operations plans will ultimately be responsible for approving the closure of the Tarrawonga Coal Mine through future mining operations plans. Whitehaven will continue to consult with the Resources Regulator in regards to the final void design and closure.</p> <p>A geotechnical assessment would be undertaken as part of the final void closure.</p>
<i>Progressive Rehabilitation</i>		
4.2	<p>It is the Regulator's expectation that rehabilitation is undertaken as soon as reasonably practicable. To provide an indication of what is reasonable practicable in the context of the Tarrawonga MOD7 project, it is the Regulator's advice that the figures are updated to show the areas available for progressive rehabilitation as outlined in the Whitehaven response as well as those areas beyond year 7.</p>	<p>It is noted that Whitehaven submitted a Mining Operations Plan to the Resources Regulator on 31 August 2020 that incorporates the first two years of mining including Modification 7. The level of detail on progressive rehabilitation requested by the Resources Regulator including phasing, methodology, monitoring and auditing is described in the Mining Operations Plan.</p> <p>Future submissions of the Mining Operations Plan will provide the planned annual rehabilitation progression in accordance with the <i>ESG3: Mining Operations Plan (MOP) Guidelines, September 2013</i> (Trade and Investment, 2013).</p> <p>The Resources Regulator, as the approval authority for Mining Operations Plans, will be responsible for approving the rehabilitation phasing for the Modification through future mining operations plans. Whitehaven will continue to consult with the Resources Regulator in relation to future mining operations plans that incorporate Modification 7.</p>

References

- Austrroads Ltd (2016) *Guide to Road Design Part 3: Geometric Design*.
- Austrroads Ltd (2017) *Guide to Road Design Part 4A: Intersections and Crossings: General*.
- Cox, J. and Laing, G. (2014). *Mobile Sampling of Dust Emissions from Unsealed Roads. ACARP Project C20023 – Stage 2 Final Report. 20 June 2014*.
- Environmental Resources Management Australia Pacific Pty Ltd (2020) *Development of Australia-Specific PM10 Emission Factors for Coal Mines*.
- Idemitsu and Whitehaven (2017) *BTM Complex Air Quality Management Strategy*.
- Katestone (2011) *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining. Report Compiled on behalf of NSW Department of Environment, Climate Change and Water*.
- National Pollutant Inventory (2012) *Emission Estimation Technique Manual for Mining Version 3.1 January 2012*.
- NSW EPA (2014) *NSW Coal Mining Benchmarking Study – Best-practice Measures for Reducing Non-road Diesel Exhaust Emissions*.
- Office of Environment and Heritage (2017) *Biodiversity Assessment Method*.
- Pacific Environment Limited (2014) *Tarrawonga Coal Mine PRP U1: Monitoring Results – Wheel Generated Dust*.
- Pacific Environment Limited (2014) *Werris Creek Coal PRP U1: Monitoring Results – Wheel Generated Dust*.
- Pacific Environment Limited (2016) *Maules Creek Coal Mine PRP E1: Monitoring Results – Wheel Generated Dust*.
- Ramboll Australia Pty Ltd (2019) *Tarrawonga Life of Mine Modification Air Quality and Greenhouse Gas Assessment*.
- Tarrawonga Coal Pty Ltd (2015) *Tarrawonga Coal Mine Air Quality and Greenhouse Gas Management Plan*.
- Trade and Investment (2013) *ESG3: Mining Operations Plan (MOP) Guidelines*.

ATTACHMENT 1

REVISED BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT (OCTOBER 2020)

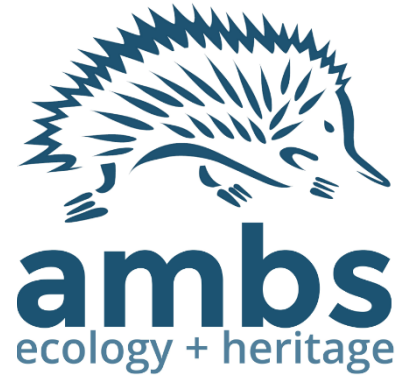


Tarrawonga Coal Mine Life of Mine Modification

Appendix F
Biodiversity Development Assessment Report



WHITEHAVEN COAL



Tarrawonga Coal Mine Life of Mine Modification – Biodiversity Development Assessment Report

Prepared by AMBS Ecology & Heritage
for Whitehaven Coal Limited

Final Report

October 2020

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1 Introduction

1.1 Background

The Tarrawonga Coal Mine is located approximately 42 kilometres (km) north-northwest of Gunnedah in New South Wales (NSW), within the Narrabri Local Government Area (LGA) (Figure 1.1). The Tarrawonga Coal Mine is owned and operated by Tarrawonga Coal Pty Limited (TCPL), a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven).

The Tarrawonga Coal Mine is an open cut coal mine which has been in operation since 2006. Run-of-mine (ROM) coal is crushed and screened on-site, and the sized ROM coal is loaded onto on highway trucks for transport via the Approved ROM Coal Transport Route to the Whitehaven coal handling preparation plant (CHPP).

TCPL proposes a modification of its Project Approval (PA) 11_0047. The Tarrawonga Coal Mine Life of Mine Modification (the Modification) would be sought under section 4.55(2) of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

Mining operations at the Tarrawonga Coal Mine are conducted in accordance with PA 11_0047, as modified.

The main activities associated with the Modification include:

- ROM coal production rate increase from 3.0 to 3.5 million tonnes per annum (Mtpa);
- increase in ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa;
- reduction of the open cut extent to avoid mining the:
 - Upper Namoi alluvium; and
 - Goonbri Creek.
- revision of the post-mining landform and land use;
- relocation of the ROM coal stockpile and associated infrastructure;
- construction of a new site access road and intersection to allow haulage of ROM coal along a section of Goonbri Road; and
- construction and use of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project (which is the subject of a separate Development Application for State Significant Development [SSD] 7480).

The Modification would result in no change to the following elements of the Tarrawonga Coal Mine:

- mine life and operating hours;
- employment;
- mining tenements;
- mining methods; and
- domestic coal production.

Only two components of the Modification may result in additional disturbance to native vegetation, being the pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project, and the new access road off Goonbri Road. Consequently, this Biodiversity Development Assessment Report (BDAR) only addresses these aspects of the Modification.

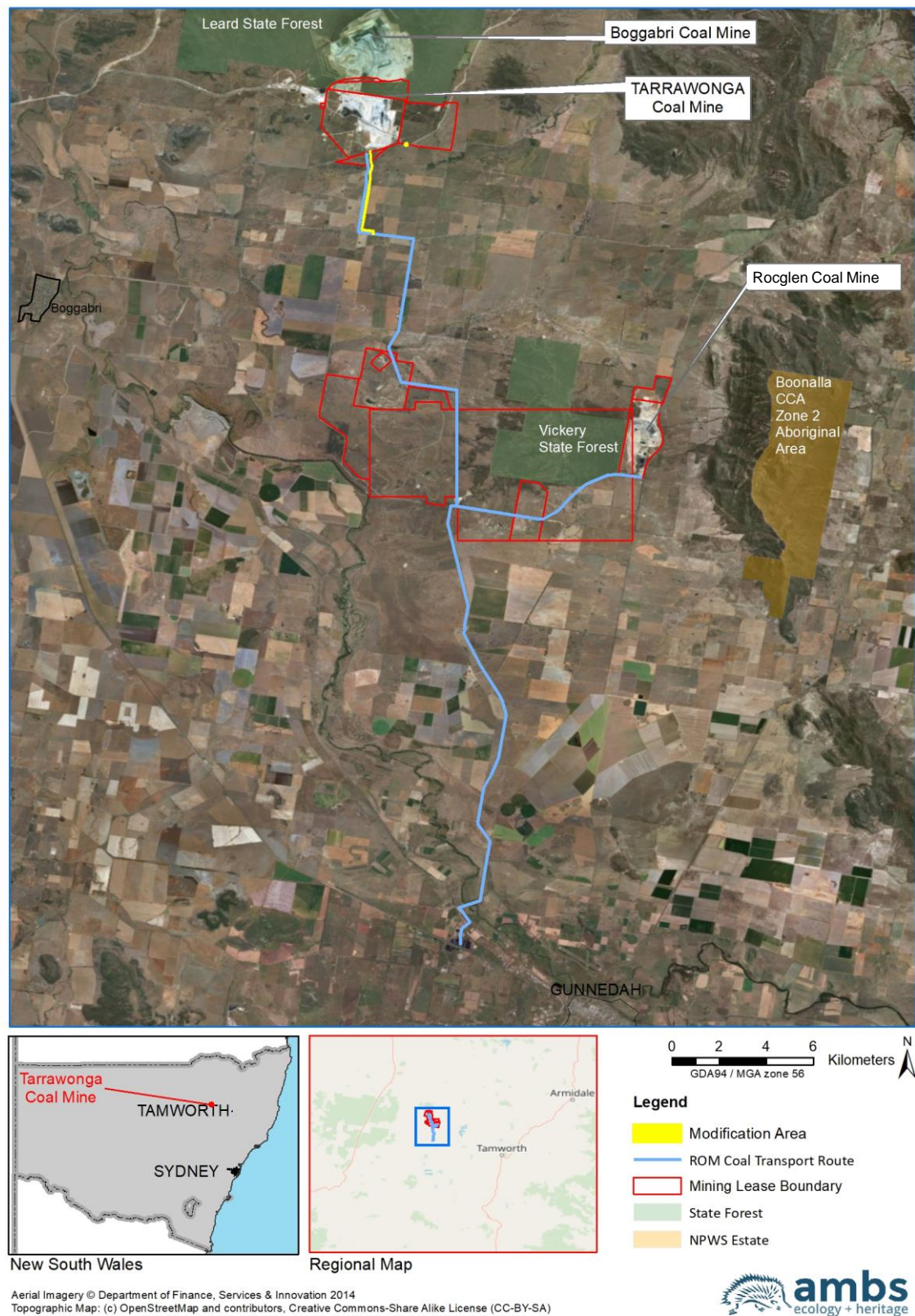
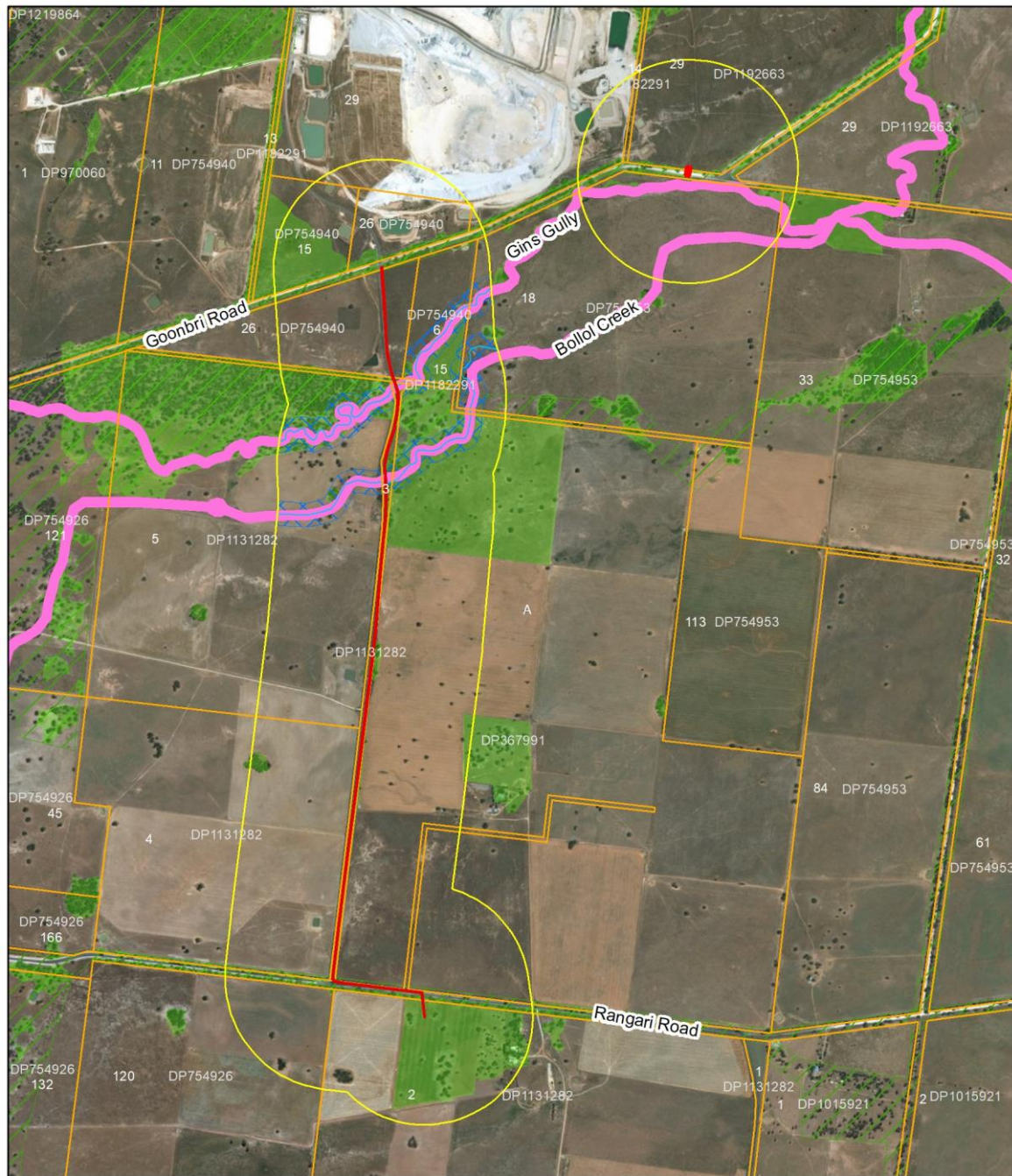


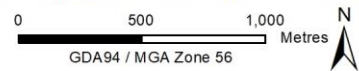
Figure 1.1 Regional location of the study area



Legend

- | | |
|--|---|
| █ Modification Area | █ Landscape Features |
| █ Buffer Area -500m | █ Native Vegetation (AMBS) |
| █ Cadastre | — Watercourse (AMBS adjusted based on Aerial Imagery) |
| | █ Riparian Buffer (AMBS adjusted) |
| | █ Biodiversity Values Map Layer (OEHL) |
| | █ Habitat Connectivity (AMBS) |

LGA: Narrabri
 Suburb: Boggabri
 IBRA: Brigalow Belt South - Liverpool Plains
 There are no wetlands, areas of geological significance, soil hazard features or any other landscape features within or near the subject land.



