Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement
Submissions report

May 2017
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Document controls

Approval and authorisation

<table>
<thead>
<tr>
<th>Title</th>
<th>Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement submissions report</th>
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</table>
| Accepted on behalf of Roads and Maritime NSW by | Steve Brailsford  
Project Development Manager, Roads and Maritime Services  
Northern Region |
| Signed | S. T. Brailsford |
| Dated | 17 May 2017 |

Revisions

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<tr>
<th>Document status</th>
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</table>
| Revision 1      | April 2017 | Danielle Haynes  
Javier Valderrama | Peter Rand  
Stephen Sheldon |
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Javier Valderrama | Javier Valderrama |
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Javier Valderrama | Javier Valderrama |

Disclaimers

This report has been prepared for Roads and Maritime Services in accordance with the terms and conditions of appointment for the HW17 Mungle Back Creek to Boggabilla heavy duty pavement project dated February 2016. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.
Executive summary

Roads and Maritime Services (Roads and Maritime) proposes to provide a heavy duty road over about 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are to:

- provide heavy duty pavement
- widen the road
- provide dedicated overtaking lanes
- upgrade intersections
- improve access to private property
- provide road delineation, sign posting and roadside furniture
- upgrade drainage to improve the Newell Highway flood immunity
- provide water supply infrastructure to facilitate the build and maintenance of the proposal.

The project may involve a staged construction process, dependant on available funding.

Roads and Maritime prepared a review of environmental factors (REF) for the proposal (Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement review of environmental factors (Roads and Maritime, February 2017)). This submissions report relates to the REF, and should be read in conjunction with that document.

The REF was publicly displayed between 28 February and 28 March 2017. Roads and Maritime received four submissions in response to the public display of the REF: one from a government agency (Department of Primary Industries (Water)) and three from members of the public. The main issue raised in the government agency submission relates to water licensing requirements to authorise use of the proposed MacIntyre River pump. The main issues raised by members of the public and the RMS response to these issues are summarised below:

- The property access intersection at chainage 100,540 was considered to be unsafe for vehicles turning right. To address this issue, the intersection will be upgraded to allow larger vehicles to safely turn into the property. This upgrade will include the widening of the culvert.
- The exclusion of works to improve the Whalan Creek Bridge and the road between Tackinbri Creek and Mungle Back Creek (south of the proposal). Given that the Whalan Creek Bridge abutment was rehabilitated in 2016 and has a remaining life of 50 years, Roads and Maritime will not be undertaking further modifications to Whalan Creek Bridge at this time. Based on the condition of the underlying pavement, Roads and Maritime has also concluded that this section
of the Newell Highway is a priority for rehabilitation over other road sections including the road between Tackinbri Creek and Mungle Back Creek.

- A respondent informed Roads and Maritime that they have a deposit of road construction material 27 kilometres east of Goondiwindi in Queensland that may suit the requirements for the proposal. Roads and Maritime takes note of the material availability as described in this submission.

### Proposal refinements

Roads and Maritime has refined and further developed a number of aspects of the proposal as documented in the REF. The major refinements can be summarised as follows:

- revised construction work zone boundary to ease constructability concerns.
- design refinements to improve the road alignment, local road intersections, allow for material reuse, and limit traffic impact impacts during construction.

### Environmental assessment of design refinements

All refinements to the proposal have been assessed against the environmental issues identified in the REF. The assessment identified where additional or different impacts are expected from those identified in the REF. For most design refinements, the assessment concludes that environmental impacts will be consistent with those described in the REF. Many of the refinements will minimise impacts, but some will result in increases to impacts particularly on Aboriginal heritage.

### Additional investigations and assessment

Additional investigations and assessments were carried out during, and after, the REF public display. The main additional investigations and assessments carried out were:

- Additional vegetation surveys – additional vegetation surveys were undertaken to validate the findings of the biodiversity assessment completed as part the project REF and to assist in completing biodiversity offsetting calculations as per Roads and Maritime’s Guideline for Biodiversity Offsets.

The additional survey concluded that many of the areas identified as being areas occupied by EPBC Act and TSC Act listed Endangered Ecological Communities (EECs) that are in moderate to good condition were occupied by exotic ground covers and EECs in low condition. As a result, the impact to EECs resulting from the proposal has been reduced. The additional survey’s finding has been incorporated into a supplementary biodiversity assessment has been completed and forms part of this report.
• Aboriginal heritage reporting – due to design refinements the proposal will result in impacts to known items of Aboriginal heritage. These impacts were not described in the project REF. A preliminary Aboriginal Cultural Heritage Assessment report has been prepared to document these impacts and has been made available to registered Aboriginal parties in accordance with stage 3 of the PACHCI process. Impacts to items of Aboriginal heritage will be managed by obtaining an Aboriginal Heritage Impact Permit.

• Afflux – due to design refinements it became necessary to complete supplementary flooding assessments to determine afflux impacts on private property. The supplementary assessment concluded that five locations would experience adverse flooding impacts of up to 125mm. Most of the identified impacts can be mitigated in design. If mitigation is not possible then further consultation with affected land owners is required.

Revised safeguards and management measures

The REF identified a range of measures to avoid, reduce, manage or offset the environmental impacts of the proposal. After considering issues raised during the REF display and the additional investigations and assessment carried out, the environmental safeguards and management measures for the proposal were revised.

Next steps

The proposal, as amended by this submissions report, will be submitted for determination. Should the proposal be approved, Roads and Maritime will continue to consult with community members, government agencies and other stakeholders during detailed design and construction.
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### Appendices

- Appendix A Design modifications
- Appendix B Supplementary biodiversity assessment report
- Appendix C Aboriginal cultural heritage assessment report
1 Introduction and background

1.1 The proposal
Roads and Maritime Services (Roads and Maritime) proposes to provide a heavy duty road over about 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW. An overview of the proposal is presented in Figure 1-1.

The main features of the proposal are to:
- provide heavy duty pavement
- widen the road
- provide dedicated overtaking lanes
- upgrade intersections
- improve access to private property
- provide road delineation, sign posting and roadside furniture
- upgrade drainage to improve the Newell Highway flood immunity up to a 20-year average recurrence interval when feasible and reasonable
- provide water supply infrastructure to facilitate the build and maintenance of the proposal.

The project may involve a staged construction process, dependant on available funding.

1.2 REF display
Roads and Maritime prepared a review of environmental factors (REF) to assess the environmental impacts of the proposal (Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement review of environmental factors (Roads and Maritime, February 2017)). The REF was displayed for 28 days between 28 February and 28 March 2017 at the following locations:

- Moree Plains Shire Council, 30 Heber Street, Moree
- Boggabilla TAFE Office (Moree Plains Shire Council), South Street, Boggabilla.

The REF was also placed on the Roads and Maritime project website and made available for download. The REF web page (www.rms.nsw.gov.au/munglebackcreek) received 194 page views with 141 being unique over the public display period. The public display was advertised in the Moree Champion and the Goondiwindi Argus newspapers and announced on radio stations 2VM and NOW FM Moree from Tuesday 28 February, with 32 radio placements across the four-week display period. An invitation to comment was emailed to 11 properties in the proposal area and several identified stakeholders including representatives of the road freight industry. A copy of the REF was sent to NSW Office of Environment and Heritage (OEH) and the Commonwealth Department of Environment and Energy. Roads and Maritime also notified adjacent property owners via letters, door knocks and one-to-one meetings to discuss the proposal and any impacts that may result from it.

1.3 Purpose of the report
The purpose of this submissions report is to:
- summarise the issues raised in submissions and provide responses to each issue (Chapter 3)
- identify refinements made to the proposal since the REF was displayed (Chapter 4)
- document additional investigations and assessments conducted during, and following, the REF public display period (Chapter 5)
- revise environmental safeguards and management measures for the proposal (Chapter 6).