Service Layer Credits: Division of Resources & Energy
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User



Figure 1.2 Site map

1.2 Study area

The study area relevant to this report is shown on Figure 1.2. It is located to the south of the Tarrawonga Coal Mine, with the proposed pipeline extending for a length of approximately 3.85 km from Goonbri Road to Rangari Road. A small area, of approximately 0.05 hectares (ha), will also be required for the new access road off Goonbri Road. For the purposes of this report Whitehaven have advised the potential area of direct impact due to the pipeline is 6 metres (m) along the length of the pipe, which equates to an area of approximately 2.3 ha. The total area of potential land disturbance including the pipeline and new access road would be 2.35 ha, and is referred to hereafter as the Modification area.

At the time AMBS Ecology and Heritage (AMBS) undertook field surveys the exact location of the proposed pipeline and new access road were to be confirmed. Consequently, an area extending up to 50 m from the edge of the road was included in the study area near the proposed pipeline, to allow for some flexibility with regard to the future location of the pipe. Detailed photographs of the location of the new access road off Goonbri Road were provided by Whitehaven, to facilitate a desktop assessment and subsequent inclusion in this report.

1.3 Information sources

Information to inform the BDAR was gathered from a number of sources, including a database and literature review focused on flora and fauna in the study area and nearby surrounds. Sources of information were:

- a search of the Office of Environment and Heritage (OEH) BioNet database for records of threatened fauna and flora within the locality (OEH 2019a);
- review of the scoping survey report within the study area (AMBS 2018);
- other previous reports regarding flora and fauna surveys undertaken within the study area or nearby surrounds (e.g. AMBS flora and fauna monitoring);
- an examination of aerial photographs of the study area and surrounds; and
- a review of *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44) and the Recovery Plan for the Koala (Department of Environment and Climate Change [DECC] 2008).

2 Landscape context

In accordance with the Biodiversity Assessment Method (BAM) (OEH 2017), a range of landscape features must be identified, where they occur on the Modification area or within the study area surrounding the Modification area. These features may contain biodiversity values that are important for the site context of the Modification area, or for informing the likely habitat suitability of the Modification area.

Details on relevant features within the Modification area and surrounds are provided in the following sections.

2.1 IBRA bioregions/subregions & NSW landscape regions

The Modification area is located within the:

- Brigalow Belt South Interim Biogeographic Regionalisation of Australia (IBRA) Region;
- Liverpool Plains IBRA subregion; and
- Liverpool Alluvial Plains landscape (Mitchell Landscapes).

These layers are shown on Figure 2.1, and relevant information was entered into the BAM calculator.

2.2 Vegetation extent in site and assessment area (native and non-native)

In accordance with the BAM (OEH 2017), the assessment was undertaken as a “linear development”, since the majority of the Modification is narrow in width and extends across the landscape for a distance greater than 3.5 km in length.

The percentage of native vegetation cover within a 1,500 m assessment circle surrounding the Modification area is required to be calculated for site context. The extent of native vegetation was initially investigated using OEH Regional Vegetation Mapping (OEH 2008), which showed some locations mapped as native vegetation. A number of other areas classed by OEH (2008) as “undefined”, required further investigations during field surveys or analysis of aerial imagery. The Regional Vegetation Mapping layer was edited as required, including refining vegetation boundaries to match the latest aerial imagery. The 1,500 m assessment circle occupied an area of approximately 2,243 ha. Of this, approximately 380 ha was estimated to comprise native vegetation, the rest was identified as cleared or exotic dominated land. This equates to a native vegetation cover of 16.9%, which falls in the >10-30% vegetation extent class.

2.3 Connectivity

Connectivity features within the Modification area and assessment circle are mostly limited to roadside and riparian vegetation. However, these habitat areas may facilitate the movement of native fauna species, including threatened species, across their range or during dispersal. Potential connectivity features include (Figure 2.1):

- vegetation along Gins Gully and Bollol Creek;
- roadside vegetation along Goonbri Road and Rangari Road; and
- roadside vegetation adjacent to the hauling road linking Goonbri and Rangari Road.

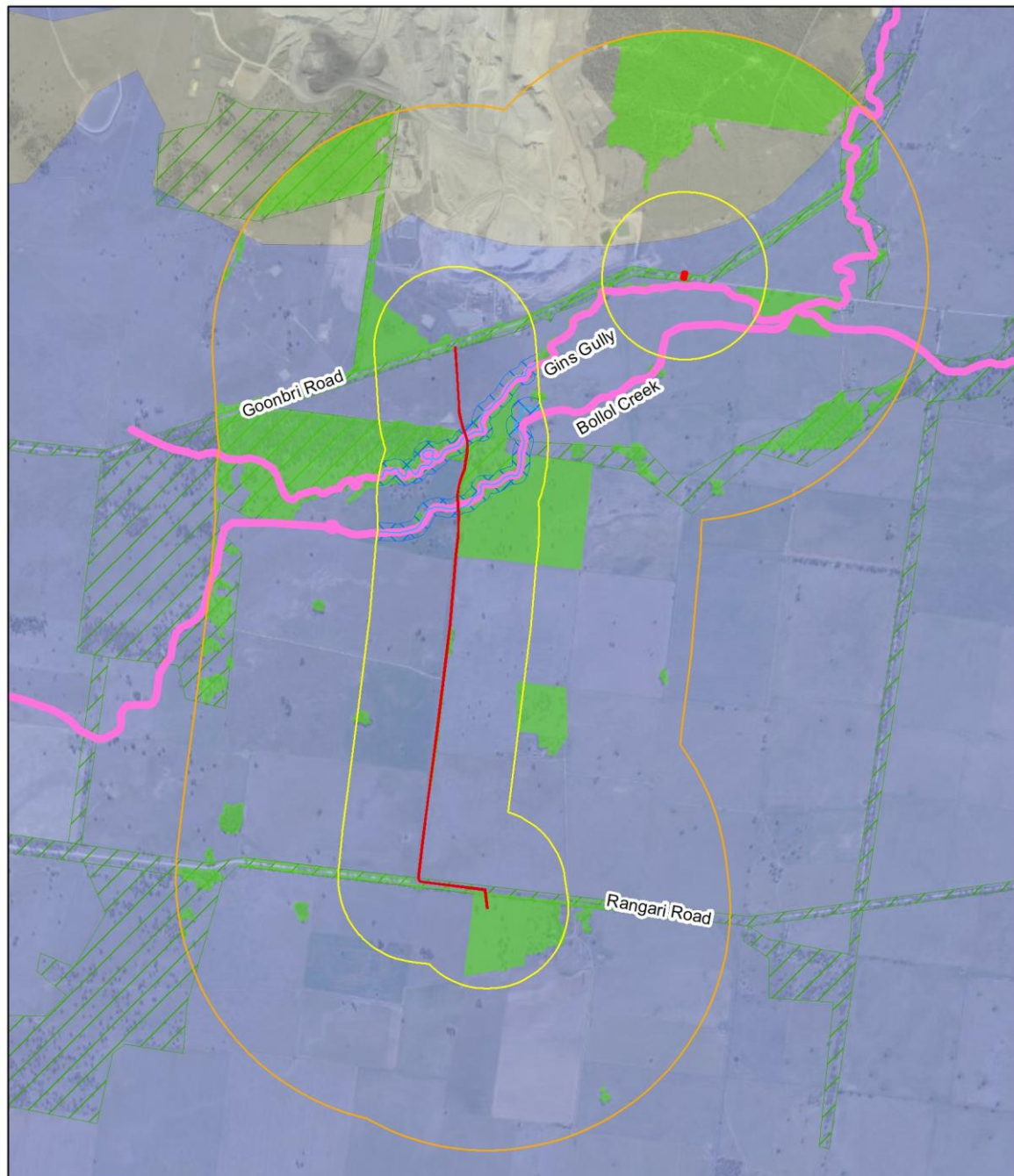
The riparian vegetation along Gins Gully and Bollol Creek provide some connectivity with the roadside vegetation along Goonbri Road. While not extensive, there is vegetation along Goonbri Road which may provide some connectivity with the Leard State Forest (Figure 2.1). Similarly, the vegetation along Rangari Road may provide connectivity with habitat areas to the south-west, and eventually linking with the Namoi River (Figure 2.1).

2.4 Other features (streams, geological soil hazard features)

Two drainage lines that occur in both the Modification area and assessment circle are mapped: Gins Gully and Bollol Creek (Figure 2.1). Both watercourses were predominantly dry during field surveys and do not hold permanent water. Gins Gully is classed as a sixth order stream and flows west. Bollol Creek is a sixth order stream which appears to flow west into Barbers Lagoon, which eventually feeds into the Namoi River. Both Gins Gully and Bollol Creek are also identified as areas of Biodiversity Value (Figure 2.1).

A third unnamed drainage line was identified on the *Water Management (General) Regulation 2018* hydroline (spatial data 1.0). The drainage line extended south of Bollol Creek and north of Rangari Road. It appears to be historic, with field surveys unable to identify the edges or bed of the creek, and from aerial imagery, the land surrounding the drainage line has been cultivated with no distinct watercourse observed. It is likely the drainage line no longer exists and therefore it was not included on Figure 2.1. Riparian buffers have been calculated in accordance with the BAM (OEH 2017) and are shown on Figure 2.1.

Important and/or local wetland, karsts, caves, crevices, cliffs and areas of geological significance, or areas of outstanding biodiversity value that have been identified under the *Biodiversity Conservation Act 2016* (BC Act), do not occur in the assessment circle.



Legend

- Modification Area
- Buffer Area -500m
- Buffer Area -1500m

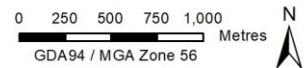
LGA: Narrabri
 Suburb: Boggabri
 IBRA: Brigalow Belt South - Liverpool Plains
 There are no wetlands, areas of geological significance, soil hazard features or any other landscape features within or near the subject land.

Landscape Features

- Watercourse (AMBS adjusted based on Aerial Imagery)
- Riparian Buffer (AMBS adjusted)
- Biodiversity Values Map Layer (OEH)
- Native Vegetation (AMBS)
- Habitat Connectivity (AMBS)

Mitchell Landscapes

- Liverpool Alluvial Plains
- Bugaldie Uplands



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 Division of Resources & Energy



Figure 2.1 Location map

3 Native vegetation

Determination of native vegetation present in the Modification area was based on the topography, soils and data collected from field surveys (Rapid Assessment Plots and subsequent BAM plots). The total area of vegetation within the subject land is small and therefore only a small number of BAM plots (six in total) were required across the designated vegetation zones in accordance with the BAM (OEH 2017). Analyses of quantitative data is recommended in the BAM (OEH 2017) to assist in determining PCT's. Data from six, poor condition BAM plots is not sufficient for a full floristic data analysis and if added to a larger export of site data already held in the NSW Vegetation Information System (VIS) the resulting analysis would be inconclusive in allocating potential PCT's. Determination of relevant PCT's in this assessment was therefore based on the expert opinion of the botanist who undertook the surveys.

3.1 Plant community types and threatened ecological communities

Two native PCTs were determined to occur in the Modification area:

- Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (PCT 101); and
- Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion (PCT 847).

Other vegetated areas within the Modification area were either degraded land dominated by exotic species or agricultural land. These areas did not conform to a native PCT. In addition, a small area of planted trees was recorded just outside the Modification area.

Descriptions of each PCT and other mapped areas are provided below, and their locations are mapped on Figures 3.1 and 3.2.

For the purposes of the BAM Calculator, PCT 847 was added from outside the IBRA subregion as it was considered the best matching PCT to the vegetation within the study area and is recorded as occurring nearby in the adjacent Nandewar IBRA subregion.

3.1.1 PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion

Vegetation formation: KF_CH11A Semi-arid Woodlands (Grassy sub-formation)

Vegetation Class: Brigalow Clay Plain Woodlands

Area within Modification Area: 0.17 ha

- Semi-cleared woodland (moderate condition) [101_Mod_SCW]: 0.08 ha
- Derived grassland (low condition) [101_Low_DNG]: 0.05 ha
- Mature trees over exotic dominated groundlayer (low condition) [101_Low_ExDG]: 0.04 ha

Likely Cleared Value: 75% (+/-60)

PCT 101 was recorded in the study area in three forms, a moderate condition semi cleared woodland (Plate 3.1), a low condition derived grassland (Plate 3.2), and a low condition form which consisted of mature trees over an exotic dominated groundlayer (Plate 3.3). The areas supporting this vegetation have been partially or totally cleared primarily for use as grazing lands. The canopy consisted of *Eucalyptus populneus* subsp. *populneus* (Poplar Box), *Eucalyptus pilligaensis* (Narrow-leaved Grey Box) and *Callitris glaucophylla* (White Cypress Pine). Few shrubs occur in the mid layer due to past grazing, while the ground layer consisted of native grass species such as *Enteropogon acicularis*, *Austrostipa scabra*, *Aristida ramosa*, *Digitaria parvifolia*, *Eragrostis brownii*, *Sporobolus*

crebra, and *Austrostipa verticillata*, as well as native forbs including *Brunoniella australis*, *Calotis lappulacea*, *Erodium crinitum*, *Dichondra Sp. A*, *Sida corrugata*, *Carex inversa*, *Cheilanthes sieberi*, *Oxalis perennans* and *Glycine tabacina*. Weed species were low in number within the semi-cleared woodland and derived grassland, most likely due to the previous low rainfall, but *Lycium ferocissimum* (Boxthorn) was present under the tree canopies.

In some locations a few remnant trees typical of this PCT are still extant, however the ground layer has been extensively disturbed and is dominated by exotic species.

While moderate to low in condition, the semi-cleared woodland and derived grassland areas of PCT 101 are likely to form part of the following Threatened Ecological Communities (TEC):

- BC Act: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions (Endangered Ecological Community [EEC]).
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): Poplar Box Grassy Woodland on Alluvial Plains (EEC).

The area, consisting of mature trees over an exotic dominated ground layer, does not conform to either of the above TECs given the high level of exotic species.



Plate 3.1 View of PCT 101 – Semi Cleared Woodland



Plate 3.2 View of PCT 101 - Derived Grassland



Plate 3.3 View of PCT 101 – Mature trees over exotic dominated groundlayer

3.1.2 PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion

Vegetation Formation: KF_CH3 Grassy Woodlands
Vegetation Class: Western Slopes Grassy Woodlands
Area within Modification Area: 0.08 ha
Likely Cleared Value: 92% (accuracy not assessed)
BAM Calculator Vegetation Zone Code: 847_Low_SCW

PCT 847 was recorded in the Study Area as low condition semi cleared woodland (Plate 3.4). The areas supporting this vegetation are located in roadside corridors or on the edges of cultivated fields. The canopy consisted of *Eucalyptus melliodora* (Yellow Box), *Eucalyptus albens* (White Box), *Callitris glaucophylla* (White Cypress Pine) and in one location planted *Eucalyptus blakelyi* (Blakely's Red Gum). A few native shrubs occur in the mid layer including *Acacia decora* and *Notelaea microcarpa* var. *microcarpa*. The ground layer consisted of native grass species such as *Enteropogon acicularis*, *Austrostipa scabra*, *Aristida ramosa*, *Sporobolus crebra*, *Austrostipa verticillata*, and native forbs such as *Brunoniella australis*, *Erodium crinitum*, *Dichondra Sp. A*, *Sida corrugata*, *Carex inversa*, and *Glycine tabacina*. Weed species were low in number most likely due to the previous low rainfall, although *Lycium ferocissimum* (Boxthorn) was present under the tree canopies.

Areas of PCT 847 within the Modification area do not form part of a TEC because the groundlayer is dominated by exotic species. One small area mapped as PCT 847, located in the larger study area but outside the Modification area, is adjacent to Goonbri Road and part of a larger road corridor. The vegetation in this corridor conforms to the following PCTs:

- BC Act: White Box Yellow Box Blakely's Red Gum Woodland (EEC).
- EPBC Act: White Box Yellow Box Blakely's Red Gum Woodland (CEEC).



Plate 3.4 View of PCT 847 adjacent to cultivated paddock

3.1.3 Agricultural Land

Vegetation Formation: N/A

Vegetation Class: N/A

Area: 0.07 ha

Likely Cleared Value: N/A

This map unit consists of paddocks that have been cultivated for crop production. In some locations cropping is currently being undertaken while in others recent cropping has not occurred (Plate 3.5).



Plate 3.5 Agricultural land not currently being cultivated

3.1.4 Degraded land primarily exotic species

Vegetation Formation: N/A

Vegetation Class: N/A

Area: 1.90 ha

Likely Cleared Value: N/A

This map unit consists of land that has been cleared of native vegetation, is highly disturbed and primarily supports exotic species. It is located adjacent to the ephemeral creek line (Plate 3.6) and on the road verges of Rangari Road, and includes the location of the new access road off Goonbri Road (Plate 3.7).



Plate 3.6 Ephemeral creekline



Plate 3.7 Degraded land dominated by exotic species in the location of the new access road

3.1.5 Planted Native Trees

Vegetation Formation: N/A

Vegetation Class: N/A

Area: 0.0 ha

Likely Cleared Value: N/A

A strip of land at the southern end and adjacent to the haul road has been replanted with native trees (Plate 3.8). The trees occur outside the Modification area but within the larger study area. Tree species include *Eucalyptus melliodora*, *Eucalyptus blakelyi*, *Casuarina cristata*, *Eucalyptus melanophloia* and *Acacia baileyana*. This small area of trees was planted over agricultural land. While a few of the species planted can be associated with a number of PCTs the narrow strip contains very few native species in the mid-layer and ground layer. As such, assigning a PCT to this area is not possible and would not be appropriate.



Plate 3.8 Planted native trees



Legend

BAM

- Included in BAM
 - Not included in BAM
 - Threatened Ecological
 - Modification
- SCW = Semi-cleared Woodland
DNG = Derived Native Grassland

Service Layer Credits: Division of Resources & Energy
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
GIS User Community

Plant Community

- PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion SCW
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion SCW
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion DNG
- Degraded land primarily exotic
- Agricultural

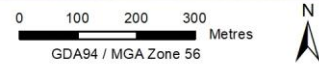


Figure 3.1 Plant Community Types (Study Area North)



Legend

BAM Plot

- Included in BAM Calculator
- Threatened Ecological Community
- Modification Area

SCW = Semi-cleared Woodland
 ExDG = Exotic Dominated Groundlayer
 DNG = Derived Native Grassland

Service Layer Credits: Division of Resources & Energy
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
 CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
 GIS User Community

Plant Community Type

- PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion SCW
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion SCW
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion DNG
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion ExDG
- Planted native trees
- Degraded land primarily exotic species
- Agricultural land

0 100 200 300 400
 Metres
 GDA94 / MGA Zone 56



Figure 3.2 Plant Community Types (Study Area South)

3.2 Vegetation integrity assessment

3.2.1 Vegetation zones

Belinda Pellow (BAAS18082) undertook a preliminary field assessment of the study area in October 2018 and prepared a draft PCT map (AMBS 2018). Because the exact location of the Modification area was to be confirmed at the time of the surveys, the PCT mapping covered a larger area to account for variation in the final location of the pipeline. Further, the potential area of direct impact was not known, so the number of BAM plots allocated was based on the PCT areas for the larger original study area.

The Modification area was divided into four vegetation zones. Vegetation zones are areas of native vegetation on the subject site that are the same PCT and have a similar broad condition state e.g. the zone has similar tree, shrub, ground cover, structure and weed extent. One vegetation zone comprised of PCT 847, a semi-cleared woodland in low condition. The remaining three vegetation zones included PCT 101 in different condition states; an area of semi-cleared woodland in moderate condition, an area of derived grassland in low condition, and an area contained mature trees over exotic dominated groundlayer which was also in low condition (Section 3.1). The vegetation zones, their area and required number of survey plots is shown in Table 3.1.

The remainder of the Modification area was mapped as degraded land with primarily exotic species, agricultural land or highly modified land. These areas are not considered to represent a native PCT and therefore do not require vegetation integrity survey plots to be undertaken.

Table 3.1 Vegetation zones, their area and required number of plots.

Vegetation Zone	Area (ha)	Required No. BAM Plots	No. BAM Plots undertaken
PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion (Semi-cleared Woodland) – low condition	0.08	1	1
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Semi-cleared Woodland) – moderate condition	0.08	1	3
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Derived Native Grassland) – low condition	0.05	1	1
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Mature trees over exotic dominated groundlayer) – low condition	0.04	1	1
Degraded Lands			
Degraded land primarily exotic species	1.90	0	0
Agricultural land	0.07	0	0
Highly modified land	0.13	0	0
TOTAL	2.35	4	6

3.2.2 Vegetation integrity survey plots

Vegetation integrity plots were surveyed in January 2019 by James Schlunke (BAAS18148) and David James. Of the six plots that were surveyed, two of these (BAM plots 1 & 2) were used to determine PCT and vegetation zones, but were not required in the BAM Calculator assessment for the final Modification area. Four vegetation integrity plots were required across four vegetation zones as outlined in Table 3.1 (Figure 3.1 and 3.2). A total of 61 native species and 40 exotic species were recorded (Appendix B). Four of the exotic species recorded were classified as High Threat Exotics according to a list of such species provided in the BAM.

3.2.3 Current and future vegetation integrity scores

Location information and BAM plot data from each of the BAM plots undertaken are provided in Table 3.2. Following entry into the BAM calculator the current and future vegetation integrity scores were calculated, which are also shown in Table 3.2. The future vegetation integrity score of zero assumes the potential for all vegetation within the Modification to be impacted.

Table 3.2 BAM plot data

BAM Attribute		BAM 1	BAM 2	BAM 3	BAM 4	BAM 5	BAM 6
PCT Details	Number	101	101	101	101	847	101
	Area (ha)	-	-	0.08	0.05	0.08	0.04
Vegetation Zone	BAM Code	-	-	Mod_SCW	Low_DNG	Low_SCW	Low_ExDG
Location	Easting	228533	228526	228512	228503	228463	228425
	Northing	6604797	6604691	6604594	6604337	6603833	6603610
	Bearing	14	9	9	5	4	13
	Patch Size	-	-	>100	0	<5	<5
Count of Native Richness (Composition)	Trees	0	1	1	0	2	3
	Shrubs	3	2	5	1	0	2
	Grasses etc	8	9	13	6	6	3
	Forbs	9	14	21	11	8	8
	Ferns	0	0	1	0	0	0
	Other	0	2	2	0	1	1
Sum of Cover of Native Vascular Plants (Structure)	Trees	0	8	15	0	8.1	20.4
	Shrubs	0.4	0.4	0.9	0.1	0	0.5
	Grasses etc	4	5.1	11.3	2.3	3.8	22.2
	Forbs	1.4	2.6	3	1.4	1.1	1.4
	Ferns	0	0	0.1	0	0	0
	Other	0	0.2	0.3	0	0.1	0.1
Stem size class (Function)	<5 regen	0	0	0	0	0	1
	5 to 9	0	0	0	0	0	0
	10 to 19	1	0	0	0	0	0
	20 to 29	0	0	0	0	0	0
	30 to 49	-	-	-	-	0	-
	50 to 79	-	-	-	-	-	-
Count large & hollow trees (Function)	Large trees	0	2	6	0	2	1
	Hollow trees	0	1	1	0	2	1
Ground habitat (Function)	Logs length	0	8.5	19	0	21	13
	Litter cover	99.0	99.0	98.8	94.8	99.4	85.0
	High threat weed cover	0.2	2	0.7	1	1.1	5.2
Current Vegetation Integrity Score		-	-	59.2	13.4	39.1	48.8
Future Vegetation Integrity Score		-	-	0	0	0	0

Note: In accordance with the BAM (OEH 2017), the presence or absence of each tree stem size class was recorded from five centimetres (cm) DBH to the large tree threshold size. The number of large trees was assessed by counting all living stems with a DBH equal to or greater than the large tree threshold DBH for the PCT or vegetation class. In Table 3.2, a dash (-) indicates that stem size class is not relevant for the PCT (i.e. the large tree threshold size is 30cm for PCT 101, and 50cm for PCT 847).

3.2.4 Patch size

Within the BAM method (OEH 2017), patch size is defined as “an area of intact native vegetation that:

- a) occurs on the development site or biodiversity stewardship site, and
- b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or $\leq 30\text{m}$ for non-woody ecosystems).

Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site.”

One vegetation zone within the Modification area contained intact native vegetation in moderate to good condition. Nearby areas of native vegetation in moderate condition within 100 m of the vegetation zone occurred to the east, west and north (Figures 3.1 and 3.2). These locations occupy an area of approximately 156 ha, and the patch size was therefore classified as >100 ha.

Other woodland vegetation zones within the study were classified as containing intact vegetation in low condition, and were generally surrounded by vegetation in low condition. Consequently, the patch size for these areas was limited to the vegetation zone itself, and were therefore classified as <5 ha.

The area of derived grassland was not considered intact native vegetation in accordance with the definition outlined in the BAM (OEH 2017).

4 Threatened species

4.1 Identify threatened species for assessment

The suitability of the habitat within the study area for threatened species is determined by a number of criteria:

- is the threatened species known or predicted to occur within the IBRA subregion;
- is the Modification area within any geographic constraints of the distribution of the species within the IBRA subregion;
- is the species associated with any of the PCTs identified as occurring within the Modification area;
- is the native vegetation cover within an assessment area 1,500 m wide surrounding the boundary of the subject equal to or greater than the minimum class that is required for the species;
- is the patch size which the vegetation zone is part of equal to or greater than the minimum specified for that species; and
- is the species identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

Consideration of these factors is undertaken within the BAM Calculator, and ultimately determines which threatened species require assessment for the Modification. If any one of the criteria relevant to the species outlined above are not met, the Modification area is considered not suitable habitat for the threatened species and no further assessment is required for that species.

The two types of threatened species that require assessment include, Ecosystem credit species which are discussed in Section 4.1.1, and Species credit species which are discussed in Section 4.1.2.