This submissions report relates to the REF, and should be read in conjunction with that document.
Figure 1-1 Overview of the proposal
2 Review of environmental factors clarification

Table 3-2 and Section 6.8 of the REF states that one of the proposal’s flood criteria is to achieve zero afflux in the one in 10 year Average Recurrence Interval flood event on surrounding properties unless agreed with affected property owners. This statement is incorrect.

The correct flood criteria for the proposal is to achieve zero afflux in the one in 100 year Average Recurrence Interval flood event on surrounding properties unless agreed with affected property owners.
### 3 Response to issues

Roads and Maritime received four submissions in response to the public display of the REF: one from a government agency (Department of Primary Industries (Water)) and three from members of the public. Submissions were accepted until 28 March 2017. No late submissions were received.

Table 3-1 lists the respondents and each respondent’s allocated submission number. The table also indicates where the issues from each submission are addressed in Chapter 3 of this report.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Submission Number</th>
<th>Where issues are addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Primary Industries (Water)</td>
<td>1</td>
<td>Section 3.2</td>
</tr>
<tr>
<td>Individual</td>
<td>2</td>
<td>Section 3.3</td>
</tr>
<tr>
<td>Individual</td>
<td>3</td>
<td>Section 3.4</td>
</tr>
<tr>
<td>Individual</td>
<td>4</td>
<td>Section 3.5</td>
</tr>
</tbody>
</table>

#### 3.1 Overview of issues raised

Submissions received during the REF public display were examined individually to understand the issues being raised. The issues raised in each submission were extracted and collated, and corresponding responses to the issues have been provided. The issues raised and Roads and Maritime response to these issues forms the basis of this chapter.

The main issues raised relate to:
- improvements at a property access intersection at chainage 100,540
- the need for improvements at Whalan Creek Bridge and the road between Tackinbri Creek and Mungle Back Creek (south of the proposal)
- an offer of materials to construct the proposal.

#### 3.2 Water licensing

**Submission number: 1**

**Issue description**

The NSW Department of Primary Industries (Water) stated that an application for approval for water supply works will be required to authorise use of the proposed MacIntyre River pump. The application must be accompanied by written permission from the current registered land owner on which the pump is to be located (that is, Moree Plains Shire Council).

The water supply works approval will be issued with a condition that requires pumping to cease in accordance with the ‘cease to pump’ rules outlined in the *NSW Border Rivers Unregulated and Alluvial Water Sources water sharing plan – Croppa Creek and Whalan Creek Water Source*.

The respondent noted that Roads and Maritime does not need to obtain flood works approval for the pump under the *Water Management Act 2000* (NSW) as the pump will be constructed or used for the purposes of a public road.
Response
The water supply works approval requirement for the pump and the written permission from the current registered land owner on which the pump is to be located (Moree Plains Shire Council) will be obtained before construction of the pump begins.

3.3 Traffic and access

3.3.1 Local road intersection improvements

Submission number: 2

Issue description
The respondent raised safety concerns regarding the right turn off the Newell Highway at the property access intersection at chainage 100,540 and suggests widening the culvert to allow more room for larger vehicles turning into the property.

Response
The property access intersection at chainage 100,540 will be upgraded to allow larger vehicles to safely turn into the property. This upgrade will include the widening of the culvert.

3.4 Proposal scope

Submission number: 3

Issue description
The respondent queried why Whalan Creek Bridge is not proposed to be widened or raised as part of the proposal.

The respondent also queried why the road between Tackinbri Creek and Mungle Back Creek (south of the proposal) is not proposed to be improved as part of the proposal.

Response
The Whalan Creek Bridge abutment was rehabilitated in 2016. The remaining life of the bridge has been assessed to be about 50 years. Therefore, Roads and Maritime made the decision not to undertake further modifications to Whalan Creek Bridge.