4.1.1 Ecosystem credit species

Ecosystem credit species are threatened species where the likelihood of occurrence or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Targeted survey is not required for these species.

In accordance with Step 1 and Step 2 in Section 6.4 of the BAM (OEH 2017), ecosystem credit species predicted to occur within the Modification area are provided in Table 4.1. For the purposes of the BAM calculation, two species were removed from further assessment due to habitat constraints identified in the threatened species data collection:

- the White-bellied Sea-eagle was removed as the study area is not within 1 km of any rivers, lakes, large dams or creeks, wetlands or coastlines; and
- the Painted Honeyeater was removed as mistletoes were not present at a density of greater than five mistletoes per hectare.

In addition, derived grassland areas were removed as potential habitat for the Regent Honeyeater, Dusky Woodswallow, Brown Treecreeper, Varied Sittella, Little Lorikeet, Square-tailed Kite and the Koala.

Table 4.1 Ecosystem credit species predicted to occur in the Modification area.

Common Name	Scientific Name	BC Act	EPBC Act
Regent Honeyeater (Foraging)	<i>Anthochaera Phrygia</i>	CE	CE
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	V	-
Little Pied Bat	<i>Chalinolobus picatus</i>	V	-
Speckled Warbler	<i>Chthonicola sagittate</i>	V	-
Spotted Harrier	<i>Circus assimilis</i>	V	-
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	-
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	E
Grey Falcon	<i>Falco hypoleucos</i>	E	-
Little Lorikeet	<i>Glossopsitta pusilla</i>	V	-
Painted Honeyeater	<i>Grantiella picta</i>	V	V
White-bellied Sea-Eagle (Foraging)	<i>Haliaeetus leucogaster</i>	V	-
Black-breasted Buzzard (Foraging)	<i>Hamirostra melanosternon</i>	V	-
Little Eagle	<i>Hieraetus morphnoides</i>	V	-
Swift Parrot (Foraging)	<i>Lathamus discolour</i>	E	CE
Square-tailed Kite (Foraging)	<i>Lophoictinia isura</i>	V	-
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	V	-
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	V	-
Turquoise Parrot	<i>Neophema pulchella</i>	V	-
Barking Owl (Foraging)	<i>Ninox connivens</i>	V	-
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	V	V
Scarlet Robin	<i>Petroica boodang</i>	V	-
Flame Robin	<i>Petroica phoenicea</i>	V	-
Koala (Foraging)	<i>Phascolarctos cinereus</i>	V	V
Superb Parrot (Foraging)	<i>Polytelis swainsonii</i>	V	V
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V	-
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V	-
Diamond Firetail	<i>Stagonopleura guttata</i>	V	-
Masked Owl (Foraging)	<i>Tyto novaehollandiae</i>	V	-

Note: BC Act = Biodiversity Conservation Act 2016; EPBC Act = Environment Protection and Biodiversity Conservation Act 1999; V = vulnerable; E = endangered; CE = critically endangered.

4.1.2 Species credit species

Species credit species are threatened species where the likelihood of occurrence or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey. Targeted survey or an expert report is required to confirm presence/absence of these species on the Modification area.

Some species have been classed as dual credit species, which requires assessment for ecosystem credits and species credits. This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat), while the remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat).

In accordance with Section 6.4 of the BAM (OEH 2017), the habitat constraints for each species were investigated. Where suitable habitat for a particular species did not occur within the Modification area it was removed as a candidate species. A summary of the species credit species and if they were included as a candidate species for the BAM calculator are provided in Table 4.2.

Table 4.2 Species credit species predicted to occur in the Modification area.

Common Name	Scientific Name	BC Act	EPBC Act	BRR	Habitat constraint	Candidate species?
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	CE	3.00	Mapped important habitat areas	No - study area is outside areas of mapped important habitat.
Bush Stone-curlew	<i>Burhinus grallarius</i>	V	-	2.00	Fallen/standing dead timber including logs	Yes
Eastern Pygmy Possum	<i>Cercartetus nanus</i>	V	-	2.00	-	Yes
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V	3.00	Cliffs; or within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 km of old mines or tunnels.	Yes – while habitat features are unlikely to occur, the species was conservatively included based on small potential for tunnels/culverts to occur outside the study area.
Cyperus conicus	<i>Cyperus conicus</i>	E	-	2.00	Waterbodies; Wetlands and wet run on areas	Yes
Bluegrass	<i>Dichanthium setosum</i>	V	V	2.00	-	Yes
Finger Panic Grass	<i>Digitaria porrecta</i>	E	-	2.00	-	Yes
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	V	-	2.00	Living or dead mature trees within suitable vegetation within 1 km of any rivers, lakes, large dams or creeks, wetlands and coastlines.	No - study area is not within 1 km of any rivers, lakes, large dams or creeks, wetlands and coastlines. No evidence of raptor nests within the Modification area. Removed as candidate species.
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	V	-	1.50	Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts.	No – study area is not within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts. No evidence of raptor nests within the Modification area. Removed as candidate species.
Little Eagle	<i>Hieraetus morphnoides</i>	V	-	1.50	Nest trees - live (occasionally dead) large	No - no evidence of raptor nests within the Modification area. Removed as candidate species.

Common Name	Scientific Name	BC Act	EPBC Act	BRR	Habitat constraint	Candidate species?
					old trees within vegetation.	
Swift Parrot	<i>Lathamus discolor</i>	E	CE	3.00	Mapped important habitat areas	No - study area is outside areas of mapped important habitat.
Square-tailed Kite	<i>Lophoictinia isura</i>	V	-	1.50	-	Yes
Barking Owl	<i>Ninox connivens</i>	V	-	2.00	Living or dead trees with hollows greater than 20 centimetres (cm) diameter and greater than 4 m above the ground.	No – no trees with hollow greater than 20 cm and greater than 4 m above the ground. Removed as candidate species.
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	-	2.00	-	Yes
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	V	-	2.00	-	Yes
Koala	<i>Phascolarctos cinereus</i>	V	V	2.00	-	Yes
Native Milkwort	<i>Polygala linariifolia</i>	E	-	2.00	-	Yes
Superb Parrot	<i>Polytelis swainsonii</i>			2.00	Living or dead <i>E. blakelyi</i> , <i>E. melliodora</i> , <i>E. albens</i> , <i>E. camaldulensis</i> , <i>E. microcarpa</i> , <i>E. polyanthemus</i> , <i>E. mannifera</i> , <i>E. intertexta</i> with hollows greater than 5 cm diameter; greater than 4 m above the ground or trees with a DBH of greater than 30 cm.	No - species credit component is for breeding. Superb Parrots' core breeding area is well-known, and roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (OEH 2019b). The Modification area occurs well outside the breeding area. Any individuals that occasionally visited the Modification area would be foraging vagrants. Removed as candidate species.
Slender Darling Pea	<i>Swainsona murrayana</i>	V	V	2.00	-	Yes
Austral Toadflax	<i>Thesium australe</i>	V	V	1.50	-	Yes
Masked Owl	<i>Tyto novaehollandiae</i>	V	-	2.00	Living or dead trees with hollows greater than 20 cm diameter.	No – no trees with hollows greater than 20 cm diameter. Removed as candidate species.
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V	-	3.00	Caves; within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2 km of old mines, tunnels, old buildings or sheds.	Yes – while habitat features are unlikely to occur, the species was conservatively included based on small potential for tunnels/culverts, old buildings or sheds to occur outside the study area.

Note: BC Act = Biodiversity Conservation Act 2016; EPBC Act = Environment Protection and Biodiversity Conservation Act 1999; V = vulnerable; E = endangered; CE = critically endangered, BRR = Biodiversity Risk Rating.

A search of the *BioNet Atlas of NSW Wildlife* (OEH 2019a) identified a number of threatened species that have been recorded within 10 km of the Modification area (Appendix D). None have been recorded within the Modification area or nearby surrounds, and for the majority, suitable habitat is limited. Consequently, no additional species credits species were included in the BAM calculator.

4.2 Determine presence or absence of a candidate species credit species

4.2.1 Targeted field surveys – flora

Based on the PCTs identified in the subject site and the BioNet database, a total of seven threatened “species credit” plant species have potential to occur in the study area (Appendix A). A series of parallel traverses as per the NSW *Guide to Surveying Threatened Plants* (OEH 2016) were surveyed in suitable habitat to search for threatened species. As outlined in the NSW *Guide to Surveying Threatened Plants* (OEH 2016) the distance between transects is dependent on the life form of the targeted species. Table 4.3 outlines the maximum distance between parallel traverses that was implemented during the surveys.

Recommended survey times for the seven species are provided in Appendix A. For any threatened flora species found, the following was recorded:

- extent of each occurrence;
- population counts or population estimates; and
- detailed habitat description and condition.

Table 4.3 Maximum distances between parallel field traverses

Life form	Maximum distance between parallel field traverses (separation width) (metres) in open vegetation
Trees	
Mallee trees	40
Tall shrubs >6 m	
Medium shrubs 1 to 6 m	20
Cycads and large ferns	
Sub-shrubs (including Chenopods) (<1m)	15
Herbs and forbs	10
Ferns (<1 m)	
Grasses/sedges/rushes and other graminoids	10
Orchids	
Epiphytes and climbers	

Source: OEH (2016)

Threatened plant searches were undertaken between 21 and 26 January 2019 by James Schlunke. No threatened plants listed under the BC Act and/or the EPBC Act were located within the study area.

One species *Swainsona murrayana* (Slender Darling Pea) can only be surveyed for in the month of September so was not targeted during surveys undertaken in January 2019. The Modification area is unlikely to provide habitat for this species due to the highly disturbed nature of the groundlayer. Regardless, under the precautionary principle, *Swainsona murrayana* was assumed to be present for the purposes of the BAM calculator.

4.2.2 Targeted field surveys – fauna

Targeted fauna surveys were undertaken between 21 and 26 January 2019 by David James. A summary of the survey techniques and effort undertaken is provided below, and the survey locations are shown on Figure 4.1. Survey site coordinates are provided in Appendix E. In addition to the targeted survey techniques outlined below, opportunistic observations of fauna were recorded while undertaking all survey work, including for example while setting-up/moving traps, and when undertaking floristic surveys.

Harp Traps

Four harp traps were deployed for four nights (i.e. sixteen harp trap nights total). Traps were checked each morning within three hours of dawn. Any captured microbats were placed in a calico bag, identified, and released in the trap location at dusk the same day. All traps were moved to a different location daily.

Ultrasonic Call Recording (Anabat)

Four Anabat Express were deployed for four nights (i.e. 16 Anabat nights). The units were set to the automatic 'night only' recording mode.

Camera Traps

Four remote cameras (Scout Guard) were deployed and left in-situ for a minimum of 14 days and nights. Two cameras were placed on the ground and two were placed approximately 3 m high in a tree. For all cameras, a bait chamber containing universal bait was placed approximately 2-3 m from the camera. Cameras were programmed to record three images each time they were triggered.

Reptile Search

Active searches of potential reptile habitats were undertaken twice on different days. Searches were undertaken between 10.00 am and 1.00 pm hours wherever possible for 30 person-minutes.

Call-Playback

Call-playback was undertaken from one location on three nights targeting the Bush Stone-curlew. During each survey two 5-minute periods of call-broadcast for the Bush Stone-curlew were each followed by a 5-minute listening period. Spotlighting of the surrounds was performed at the conclusion of the call-playback survey.

Spotlighting

Spotlighting was undertaken on two nights for approximately 60 person-minutes (i.e. 120 person-minutes total).

Bird Survey

Diurnal bird surveys were undertaken in two locations, on two separate mornings within three hours of dawn. Each survey was undertaken for a minimum of 20 minutes, with the surveyor identifying all birds observed or heard within and outside of a two-hectare area.

Pitfall traps

Six pitfall traps were deployed for four nights (i.e. 24 pitfall trap nights total). Traps were checked each morning within three hours of dawn. Due to the linear shape of the study area two lines with three pitfall traps in each were installed. Each pit was a 20-litre bucket spaced approximately 5 m apart, with a drift fence. A sheet of styrofoam was provided as cover for any trapped animals. Coopex was used as required to prevent ants.