The extent of the project has been defined by analysing the Newell Highway pavement deflection data between Moree and Boggabilla. The data analysis found that the section from Mungle Back Creek north to Boggabilla south was a priority for rehabilitation over other road sections including the road between Tackinbri Creek and Mungle Back Creek.

3.5 Offer of materials to construct the proposal

Submission number: 4

Issue description
The respondent informed Roads and Maritime that they have a deposit of material 27 kilometres east of Goondiwindi in Queensland that may suit the requirements for the proposal.

Response
Roads and Maritime takes note of the material availability as described in this submission. An assessment will be made of available sources of material (including that identified by the respondent) with procurement decisions based on quality and cost effectiveness.
4 Proposal refinements

Roads and Maritime has refined and further developed a number of aspects of the proposal as documented in the REF. These refinements have resulted in a revised construction work zone boundary. This section describes the refinements made to the proposal, including how the refinements differ in scope from the REF and the reasons for the refinements.

Additional potential impacts (either positive or negative) resulting from the proposed refinements are discussed in Chapter 4.

4.1 Refinements to the road alignment and proposal footprint

Refinements made to the road alignment and project extent are described from south to north in Table 4-1 and shown in the maps in Appendix A. The locations of the refinements are given in chainage (Ch).

Table 4-1 Refinements to the road alignment

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Ch 87,400</td>
<td>The southernmost limit of the proposal and corresponding construction work zone has been slightly shifted north from Ch 87,150 to Ch 87,400.</td>
<td>Facilitate the tie-in at the southern end of the proposal.</td>
</tr>
<tr>
<td>R2</td>
<td>Ch 89,250 – Ch 91,850</td>
<td>The road alignment in this section as described in the REF was within the existing highway’s footprint (online). Now, it is proposed to construct the road parallel (to the east) to the existing highway.</td>
<td>Minimise traffic disruptions and reduce construction timing and costs.</td>
</tr>
<tr>
<td>R3</td>
<td>Ch 94,200 – Ch 98,400</td>
<td>The road alignment has been shifted slightly to the west.</td>
<td>Avoid private property impacts.</td>
</tr>
<tr>
<td>R4</td>
<td>Ch 97,850 – Ch 98,950</td>
<td>The construction work zone has been widened slightly on both sides of the proposal.</td>
<td>Allow sufficient space for construction traffic staging near Whalan Creek Bridge.</td>
</tr>
<tr>
<td>R5</td>
<td>Ch 99,000 – Ch 99,500</td>
<td>The proposal both sides of the existing Whalan Creek Bridge approaches has been moved further from the bridge.</td>
<td>Facilitate construction traffic staging at Whalan Creek Bridge approaches.</td>
</tr>
<tr>
<td>R6</td>
<td>Ch 99,600 – Ch 102,450</td>
<td>The road alignment has been shifted slightly to the east.</td>
<td>Improve geometry between the two curves.</td>
</tr>
<tr>
<td>R7</td>
<td>Ch 102,450 – Ch 111,800</td>
<td>The road alignment in the REF was proposed to be constructed parallel to the existing highway to the east. Now, it is proposed to construct parallel to the existing highway to the west.</td>
<td>Avoid impact on existing high voltage transmission lines, minimise traffic disruptions and reduce construction timing and costs.</td>
</tr>
</tbody>
</table>
The northernmost limit of the proposal and corresponding construction work zone has been shifted slightly south from Ch 115,035 to Ch 114,600.

Facilitate the tie-in with the future Boggabilla bypass.

The road design assesses in the REF did not include Audio Tactile Line Marking (ATLM). It is now proposed to install ATLM for all major delineation along the highway with exception of intersections and overtaking lanes.

Enhance road safety by improving road delineation visibility and an audio-tactile warning to road users.

4.2 Refinements to improve local road intersections

Work on the design of local road intersections identified the need for greater space at some locations to improve the safety and function of the proposal. These are listed in Table 4-2 and shown in Appendix A.