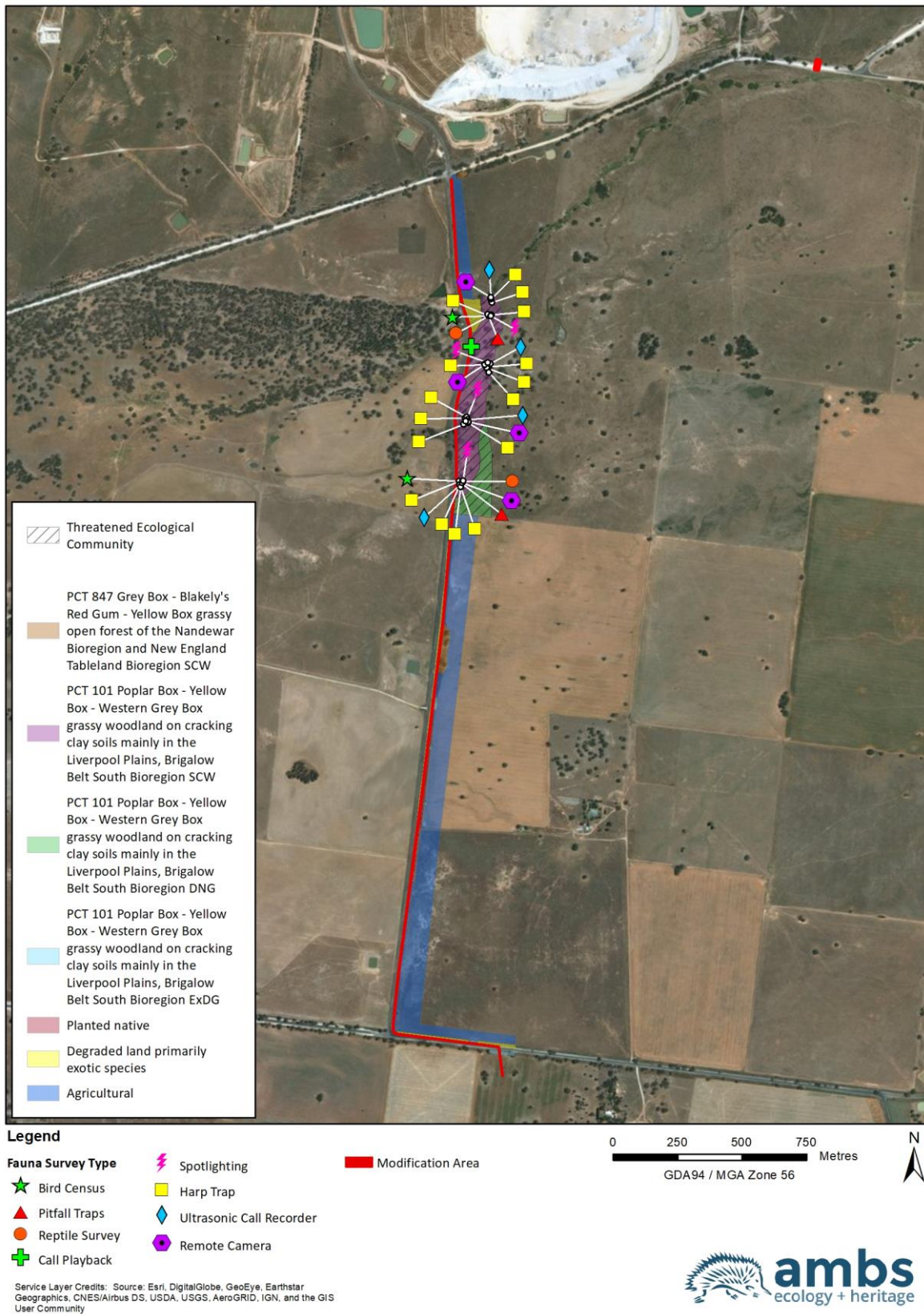


Figure 4.1 Location of fauna survey sites

4.2.3 Climate conditions

Climate data for the region during the survey period, including the period in which remote cameras were deployed, are provided in Table 4.4. The data were sourced from two weather stations located within 50 km of the Modification areas; the Boggabri (Retreat) and Gunnedah Airport Automatic Weather Station (AWS). These weather stations were selected on the basis of their geographic position relative to the Modification area and the availability of comparable data (closer weather stations may occur, but do not provide all of the climate data). Weather station data were sourced from the Bureau of Meteorology (BOM 2019).

Weather conditions within the study area during the survey period were generally hot during the day and mild at night. Temperatures above 40°C were recorded on two days. Conditions were mostly dry throughout the survey period.

Table 4.4 Climate data during the survey period

Date	Gunnedah Airport AWS		Boggabri (Retreat)
	Temp max (°C)	Temp min (°C)	Rainfall (millimetres [mm])
21/01/2019	34.8	23.1	0.2
22/01/2019	38.3	21.6	2.0
23/01/2019	35.8	21.3	0.8
24/01/2019	38.6	22.0	0.0
25/01/2019	40.1	22.0	0.0
26/01/2019	41.1	23.4	0.0
27/01/2019	39.7	25.5	0.0
28/01/2019	39.9	25.8	0.0
29/01/2019	37.7	22.6	0.0
30/01/2019	36.5	26.4	0.0
31/01/2019	34.3	23.9	0.0
1/02/2019	34.7	22.4	0.0
2/02/2019	38.0	21.1	0.0
3/02/2019	37.2	20.8	0.0
4/02/2019	37.8	20.0	0.0
5/02/2019	38.4	24.4	0.0
6/02/2019	34.9	19.9	0.0
7/02/2019	35.6	20.9	0.0
8/02/2019	36.8	20.6	0.0
9/02/2019	36.3	20.1	0.0

No species credit species were recorded during the surveys. As such, no species polygons have been produced as part of this report. Other threatened or migratory fauna species recorded within the larger study area are summarised in Table 4.5, with their locations shown on Figure 4.2. A full list of species recorded during the surveys is provided in Appendix C.

Table 4.5 Threatened and/or migratory fauna recorded during the surveys

Class	Scientific name	Common Name	BC Act	EPBC Act
Birds	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	-
	<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M
	<i>Apus pacificus</i>	Fork-tailed Swift	-	M
Mammals	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat	V	-

Note: The Dusky Woodswallow was also recorded approximately 3.9 km west of the study area during the survey period. The species is listed as vulnerable under the BC Act.

Fauna habitats within the study area were generally poor quality. No native understorey was present throughout the majority of the study area, except around the creeks. No large tree hollows or rocky outcrops were observed, and there were no mistletoe or fruit bearing trees. Some fallen logs were present as were a couple of stags. No evidence of raptor nests was observed. The creek was likely ephemeral and no dams were present.

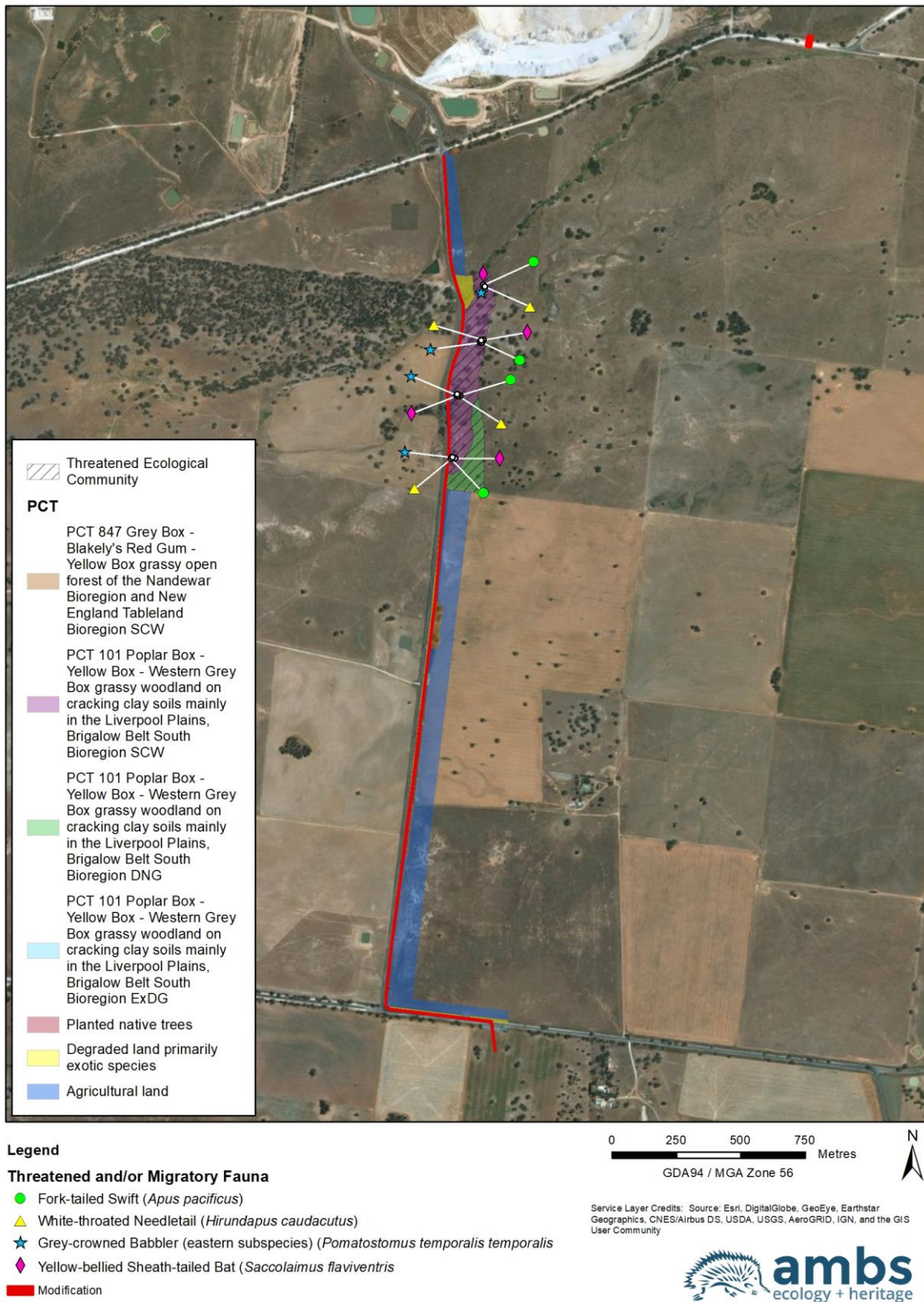


Figure 4.2 Threatened fauna recorded in the study area

5 Avoiding and minimising impacts on biodiversity values

5.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

A total of 2.35 ha of land may be disturbed within the Modification area, of which approximately 0.25 ha is comprised of native PCTs. Approximately 1.97 ha are classified as exotic dominated grassland or agricultural land, and the remaining 0.13 ha includes highly modified land (e.g. gravel road edge).

The likely impacts of the Modification have been reduced through early planning and avoiding areas of native PCT and fauna habitat where possible. A preliminary assessment was commissioned by Whitehaven (AMBS 2018) to survey a larger study area of up to approximately 50 m from the edge of the road, as this area was being considered as the location of the pipeline. The field surveys identified areas of native PCT and fauna habitat to the east of the road reserve, including a number of large potential hollow-bearing trees. Further, the density of trees is greater to the east of the road reserve.

The preliminary report recommended that the pipeline be located within the road reserve, on the western side of the road reserve fence. Locating the pipeline in this area would minimise the area of native PCT that would be impacted, maximise the use of areas of exotic or poor condition habitats, and minimise the number of trees that would be removed.

5.2 Avoiding and minimising prescribed biodiversity impacts during project planning

As discussed in Section 2.4 there are no karsts, caves, crevices, cliffs, or significant rock outcrops in the study area. The Modification does not involve the use of wind turbines. Due to the small-scaled nature of the Modification, it is not expected to impact the hydrology of creeks or increase the likelihood of vehicle strikes.

There may be potential for prescribed impacts associated with connectivity, which have been minimised in the same way as discussed in Section 5.1 and are further described in Section 6.3.

6 Assessing and offsetting impacts

6.1 Assessment of direct impacts

6.1.1 *Loss of native vegetation and habitat, threatened ecological communities and threatened species habitat*

Direct impacts of the proposed works would include the removal of some native vegetation and fauna habitat within the Modification area, which constitutes a length of approximately 3.85 km, and a clearing corridor of up to 6 m wide, as well as a small area of the new access road. The total disturbance area for the Modification is estimated to be approximately 2.35 ha. Of this, 0.25 ha has been classified as a native PCT and provides habitat for native fauna, some of which are of conservation significance. Most areas of native vegetation within the Modification area are also classified as a TEC (approximately 0.13 ha). The approximate area of each PCT that would be removed is displayed in Table 6.1.

No threatened flora species were recorded in the study area and none are likely to be directly impacted by the proposed works.

Table 6.1 Approximate area of each plant community to be impacted by the Modification

PCT	Approximate area to be removed (ha)
PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion (Semi-cleared Woodland) – low condition	0.08
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Semi-cleared Woodland) – moderate condition (TEC)	0.08
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Derived Grassland) – low condition (TEC)	0.05
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Mature trees over exotic dominated groundlayer) – low condition	0.04
TOTAL	0.25

6.1.2 Loss of hollow-bearing trees

Hollows are used by a range of vertebrates and invertebrate species for different life cycle stages and are considered to be a limiting factor for population growth for a number of threatened species. Many species that rely on hollows are highly selective and only use hollows of a particular diameter, aspect and shape.

The clearance of fauna habitat for the Modification may result in the loss of hollow bearing trees. The majority of potential hollow-bearing trees within the study area were recorded outside the Modification area, on the eastern side of the road reserve fence. It is possible that no hollow-bearing trees will be impacted, depending on the specific installation location of the pipeline. Further, it can be difficult to accurately determine the actual number of hollow-bearing trees based on observations from the ground, and it is possible that some of the identified trees do not contain functional hollows.

Management and mitigation measures to minimise the impact of loss of hollow-bearing trees are presented in Section 6.4.

6.2 Assessment of indirect impacts

Indirect impacts are considered most likely during the construction phase. Potential indirect impacts to the native flora and fauna habitat within the study area include:

- increased sediment flowing into the creeks or TECs during construction;
- weed proliferation due to construction equipment with soil contaminated with weeds from other construction sites; and
- construction activity dispersing weed seed from the current small infestations.

In addition, the introduction of pathogens has potential to impact on biodiversity as a result of their movement and infection during construction projects. One soil-born fungus, *Phytophthora cinnamomic*, causes dieback by attacking the roots of a range of native plant species. It spreads through dispersal of spores which can be transported by vehicles (e.g. earth moving equipment) from contaminated areas to un-infected areas. The modification is not considered to result in an increased risk of pathogens relative to the current approved operations given the minor nature of works associated with the pipeline and new access road.

Mitigation and management recommendations to manage the risk of increased sedimentation, spread of weeds and spread of disease-causing pathogens are presented in Section 6.4.

The other potential indirect impacts identified in Section 9.1.4.2 of the BAM are not considered relevant to this Modification.