Table 4-2 Refinements to improve local road intersections

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Ch 94,700</td>
<td>The property access tie-in has been refined.</td>
<td>Allow removal of the existing embankment.</td>
</tr>
<tr>
<td>L2</td>
<td>Ch 98,350</td>
<td>The extension of the construction work zone on local road has been refined.</td>
<td>Allow upgrade of the local road connecting ancillary facility No 2 with the highway.</td>
</tr>
<tr>
<td>L3</td>
<td>Ch 98,400</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L4</td>
<td>Ch 100,500</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L5</td>
<td>Ch 113,500</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L6</td>
<td>Ch 114,700</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L7</td>
<td>Ch 115,250</td>
<td>The extension of the construction work zone on the local road has been refined.</td>
<td>Allow upgrade of the local road connecting ancillary facility No 3 with the highway.</td>
</tr>
</tbody>
</table>
### 4.3 Refinements to improve drainage

Design and modelling work of the proposal’s drainage strategy identified the need for greater space to accommodate some drainage structures. These are listed in **Table 4-3**.

**Table 4-3 Refinements to improve drainage**

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Ch 87,800</td>
<td>An additional open drain coming from existing culvert has been provided</td>
<td>Convey runoff from the pavement surface</td>
</tr>
<tr>
<td>D2</td>
<td>Ch 88,400</td>
<td>An additional open drain coming from existing culvert has been provided</td>
<td>Convey runoff from the pavement surface</td>
</tr>
<tr>
<td>D3</td>
<td>Ch 89,750</td>
<td>Culvert sizes have been reduced.</td>
<td>Remove the need for safety barrier while still meeting drainage requirements.</td>
</tr>
<tr>
<td>D4</td>
<td>Ch 93,500</td>
<td>Allowance has been made for longitudinal drainage at a property access.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D5</td>
<td>Ch 96,400</td>
<td>Allowance has been made for longitudinal drainage at a property access.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D6</td>
<td>Ch 100,000</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D7</td>
<td>Ch 100,550</td>
<td>The existing embankment has been removed.</td>
<td>Reduce flooding impacts on adjacent land.</td>
</tr>
<tr>
<td>D8</td>
<td>Ch 101,200</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D9</td>
<td>Ch 102,300</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D10</td>
<td>Ch 103,100</td>
<td>The vertical alignment of the highway has been lowered.</td>
<td>Reduce flooding impacts on adjacent land.</td>
</tr>
<tr>
<td>D11</td>
<td>Ch 111,800</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D12</td>
<td>Ch 112,300</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D13</td>
<td>Ch 112,400</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D14</td>
<td>Ch 112,500</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
</tbody>
</table>
5 Additional investigations and assessment

Additional investigations and assessments were carried out during, and after, the REF public display. These are documented below and in the appendices to this report.

5.1 Design refinement

5.1.1 Summary
As noted in Chapter 4, Roads and Maritime has made a number of refinements to the proposal. These refinements have resulted in a revised construction work zone boundary. Refinements have been made to:
- the road alignment and proposal extent
- local road intersections
- drainage
- the work zone to enable construction traffic staging.

5.1.2 Impact assessment
To understand the potential change in environmental impacts compared to that assessed in the REF, a screening assessment was conducted and is presented in Table 5-1. This assessment considers potential environmental aspects that may require further assessment to understand likely environmental impacts, and identify any relevant mitigation measures that may be required. An assessment of those aspects determined to have a potential change in impacts from the Environmental Impact Statement is provided below. Only changed additional potential impacts (either positive or negative) resulting from the proposed refinements are discussed in the following sections. Impacts considered to be consistent with the REF or regarded as being unaltered are not discussed.