6.3 Assessing prescribed biodiversity impacts

The only potential prescribed impact requiring assessment is connectivity. The small corridor (6 m wide) that will be disturbed for the installation of the pipeline is unlikely to result in significant habitat fragmentation for fauna species. The pipeline will be less than 300 mm diameter and above ground for the majority of its length; a pipe of this size is unlikely to present a significant obstruction to the movement patterns of any of the threatened fauna species with potential to occur in the study area.

The pipeline is unlikely to prevent fauna moving along any watercourse within the Modification area. In locations where the pipeline crosses Goonbri and Rangari Road, it will be buried and won't create an obstruction for fauna moving through the small roadside corridors.

6.4 Mitigating and managing impacts on biodiversity values

Measures to mitigate impacts to biodiversity have been described in the existing Tarrawonga Coal Mine Biodiversity Management Plan (BMP) (EcoLogical 2015). Those relevant to this BDAR and the proposed Modification are listed below:

- integration with the nest box program;
- weed control measures including as a minimum control of Priority Weeds and High Threat Exotics (Appendix B) prior to construction works;
- revegetation of any impacted woodland areas by planting species characteristic of relevant PCT;
- hygiene protocols to minimise the risk of spreading plant diseases;
- erosion and sediment control measures;
- pre-clearance surveys undertaken prior to clearing activities by a suitably qualified ecologist, following the Land Disturbance Protocol;
- avoiding the removal of trees and shrubs wherever possible;
- two-staged clearing approach, with a suitably trained fauna ecologist present during the removal of any potential hollow-bearing trees, in accordance with the Tarrawonga Coal Mine BMP; and
- salvage of hollow-bearing trees, logs and woody ground debris for reuse in rehabilitation areas, where practicable, using the Stage 1 and 2 clearing protocol.

6.5 Adaptive management strategies for uncertain impacts

Regular review of the Tarrawonga Coal Mine BMP allows for adaptive management and ensures that it is consistent with management plans, environmental policies and objectives (Eco Logical 2015). Adaptive management strategies for uncertain impacts within the Modification area would conform to the requirements of the Tarrawonga Coal Mine BMP.

6.6 State Environmental Planning Policy No 44—Koala Habitat Protection

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

- (a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and
- (b) by encouraging the identification of areas of core koala habitat, and
- (c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

Under SEPP 44 there are two definitions that are important in determining the outcome of a development proposal:

1. *Potential koala habitat*: areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.
2. *Core koala habitat*: an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Based on the above definitions, the habitats within the Modification area are considered **potential koala habitat** based on the presence of White Box (*Eucalyptus albens*), a known koala feed tree. The land is not considered core koala habitat as it is unlikely for a resident population of koalas to occur. There was no evidence of breeding females, no recent sightings, and no evidence of the species were recorded during surveys.

6.7 Thresholds for the assessment and offsetting of impacts of development

6.7.1 Serious and irreversible impacts

No entities within the BAM Calculator are candidates for serious and irreversible impacts.

6.7.2 Impacts which require/do not require an offset

In accordance with Section 10.3 of the BAM (OEH 2017), offsets are required for all impacts of development on PCTs that are associated with:

- a vegetation zone that has a vegetation integrity score ≥ 15 where the PCT is representative of an EEC or CEEC, or
- a vegetation zone that has a vegetation integrity score of ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
- a vegetation zone that has a vegetation integrity score ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

Based on the information outlined above, a summary of entities occurring in the Modification area, and whether or not they require offsetting under the BAM (OEH 2017), are displayed in Table 6.2. Impacts associated with woodland areas of PCT 101 and PCT 847 require offsets. However, the derived grassland form of PCT 101 has a vegetation integrity score of less than 15, and consequently no offsets are required for this vegetation zone.

Table 6.2 PCTs which require offsets under the BAM

Vegetation Zone	PCT	TEC	Condition	Area (ha) ¹	Vegetation Integrity Score
Vegetation zones within the Modification area which require offsets					
101_Mod_SCW	101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Semi-cleared woodland)	Yes	Moderate	0.1	59.2
101_Low_ExDG	101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Mature trees over exotic dominated groundlayer)	No	Low	0.0	48.8
847_Low_SCW	847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion (semi-cleared woodland)	No	Low	0.1	39.1
Vegetation zones within the Modification area which don't require offsets					
101_Low_DNG	101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Derived Native Grassland)	Yes	Low	0.1	13.4

¹ Note: the areas (ha) are generated from the BAM Calculator, which rounds values to the nearest decimal point.

Impacts to *Swainsona murrayana* require offset under the BAM (OEH 2017) as the species has been assumed to be present (i.e. surveys could not be undertaken during the appropriate season). Potential habitat for the species occurs in vegetation zones 847_Low_SCW, 101_Mod_SCW and 101_Low_ExDG. Despite this, it is considered unlikely that the Modification would result in a significant impact to the species.

Potential species habitat polygons are shown in Figures 6.1 and 6.2.



Legend

Threatened Flora Habitat

 Slender Darling Pea (*Swainsona murrayana*) species polygon

 Modification Area

Service Layer Credits: Division of Resources & Energy
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
GIS User Community

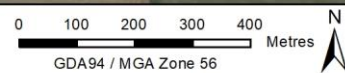



Figure 6.1 *Swainsona murrayana* species polygon (northern study area)



Threatened Flora

 Slender Darling Pea (*Swainsona murrayana*) species

 Modification

Service Layer Credits: Division of Resources & Energy
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the
GIS User Community

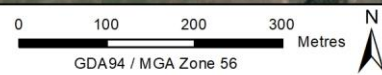


Figure 6.2 *Swainsona murrayana* species polygon (southern study area)

7 Final Credit Calculations

7.1 Credit calculations and classes

7.1.1 Ecosystem credits

Ecosystem credits required to offset the Modification are summarised in Table 7.1. Like-for-like options for offsetting each PCT are summarised in Table 7.2. The full biodiversity credit report is provided in Appendix F.

Table 7.1 PCTs which require offsets under the BAM

PCT	Area (ha)	Credits Required
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Semi-cleared Woodland) – moderate condition	0.1	2
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Derived Native Grassland) – low condition	0.1	0
PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (Mature trees over exotic dominated groundlayer) – low condition	0.0	1
PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	0.1	2

Table 7.2 Like-for-like offset options

PCT	Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
101	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (including PCTs 76, 80, 81, 82, 101, 110, 237, 248)	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
847	Western Slopes Grassy Woodlands (including PCTs 201, 266, 276, 277, 282, 283, 337, 426, 441, 483, 847), and in any of the following trading groups: Western Slopes Grassy Woodlands - ≥ 90% cleared group (including Tier 2 or higher).	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.

Note: HBT = hollow-bearing tree.

7.1.2 Species credits

Species credits required to offset the Modification are summarised in Table 7.3. The full biodiversity credit report is provided in Appendix F.

Table 7.3 Species credit species which require offsets under the BAM

Common Name	Scientific Name	Area	Credits
Slender Darling Pea	<i>Swainsona murrayana</i>	0.2	5

Options for offsetting impacts to *Swainsona murrayana* include trading credits for the same species in any IBRA subregion within NSW.

7.2 Credit costs

Under the BC Act, proponents may choose to pay into the Biodiversity Conservation Fund as an alternative to retiring biodiversity credits. Proponents may only pay into the fund once a consent authority has issued conditions of consent that specify the number and type of credits to be retired. The total cost of credits is estimated to be \$62,298.50 (incl. GST), as outlined in Table 7.4. The full biodiversity credit report is provided in Appendix F.

Table 7.4 Ecosystem and species credit cost estimate

Entity Requiring Offset	Risk premium	Administrative cost	Price per credit	No. of credits	Final credits price
101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	23.58%	\$426.56	\$13,605.15	3	\$40,815.45
847 - Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	19.73%	\$232.96	\$7,206.11	2	\$14,412.23
Subtotal					\$55,227.68
GST					\$5,522.77
Total ecosystem credits (incl. GST)					\$60,750.45
<i>Swainsona murrayana</i> (Slender Darling Pea)	34.31%	\$80.00	\$150.00	5	\$1,407.32
GST					\$140.73
Total species credits (incl. GST)					\$1,548.05
GRAND TOTAL (incl. GST)					\$62,298.50

References

- AMBS (2018). TCM - LOM Approval - Project Scope - MWD/Disturbance Limit/Rehabilitation Progressions. Letter report prepared for Whitehaven Coal Limited, 22 October 2018.
- Bureau of Meteorology (2019). "Climate Data Online", Accessed February 2019.
- Department of the Environment and Climate Change (2008). Recovery plan for the koala (*Phascolarctos cinereus*).
- Eco Logical Australia (2015). Tarrawonga Biodiversity Management Plan. Prepared for Whitehaven Coal Limited.
- Office of Environment and Heritage (2008). Namoi and Border Rivers Gwydir Catchments composite vegetation map (2008) - VIS_ID 3842.
- Office of Environment and Heritage (2016). NSW Guide to Surveying Threatened Plants.
- Office of Environment and Heritage (2017). Biodiversity Assessment Method.
- Office of Environment and Heritage (2019a). NSW BioNet Atlas Search. NSW Office of Environment and Heritage BioNet Website: <http://www.bionet.nsw.gov.au/> [Accessed March 2019].
- Office of Environment and Heritage (2019b). NSW Threatened Species Profiles Database. NSW Office of Environment and Heritage Website: <http://www.environment.nsw.gov.au/threatenedSpeciesApp/> [Accessed March 2019].

Appendix A: Target “species credit” species and survey months

Note: highlighted cells indicate proposed survey times for the current scope of work.

CA= camera, DB = diurnal bird survey, CP = call-playback, SL = spotlighting, RS = reptile search, ET = Elliot trapping, AN = anabat, HT = harp trapping, SAT =Spot Assessment Technique, PT = pitfall trapping, OP = opportunistic, ST = scat and track search.

For some species AMBS were unable to comply with the recommended survey times specified by OEH and, therefore no survey techniques were undertaken. This is due to the short timeframe of the Modification, with the BDAR requiring completion early April 2019.

Common Name	Scientific Name	Class of Credit	J	F	M	A	M	J	J	A	S	O	N	D	Survey Technique
Birds															
Bush Stone-curlew	<i>Burhinus grallarius</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CP, SL
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	Species/Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	None, outside survey time. Removed as a candidate species based on habitat constraints (Table 4.2).
Square-tailed Kite	<i>Lophoictinia isura</i>	Species/Ecosystem	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	DB
Barking Owl	<i>Ninox connivens</i>	Species/Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None, outside survey time. Removed as a candidate species based on habitat constraints (Table 4.2).
Superb Parrot	<i>Polytelis swainsonii</i>	Species/Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	None, outside survey time. Removed as a candidate species based on habitat constraints and known breeding distribution (Table 4.2).
Masked Owl	<i>Tyto novaehollandiae</i>	Species/Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	None, outside survey time. Removed as a candidate species based on habitat constraints (Table 4.2).
Regent Honeyeater	<i>Anthochaera phrygia</i>	Species/Ecosystem	No	No	No	No	No	No	No	No	No	No	No	No	None, refer to OEH for mapped important areas.
Little Eagle	<i>Hieraaetus morphnoides</i>	Species/Ecosystem	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	None, outside survey time. Removed as a candidate species based on habitat constraints (Table 4.2).
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Species/Ecosystem	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	None, outside survey time. Removed as a candidate species based on habitat constraints (Table 4.2).

Common Name	Scientific Name	Class of Credit	J	F	M	A	M	J	J	A	S	O	N	D	Survey Technique
Swift Parrot	<i>Lathamus discolor</i>	Species/Ecosystem	No	No	No	No	No	No	No	No	No	No	No	No	None, refer to OEH for mapped important areas.
Mammals															
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Species	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	PT, SL
Squirrel Glider	<i>Petaurus norfolcensis</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SL, CA
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA, ST
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SL, CA
Koala	<i>Phascolarctos cinereus</i>	Species/Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SL, SAT
Eastern Cave Bat	<i>Vespardelus troughtoni</i>	Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HT
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HT, AN
Plants															
Cyperus conicus	<i>Cyperus conicus</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Transects in suitable habitat
Bluegrass	<i>Dichanthium setosum</i>	Species	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Transects in suitable habitat
Finger Panic Grass	<i>Digitaria porrecta</i>	Species	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Transects in suitable habitat
Slender Darling Pea	<i>Swainsona murrayana</i>	Species	No	No	No	No	No	No	No	No	Yes	No	No	No	None, outside survey time.
Austral Toadflax	<i>Thesium australe</i>	Species	Yes	Yes	No	No	No	No	No	No	No	No	Yes	Yes	Transects in suitable habitat
Lobed Bluegrass	<i>Bothriochloa biloba</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Transects in suitable habitat
Native Milkwort	<i>Polygala linariifolia</i>	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Transects in suitable habitat

Appendix B: Flora species list

Family	Scientific Name	Common Name	Classification*	BAM 1	BAM 2	BAM 3	BAM 4	BAM 5	BAM6
Malvaceae	<i>Abutilon oxycarpum</i>	Straggly Lantern-bush	N			X			
Fabaceae	<i>Acacia salicina</i>	Cooba	N						X
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	N			X			
Amaranthaceae	<i>Amaranthus hybridus</i>	Slim Amaranth	E		X	X	X	X	
Apiaceae	<i>Ammi majus</i>	Bishop's Weed	E				X	X	
Poaceae	<i>Aristida ramosa</i>	Purple Wiregrass	N		X	X	X	X	X
Asteraceae	<i>Aster subulatus</i>	Wild Aster	E				X		
Chenopodiaceae	<i>Atriplex semibaccata</i>	Creeping Saltbush	N						X
Poaceae	<i>Austrostipa aristiglumis</i>	Plains Grass	N		X				
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	N	X	X	X			X
Poaceae	<i>Avena fatua</i>	Wild Oats	E	X	X	X	X	X	X
Asteraceae	<i>Bidens subalternans</i>	Greater Beggar's Ticks	HTE	X	X	X	X	X	X
Nyctaginaceae	<i>Boerhavia dominii</i>	Tarvine	N	X	X	X	X	X	X
Poaceae	<i>Bothriochloa decipiens</i> <i>var. decipiens</i>	Pitted Bluegrass	N	X	X	X	X	X	
Brassicaceae	<i>Brassica spp.</i>	Brassica	E					X	X
Poaceae	<i>Bromus catharticus</i>	Praire Grass	E	X	X	X	X	X	X
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	N		X				X
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	N			X			
Cyperaceae	<i>Carex inversa</i>	Knob Sedge	N	X	X	X	X		
Asteraceae	<i>Carthamus lanatus</i>	Saffron Thistle	HTE						X
Asteraceae	<i>Centaurea melitensis</i>	Maltese Cockspur	E	X			X	X	X
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	N			X	X		
Pteridaceae	<i>Cheilanthes sieberi</i> <i>subsp. sieberi</i>	Rock Fern	N			X			
Chenopodiaceae	<i>Chenopodium album</i>	Fat Hen	E					X	
Chenopodiaceae	<i>Chenopodium cristatum</i>	Crested Goosefoot	N	X					
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	N		X	X			
Convolvulaceae	<i>Convolvulus erubescens</i>	Pink Bindweed	N					X	
Convolvulaceae	<i>Convolvulus recurvatus</i>		N			X			
Poaceae	<i>Cynodon dactylon</i>	Common Couch	N			X	X	X	X
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	N			X			

Family	Scientific Name	Common Name	Classification*	BAM 1	BAM 2	BAM 3	BAM 4	BAM 5	BAM6
Cyperaceae	<i>Cyperus spp.</i>		N				X		
Solanaceae	<i>Datura spp.</i>		E		X				
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	N		X	X			
Poaceae	<i>Digitaria brownii</i>	Cotton Panic Grass	N			X			
Poaceae	<i>Digitaria divaricatissima</i>	Umbrella Grass	N	X					
Chenopodiaceae	<i>Dysphania cristata</i>	Crested Crumbweed	N				X	X	
Boraginaceae	<i>Echium plantagineum</i>	Patterson's Curse	E		X		X	X	X
Chenopodiaceae	<i>Einadia nutans subsp. linifolia</i>	Climbing Saltbush	N		X	X			
Chenopodiaceae	<i>Einadia nutans subsp. nutans</i>	Climbing Saltbush	N	X	X		X	X	X
Chenopodiaceae	<i>Einadia trigonos</i>	Fishweed	N	X	X	X	X	X	X
Poaceae	<i>Elymus scaber</i>	Common Wheatgrass	N			X			
Poaceae	<i>Enteropogon acicularis</i>	Curly Windmill Grass	N	X	X	X			
Poaceae	<i>Eragrostis cilianensis</i>	Stinkgrass	E					X	
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	E			X			
Poaceae	<i>Eragrostis mexicana</i>	Mexican Lovegrass	E			X	X		
Poaceae	<i>Eragrostis spp.</i>	A Lovegrass	E			X			
Poaceae	<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass	N				X	X	
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum	N					X	
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	N						X
Myrtaceae	<i>Eucalyptus melliodora</i>	Yellow Box	N					X	
Myrtaceae	<i>Eucalyptus pilligaensis</i>	Narrow-leaved Grey Box	N						X
Myrtaceae	<i>Eucalyptus populnea</i>	Bimble Box	N		X	X			
Geraniaceae	<i>Geranium solanderi var. solanderi</i>		N			X			
Verbenaceae	<i>Glandularia aristigera</i>	Mayne's Pest	E			X	X		
Fabaceae	<i>Glycine tabacina</i>	Variable Glycine	N		X	X			X
Amaranthaceae	<i>Gomphrena celosioides</i>	Gomphrena Weed	E			X		X	
Poaceae	<i>Hordeum leporinum</i>	Barley Grass	E	X	X	X	X	X	X
Juncaceae	<i>Juncus subsecundus</i>	Finger Rush	N	X				X	
Asteraceae	<i>Lactuca serriola</i>	Prickly Lettuce	E	X	X	X	X	X	X
Brassicaceae	<i>Lepidium africanum</i>	Common Peppergrass	E	X				X	X
Poaceae	<i>Lolium perenne</i>	Perennial Ryegrass	E	X	X				
Poaceae	<i>Lolium rigidum</i>	Wimmera Ryegrass	E			X	X	X	

Family	Scientific Name	Common Name	Classification*	BAM 1	BAM 2	BAM 3	BAM 4	BAM 5	BAM6
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>		N		X	X			
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	HTE #			X			X
Chenopodiaceae	<i>Maireana enchylaenoides</i>	Wingless Fissure-weed	N			X			
Malvaceae	<i>Malva parviflora</i>	Small-flowered Mallow	E	X	X		X	X	X
Fabaceae	<i>Medicago minima</i>	Woolly Burr Medic	E		X		X		
Fabaceae	<i>Medicago polymorpha</i>	Burr Medic	E	X	X	X			
Fabaceae	<i>Medicago sativa</i>	Lucerne	E		X		X		X
Oxalidaceae	<i>Oxalis exilis</i>		N		X	X			X
Oxalidaceae	<i>Oxalis perennans</i>		N	X		X			
Poaceae	<i>Paspalidium distans</i>		N	X	X	X	X	X	
Polygonaceae	<i>Polygonum aviculare</i>	Wireweed	E	X			X	X	
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed	N			X	X		
Brassicaceae	<i>Rapistrum rugosum</i>	Turnip Weed	E	X	X	X	X	X	
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock	N		X	X	X	X	X
Poaceae	<i>Rytidosperma bipartitum</i>	Wallaby Grass	N		X	X			
Poaceae	<i>Rytidosperma fulvum</i>	Wallaby Grass	N	X					
Chenopodiaceae	<i>Salsola australis</i>		N	X	X	X			X
Asteraceae	<i>Schkuhria pinnata</i> var. <i>abrotanoides</i>	Dwarf Marigold	E		X	X	X		
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanized Burr	N	X	X	X	X		
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Rolypoly	N	X		X			
Asteraceae	<i>Senecio quadridentatus</i>	Cotton Fireweed	N			X			
Fabaceae	<i>Senna barclayana</i>	Smooth Senna	N			X			
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida	N		X	X	X		
Malvaceae	<i>Sida cunninghamii</i>	Ridge Sida	N			X			
Malvaceae	<i>Sida hackettiana</i>	Golden Rod, Spiked Sida, Queensland Hemp	N		X	X	X	X	
Malvaceae	<i>Sida spinosa</i>		E	X	X	X	X	X	X
Malvaceae	<i>Sida trichopoda</i>	High Sida	N	X	X	X			
Brassicaceae	<i>Sisymbrium irio</i>	London Rocket	E		X		X	X	X
Brassicaceae	<i>Sisymbrium orientale</i>	Indian Hedge Mustard	E						X
Solanaceae	<i>Solanum esuriale</i>	Quena	N	X	X		X	X	X
Solanaceae	<i>Solanum nigrum</i>	Black-berry Nightshade	E					X	
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	E	X	X	X			

Family	Scientific Name	Common Name	Classification*	BAM 1	BAM 2	BAM 3	BAM 4	BAM 5	BAM6
Zygophyllaceae	<i>Tribulus terrestris</i>	Cat-head	E	X	X	X	X	X	X
Poaceae	<i>Urochloa panicoides</i>	Urochloa Grass	E	X	X	X	X	X	X
Verbenaceae	<i>Verbena quadrangularis</i>		E				X		
Asteraceae	<i>Vittadinia spp.</i>	Fuzzweed	N	X	X	X			
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	N		X	X			
Asteraceae	<i>Xanthium spinosum</i>	Bathurst Burr	HTE			X		X	
Aizoaceae	<i>Zaleya galericulata</i>	Hogweed	N	X			X	X	X

Note: * N=Native; E=Exotic, HTE=High Threat Exotic as per the BAM Method (OEH 2017).

Priority Weed within the Narrabri LGA under the *NSW Biosecurity Act 2015*.

Appendix C: Fauna species list

Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	
AMPHIBIANS	Hylidae	<i>Cyclorana verrucosa</i>	Rough Frog			
		<i>Litoria caerulea</i>	Green Tree Frog			
		<i>Litoria latopalmata</i>	Broad-palmed Frog			
		<i>Litoria peronii</i>	Peron's Tree Frog			
	Limnodynastidae	<i>Litoria rubella</i>	Desert Tree Frog			
		<i>Limnodynastes salmini</i>	Salmon Striped Frog			
		<i>Limnodynastes tasmaniensis</i>	Spotted Grass Frog			
REPTILES	Agamidae	<i>Pogona barbata</i>	Common Bearded Dragon			
	Gekkonidae	<i>Gehyra sp.</i>	unidentified Gehyra			
	Scincidae	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink			
		<i>Egernia striolata</i>	Tree Skink			
		<i>Lampropholis delicata</i>	Garden Skink			
BIRDS	Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk			
		<i>Haliastur sphenurus</i>	Whistling Kite			
	Anatidae	<i>Anas gracilis</i>	Grey Teal			
		<i>Anas superciliosa</i>	Pacific Black Duck			
		<i>Aythya australis</i>	Hardhead			
		<i>Chenonetta jubata</i>	Australian Wood Duck			
	Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift			M
		<i>Hirundapus caudacutus</i>	White-throated Needletail			M
	Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth			
	Charadriidae	<i>Vanellus miles</i>	Masked Lapwing			
	Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon			
	Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra			
		<i>Todiramphus sanctus</i>	Sacred Kingfisher			
	Falconidae	<i>Falco berigora</i>	Brown Falcon			
		<i>Falco cenchroides</i>	Nankeen Kestrel			
		<i>Falco longipennis</i>	Australian Hobby			
		<i>Falco peregrinus</i>	Peregrine Falcon			
	Phasianidae	<i>Synoicus ypsilophorus</i>	Brown Quail			
	Alaudidae	<i>Mirafra javanica</i>	Horsfield's Bushlark			
Artamidae	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow^		V		
	<i>Cracticus nigrogularis</i>	Pied Butcherbird				
	<i>Cracticus torquatus</i>	Grey Butcherbird				

Class	Family	Scientific Name	Common Name	BC Act	EPBC Act
		<i>Gymnorhina tibicen</i>	Australian Magpie		
	Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		
		<i>Lalage tricolor</i>	White-winged Triller^		
	Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough		
		<i>Struthidea cinerea</i>	Apostlebird		
	Corvidae	<i>Corvus coronoides</i>	Australian Raven		
		<i>Corvus orru</i>	Torresian Crow		
	Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird		
	Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch^		
	Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren		
		<i>Malurus leucopterus</i>	White-winged Fairy-wren		
	Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		
		<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater		
		<i>Manorina melanocephala</i>	Noisy Miner		
		<i>Plectorhyncha lanceolata</i>	Striped Honeyeater		
	Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark		
	Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote		
	Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	
	Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird		
	Sturnidae	<i>Acridotheres tristis</i>	Common Myna*		
		<i>Sturnus vulgaris</i>	Common Starling*		
	Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron		
	Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican		
	Threskiornithidae	<i>Platalea regia</i>	Royal Spoonbill		
		<i>Threskiornis spinicollis</i>	Straw-necked Ibis		
	Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		
		<i>Cacatua sanguinea</i>	Little Corella		
		<i>Eolophus roseicapilla</i>	Galah		
		<i>Nymphicus hollandicus</i>	Cockatiel		
	Psittaculidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot		
		<i>Glossopsitta concinna</i>	Musk Lorikeet		
		<i>Northiella haematogaster</i>	Blue Bonnet		
		<i>Platycercus eximius</i>	Eastern Rosella		
		<i>Psephotus haematonotus</i>	Red-rumped Parrot		
	Tytonidae	<i>Tyto alba</i>	Barn Owl		
MAMMALS	Bovidae	<i>Bos taurus</i>	Cattle*		

Class	Family	Scientific Name	Common Name	BC Act	EPBC Act
	Canidae	<i>Vulpes vulpes</i>	Red Fox*		
	Felidae	<i>Felis catus</i>	Cat*		
	Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat	V	
	Molossidae	<i>Austronomus australis</i>	White-striped Free-tailed Bat		
		<i>Mormopterus (Ozimops) petersi</i>	Inland Free-tailed bat		
		<i>Mormopterus (Ozimops) planiceps</i>	South-eastern Free-tailed bat		
	Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		
		<i>Chalinolobus morio</i>	Chocolate Wattled Bat		
		<i>Nyctophilus sp.</i>	unidentified Nyctophilus		
		<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat		
		<i>Scotorepens greyii/Scotorepens unnamed</i>	Little Broad-nosed Bat/Central-eastern Broad-nosed Bat		
		<i>Vespadelus darlingtoni</i>	Large Forest Bat		
		<i>Vespadelus vulturnus</i>	Little Forest Bat		
	Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo		
		<i>Wallabia bicolor</i>	Swamp Wallaby		
	Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum		
	Leporidae	<i>Lepus europaeus</i>	European Brown Hare*		
		<i>Oryctolagus cuniculus</i>	European Rabbit*		

Appendix D: Threatened Species within 10 km of Modification Area (BioNet 2019a)