Table 5-1 Environmental screening assessment

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential change of impacts</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity</td>
<td>Yes</td>
<td>The proposal refinements have resulted in a revised construction work zone boundary which in turn has resulted on changes to the impacts assessed in the REF. A further assessment is provided in Section 5.2.</td>
</tr>
<tr>
<td>Noise</td>
<td>No</td>
<td>The horizontal and vertical alignment refinements are considered to be small from an acoustic perspective, especially in sections near sensitive receivers. Given the small nature of the design alignment refinements and the large separation distances to the nearest sensitive receivers, it is unlikely the refinements would affect the outcomes of this noise assessment documented in the REF.</td>
</tr>
<tr>
<td>Landscape character and visual amenity</td>
<td>No</td>
<td>The proposal refinements are considered to be minor and confined within the road reserve. The magnitude, sensitivity and resulting impacts on the landscape character zones and sensitive receivers would be consistent with the impacts documented in the REF.</td>
</tr>
</tbody>
</table>
## Aspect | Potential change of impacts | Commentary
--- | --- | ---
Aboriginal heritage | Yes | The proposal refinements would result in direct impacts to three Aboriginal Artefacts which were assessed as not impacted in the REF. A further assessment is provided in Section 5.3.
Non-Aboriginal heritage | No | There are no heritage listed items within or near the proposal area hence the proposal refinements are not expected to impact the non-Aboriginal heritage. No further assessment is considered necessary.
Traffic and access | No | The proposal refinements would not result in changes to the construction traffic impacts documented in the REF. Proposed refinements to the road alignment and local road intersections are expected to improve local road access and safety during operation. No further assessment is considered necessary.
Soils and water | No | The proposal refinements would not change the potential soils, contamination or water quality impacts. No further assessment is considered necessary.
Flooding and hydrology | Yes | Refinements to the road alignment would result on afflux in private land which were not identified as impacts in the REF. A further assessment is provided in Section 5.4.
Socio-economic and land use | No | The proposal refinements would not result in additional impacts to amenity, social and community infrastructure or local businesses. It would not trigger private land acquisition. No further assessment is considered necessary.
Air quality | No | The proposal refinements would not result in any additional air quality impacts. No further assessment is considered necessary.
Greenhouse gas emissions and climate change | No | The proposal refinements would not result in noticeable changes to greenhouse emissions. No further assessment is considered necessary.
Waste and resource minimisation and management | No | The proposal refinements would result in minor changes in the volume of materials handled. However, it would not result in the generation of any different waste materials or a change in the management approach.
Bushfire risk | No | The proposal refinements would not result in changes to bushfire risk or the proposed management approach. No further assessment is considered necessary.

### 5.2 Supplementary biodiversity assessment

This section describes the supplementary investigations and assessment that were undertaken for this submissions report. The full supplementary biodiversity assessment report is presented in Appendix B.
5.2.1 Summary

The REF determined that the Brigalow-Belah Woodland found in the proposal area is commensurate with Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions, listed as an Endangered Ecological Community (EEC) under the Threatened Species Conservation Act 1995 (TSC Act) (NSW), and Brigalow (Acacia harpophylla dominant and co-dominant), listed as an EEC under the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) (Cwth) and is herein referred to as Brigalow-Belah EEC.

Roads and Maritime commissioned OzArk Environmental & Heritage Management Pty Ltd (OzArk) to provide an independent review of the extent of Brigalow-Belah EEC and other plant community types in the proposal area, review the area of potential impact on Brigalow-Belah EEC and subsequently revaluate the requirement for offsetting this EEC to inform the biodiversity offset strategy as required by REF environmental safeguard BD-1.

Additional field survey was carried out in the proposal area by OzArk between 19 and 20 March 2017. OzArk field survey involved the collection of data from eight biobanking plots, including:

- data required in accordance with NSW Biobanking Assessment Methodology (2014), to fulfil the requirements of the biobanking credit calculator and to calculate offset requirements for the proposal
- full floristic data including abundance information
- eight biobanking plots in the following areas:
  - four plots in vegetation within maintained roadside areas (mapped as moderate-good condition Brigalow-Belah EEC by Arcadis)
  - three plots in vegetation within table drains adjoining roadside areas (mapped as moderate-good condition Brigalow-Belah EEC by Arcadis)
  - one plot within the Belah Woodland plant community.