Type	Class	Family	Scientific Name	Common Name	BC Act	EPBC Act	
FLORA		Apocynaceae	<i>Tylophora linearis</i>	-	V	E	
		Rhamnaceae	<i>Pomaderris queenslandica</i>	Scant Pomaderris	E		
FAUNA	Aves	Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler	V		
		Accipitridae	<i>Circus assimilis</i>	Spotted Harrier	V		
		Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V		
		Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V		
		Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M	
		Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	V		
		Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V		
		Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V		
		Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail	V		
		Falconidae	<i>Falco subniger</i>	Black Falcon	V		
		Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	V	V	
		Meliphagidae	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		
		Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	-	M	
		Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		
		Petroicidae	<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V		
		Pomatostomidae	<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		
		Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V		
		Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	V		
		Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous Fantail	-	M	
		Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe	-	M	
		Strigidae	<i>Ninox connivens</i>	Barking Owl	V		
		Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis	-	C	
		Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V		
		Mammalia	Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	
			Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V	
			Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	V
Vespertilionidae	<i>Chalinolobus dwyeri</i>		Large-eared Pied Bat	V	V		
Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>		Eastern Bentwing-bat	V			
Vespertilionidae	<i>Nyctophilus corbeni</i>		Corben's Long-eared Bat	V	V		
Vespertilionidae	<i>Vespadelus troughtoni</i>		Eastern Cave Bat	V			
Reptilia	Elapidae	<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V			

Appendix E: Fauna survey site coordinates

Survey Type	Easting	Northing
Bird Census	228636	6605105
	228520	6604464
Reptile Survey	228636	6605105
	228520	6604464
Pitfall Line (Centre Point)	228636	6605105
	228520	6604464
Harp Trap	228649	6605157
	228645	6605170
	228646	6605109
	228633	6605110
	228637	6604907
	228621	6604917
	228629	6604904
	228637	6604886
	228544	6604709
	228551	6604712
	228556	6604692
	228538	6604686
	228527	6604442
	228520	6604464
228522	6604450	
Ultrasonic Call Recorder (Anabat)	228526	6604442
	228554	6604703
	228643	6604919
	228644	6605177
Remote Camera	228535	6604461
	228645	6605177
	228621	6604916
	228556	6604695
Call-Playback	228533	6604458
	228469	6604019
Spotlighting	228568	6604986
	228644	6605104
	228631	6604923
	228546	6604696
	228536	6604466

Appendix F: Biodiversity Credit Report



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014760/BAAS17072/19/00014796	Tarrawonga Pipeline BDAR	05/05/2020
Assessor Name	Assessor Number	BAM Data version *
Belinda Pellow	18082	26
Proponent Names	Report Created	BAM Case Status
TARRAWONGA COAL PTY LTD	26/05/2020	Open
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (General)	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Grantiella picta / Painted Honeyeater
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	0.2	3.00
847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Not a TEC	0.1	2.00

101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Like-for-like credit retirement options			
	Name of offset trading group	Trading group	HBT	IBRA region

BAM Biodiversity Credit Report (Like for like)

	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248	-	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion				
Like-for-like credit retirement options				
	Class	Trading group	HBT	IBRA region
	Western Slopes Grassy Woodlands This includes PCT's: 201, 266, 276, 277, 282, 283, 337, 426, 441, 483, 847	Western Slopes Grassy Woodlands >=90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

Species	Area	Credits
Swainsona murrayana / Slender Darling Pea	0.2	5.00

Swainsona murrayana / Slender Darling Pea	101_Low_ExDG	Like-for-like credit retirement options	
		Spp	IBRA region
		Swainsona murrayana /Slender Darling Pea	Any in NSW
	101_Mod_SCW	Like-for-like credit retirement options	
		Spp	IBRA region
		Swainsona murrayana /Slender Darling Pea	Any in NSW
	847_Low_SCW	Like-for-like credit retirement options	
		Spp	IBRA region
		Swainsona murrayana /Slender Darling Pea	Any in NSW



BAM Biodiversity Credit Report (Like for like)

Swainsona murrayana/ Slender Darling Pea	847_Low_SCW
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BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014760/BAAS17072/19/00014796	Tarrawonga Pipeline BDAR	05/05/2020
Assessor Name	Assessor Number	BAM Data version *
Belinda Pellow	18082	26
Proponent Name(s)	Report Created	BAM Case Status
TARRAWONGA COAL PTY LTD	26/05/2020	Open
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (General)	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Grantiella picta / Painted Honeyeater
Haliaeetus leucogaster / White-bellied Sea-Eagle

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	0.2	3.00
847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Not a TEC	0.1	2.00

101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Like-for-like credit retirement options			
	Name of offset trading group	Trading group	HBT	IBRA region

BAM Biodiversity Credit Report (Variations)

	<p>Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248</p>	-	Yes	<p>Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
Variation options				
Formation	Trading group	HBT	IBRA region	
Semi-arid Woodlands (Grassy sub-formation)	Tier 3 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	
847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Like-for-like credit retirement options			
Class	Trading group	HBT	IBRA region	
Western Slopes Grassy Woodlands This includes PCT's: 201, 266, 276, 277, 282, 283, 337, 426, 441, 483, 847	Western Slopes Grassy Woodlands >=90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

BAM Biodiversity Credit Report (Variations)

847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 2 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Swainsona murrayana / Slender Darling Pea	0.2	5.00

Swainsona murrayana/ Slender Darling Pea	101_Low_ExDG	Like-for-like options	
		Spp	IBRA region
		Swainsona murrayana/ Slender Darling Pea	Any in NSW
		Variation options	
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

BAM Biodiversity Credit Report (Variations)

		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	101_Mod_SCW	Like-for-like options		
		Spp	IBRA region	
		Swainsona murrayana /Slender Darling Pea	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

	847_Low_SCW	Like-for-like options			
		Spp		IBRA region	
		Swainsona murrayana/Slender Darling Pea		Any in NSW	
		Variation options			
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region	
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.	

Proposal Details

Assessment Id 00014760/BAAS17072/19/0001479 6	Proposal Name Tarrawonga Pipeline BDAR	BAM data last updated * 05/05/2020
Assessor Name Belinda Pellow	Report Created 26/05/2020	BAM Data version * 26
Assessor Number 18082	Assessment Type Part 4 Developments (General)	BAM Case Status Open
	Assessment Revision 2	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months												
<i>Burhinus grallarius</i> Bush Stone-curlew	No (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Cercartetus nanus</i> Eastern Pygmy-possum	No (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	No (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Cyperus conicus</i> Cyperus conicus	No (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									
<i>Dichanthium setosum</i> Bluegrass	No (surveyed)	<table border="1"> <tr> <td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td><td>Jun</td> </tr> <tr> <td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td> </tr> </table>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jan	Feb	Mar	Apr	May	Jun									
Jul	Aug	Sep	Oct	Nov	Dec									

BAM Candidate Species Report

<i>Digitaria porrecta</i> Finger Panic Grass	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Lophoictinia isura</i> Square-tailed Kite	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Vespadelus troughtoni</i> Eastern Cave Bat	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Petaurus norfolcensis</i> Squirrel Glider	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Phascolarctos cinereus</i> Koala	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Polygala linariifolia</i> Native Milkwort	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Swainsona murrayana</i> Slender Darling Pea	Yes (assumed present)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
<i>Thesium australe</i> Austral Toadflax	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

List of Species Not On Site

Name

Hamirostra melanosternon Black-breasted Buzzard

Lathamus discolor Swift Parrot

Ninox connivens Barking Owl

Polytelis swainsonii Superb Parrot

Tyto novaehollandiae Masked Owl

Anthochaera phrygia Regent Honeyeater

Hieraaetus morphnoides Little Eagle

Haliaeetus leucogaster White-bellied Sea-Eagle

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014760/BAAS17072/19/00014796	Tarrawonga Pipeline BDAR	05/05/2020
Assessor Name	Report Created	BAM Data version *
Belinda Pellow	26/05/2020	26
Assessor Number	BAM Case Status	Date Finalised
18082	Open	To be finalised
Assessment Revision	Assessment Type	
2	Part 4 Developments (General)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion								
	3 847_Low_SCW	39.1	0.1	0.25	High Sensitivity to Potential Gain	2.50		2
							Subtotal	2

BAM Credit Summary Report

Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion								
1	101_Mod_SCW	59.2	0.1	0.25	High Sensitivity to Potential Gain	2.00		2
2	101_Low_DNG	13.4	0.1	0.25	High Sensitivity to Potential Gain	2.00		0
4	101_Low_ExDG	48.8	0.0	0.25	High Sensitivity to Potential Gain	2.00		1
							Subtotal	3
							Total	5

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits	
<i>Swainsona murrayana</i> / <i>Slender Darling Pea</i> (Flora)							
101_Mod_SCW	59.2	0.08	0.25	2	False	2	
847_Low_SCW	39.1	0.08	0.25	2	False	2	
101_Low_ExDG	48.8	0.04	0.25	2	False	1	
						Subtotal	5

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00014760/BAAS17072/19/00014796	63	2	26/05/2020
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Belinda Pellow	18082	Tarrawonga Pipeline BDAR	Open
	Assessment Type	Date Finalised	
	Part 4 Developments (General)	To be finalised	

PCT list

Price calculated	PCT common name	Credits
Yes	101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	3
Yes	847 - Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	2

Species list

Price calculated	Species	Credits
Yes	<i>Swainsona murrayana</i> (Slender Darling Pea)	5

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat



Biodiversity payment summary report

Assessment Id

00014760/BAAS17072/19/00014796

Proposal Name

Tarrawonga Pipeline BDAR

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Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Liverpool Plains	101 - Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	No	Brigalow Clay Plain Woodlands >=70% and <90%	23.58%	\$426.56	2.3233	\$13,605.15	3	\$40,815.45
Liverpool Plains	847 - Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	No	Western Slopes Grassy Woodlands >90%	19.73%	\$232.96	2.2672	\$7,206.11	2	\$14,412.23
Subtotal (excl. GST)									\$55,227.68
GST									\$5,522.77
Total ecosystem credits (incl. GST)									\$60,750.45

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10779	<i>Swainsona murrayana</i> (Slender Darling Pea)	Vulnerable	\$150.00	34.3100%	\$80.00	5	\$1,407.32



Biodiversity payment summary report

Assessment Id

00014760/BAAS17072/19/00014796

Proposal Name

Tarrawonga Pipeline BDAR

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Biodiversity payment summary report

Subtotal (excl. GST)	\$1,407.32
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GST	\$140.73
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Total species credits (incl. GST)	\$1,548.05
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Grand total	\$62,298.50
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Biodiversity payment summary report

Assessment Id

00014760/BAAS17072/19/00014796

Proposal Name

Tarrawonga Pipeline BDAR

Page 6 of 6

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014760/BAAS17072/19/00014796	Tarrawonga Pipeline BDAR	05/05/2020
Assessor Name	Report Created	BAM Data version *
Belinda Pellow	26/05/2020	26
Assessor Number	Assessment Type	BAM Case Status
18082	Part 4 Developments (General)	Open
	Assessment Revision	Date Finalised
	2	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	<i>Ninox connivens</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Black-breasted Buzzard	<i>Hamirostra melanosternon</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Corben's Long-eared Bat	<i>Nyctophilus corbeni</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Diamond Firetail	<i>Stagonopleura guttata</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion

BAM Predicted Species Report

Diamond Firetail	Stagonopleura guttata	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Dusky Woodswallow	Artamus cyanopterus cyanopterus	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
		847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Flame Robin	Petroica phoenicea	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Grey Falcon	Falco hypoleucos	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis temporalis	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
		847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Hooded Robin (south-eastern form)	Melanodryas cucullata cucullata	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
		847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Koala	Phascolarctos cinereus	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
		847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Little Eagle	Hieraetus morphnoides	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
		847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion

BAM Predicted Species Report

Little Lorikeet	<i>Glossopsitta pusilla</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Little Pied Bat	<i>Chalinolobus picatus</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Masked Owl	<i>Tyto novaehollandiae</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Regent Honeyeater	<i>Anthochaera phrygia</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Scarlet Robin	<i>Petroica boodang</i>	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Speckled Warbler	<i>Chthonicola sagittata</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Spotted Harrier	<i>Circus assimilis</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion

BAM Predicted Species Report

Square-tailed Kite	<i>Lophoictinia isura</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Superb Parrot	<i>Polytelis swainsonii</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
Swift Parrot	<i>Lathamus discolor</i>	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Turquoise Parrot	<i>Neophema pulchella</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Varied Sittella	<i>Daphoenositta chrysoptera</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion

Threatened species not within the area of these PCT's

Common Name	Scientific Name	Vegetation Types(s)
Painted Honeyeater	<i>Grantiella picta</i>	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion 847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion

White-bellied Sea-Eagle	Haliaeetus leucogaster	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
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Proposal Details

Assessment Id 00014760/BAAS17072/19/00014796	Assessment name Tarrawonga Pipeline BDAR	BAM data last updated * 05/05/2020
Assessor Name Belinda Pellow	Report Created 26/05/2020	BAM Data version * 26
Assessor Number 18082	Assessment Type Part 4 Developments (General)	BAM Case Status Open
* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	Assessment Revision 2	Date Finalised To be finalised

Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	101_Mod_SCW	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Mod_SCW	0.08	1	

BAM Vegetation Zones Report

2	101_Low_DNG	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Low_DNG	0.05	1	
3	847_Low_SCW	847-Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Low_SCW	0.08		
4	101_Low_ExDG	101-Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Low_ExDG	0.04	1	

ATTACHMENT 2
AIR QUALITY MODELLING EMISSIONS INVENTORIES