OzArk findings in relation to Brigalow-Belah EEC were as follows:

- maintained areas (defined as regularly mowed area immediately adjacent to sealed road surface, approximately seven metres wide) do not support vegetation commensurate with Brigalow-Belah EEC listed under either the TSC Act or EPBC Act
- table drains (defined as not mowed but irregularly slashed areas approximately up to seven metres wide, on the outer side of the maintained area) support vegetation commensurate with Brigalow-Belah EEC listed under the TSC Act, but this area of EEC has been changed from moderate-good condition to low condition. This vegetation is not commensurate with Brigalow-Belah EEC listed under the EPBC Act
- areas more than 14 metres from the sealed road surface support native vegetation commensurate with Brigalow-Belah EEC listed under both the TSC Act or EPBC Act in moderate condition.

In addition, OzArk made refinements to the following plant community types mapped by Arcadis (2016):

- one area at Ch 87,000 (southbound lane) was changed from Brigalow-Belah EEC to Popular Box Shrubby Woodland in moderate-good condition
- one area between Ch 92,500 and Ch 93,250 (southbound lane) was changed from Belah Woodland to two separate communities (half Brigalow-Belah EEC and half as Popular Box Shrubby Woodland) in mostly moderate-good condition.

Roads and Maritime has adopted OzArk’s approach as discussed above and revised the plant community types found in the proposal area are listed in Table 5-2 and shown in Figure 5-1. Appendix B contains an updated detailed description of these vegetation communities.
<table>
<thead>
<tr>
<th>Vegetation community</th>
<th>Area (ha) in study area reported in the REF</th>
<th>Area (ha) in study area mapped by OzArk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brigalow-Belah woodland EEC</td>
<td>52</td>
<td>45</td>
</tr>
<tr>
<td>Belah woodland</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Poplar Box shrubby woodland</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>River Red Gum open woodland</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Windmill Grass - Bluegrass derived grassland</td>
<td>128</td>
<td>105</td>
</tr>
<tr>
<td><strong>Total native vegetation</strong></td>
<td><strong>253</strong></td>
<td><strong>216</strong></td>
</tr>
<tr>
<td>Cleared and disturbed</td>
<td>11</td>
<td>48</td>
</tr>
<tr>
<td>Crop/pasture</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
</tr>
</tbody>
</table>
Figure 5-1 Revised plant community types in the proposal area (1 of 7)
Figure 4-2 Revised plant community types in the proposal area (2 of 7)
Figure 4-2 Revised plant community types in the proposal area (3 of 7)
Figure 4-2 Revised plant community types in the proposal area (4 of 7)
Figure 4-2 Revised plant community types in the proposal area (5 of 7)
Figure 4-2 Revised plant community types in the proposal area (6 of 7)
Figure 4-2 Revised plant community types in the proposal area (7 of 7)
5.2.2 Impact of design refinements

As outlined in Chapter 4, several refinements have been made to the proposal resulting in a revised construction work zone boundary (as shown in Appendix A). The impacts of the design refinements are documented in the following sections.

Revised impact on native vegetation and threatened ecological communities

Table 5-3 shows the revised amounts of vegetation that would require clearing, adopting the refinements carried out by OzArk listed in Table 5-2.

The REF determined that 17.5 hectares of Brigalow-Belah Woodland, commensurate with Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions, listed as an EEC under the TSC Act and Brigalow (*Acacia harpophylla* dominant and co-dominant), listed as an EEC under the EPBC Act, would be cleared for the proposal.

The revised area of Brigalow-Belah EEC to be cleared, incorporating the mapping refinements carried out by OzArk (2017), would be:
- Total of 10.2 hectares of Brigalow-Belah EEC as listed under the EPBC Act
- Total of 15.3 hectares of Brigalow-Belah EEC as listed under the TSC Act comprising of 5.1 hectares in low condition and 10.2 hectares in moderate-good condition.

### Table 5-3 Vegetation to be cleared

<table>
<thead>
<tr>
<th>Plant Community Type</th>
<th>Condition</th>
<th>Area to be cleared, as determined by the REF</th>
<th>Area to be cleared in revised construction work zone (ha)</th>
<th>REF vegetation community mapping</th>
<th>OzArk (2017) vegetation community mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under TSC Act)</td>
<td>Low</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5.1</td>
</tr>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under TSC Act)</td>
<td>Moderate-Good</td>
<td>17.5</td>
<td>20.8</td>
<td>10.2</td>
<td></td>
</tr>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under EPBC Act)</td>
<td>Moderate-Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belah woodland</td>
<td>Moderate-good</td>
<td>5.5</td>
<td>6.0</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Poplar Box shrubby woodland</td>
<td>Moderate-good</td>
<td>10.6</td>
<td>16.9</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>River Red Gum open woodland</td>
<td>Moderate-good</td>
<td>0.4</td>
<td>0.7</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Windmill Grass - Bluegrass derived grassland</td>
<td>Moderate-good</td>
<td>41.2</td>
<td>60.9</td>
<td>38.3</td>
<td></td>
</tr>
<tr>
<td><strong>Total native vegetation</strong></td>
<td></td>
<td><strong>75.2</strong></td>
<td><strong>105.3</strong></td>
<td></td>
<td><strong>69.7</strong></td>
</tr>
</tbody>
</table>
### Revised impact on threatened flora and fauna species

The TSC Act assessments of significance and EPBC Act significant impact assessments documented in the REF were updated based on the refinements to the proposal documented in Chapter 4.

The updated assessments concluded that the proposal as documented in this submissions report would not have significant impact on all relevant threatened species, populations and communities listed under the above legislation.

Refer to Appendix B for the updated assessments of significance (TSC Act) and significant impact assessments (EPBC Act).

### Revised impact on fauna

The REF determined that a total of 75.2 hectares of fauna habitat would be cleared for the proposal (Table 5-4), although this includes 41.3 hectares of grassland that offers limited habitat resources to fauna. Within the area of habitat to be removed, a total of 11 hollow-bearing trees were impacted. Based on the revised construction work zone boundary, 109.2 hectares of fauna habitat would be cleared for the proposal including 16 hollow-bearing trees.

#### Table 5-4 Revised fauna habitat impacts

<table>
<thead>
<tr>
<th>Impact</th>
<th>REF impact</th>
<th>Revised impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacted woodland containing fauna habitat</td>
<td>34 hectares</td>
<td>44.4 hectares</td>
</tr>
<tr>
<td>Impacted grassland with limited habitat resources</td>
<td>41.3 hectares</td>
<td>64.8 hectares</td>
</tr>
<tr>
<td>Number of hollow-bearing trees impacted</td>
<td>11</td>
<td>16</td>
</tr>
</tbody>
</table>

### Revised impact on fauna connectivity

The REF states that, between Ch 89,250 and Ch 91,850, the proposal would be constructed within the existing highway's footprint. It is now proposed to be parallel to the existing highway (refer to design refinement No R2 in Table 4-1 and Appendix A).

This refinement would result in a wider gap between patches of habitat occurring on the eastern and western side of the Newell Highway at this location. It would also result in construction work on riparian vegetation at Wallaby Creek and other unnamed watercourses located within these chainages.

Notwithstanding these additional impacts, the overall impact on fauna connectivity is considered to be negligible.

---

<table>
<thead>
<tr>
<th>Plant Community Type</th>
<th>Condition</th>
<th>Area to be cleared, as determined by the REF (ha)</th>
<th>Area to be cleared in revised construction work zone (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleared and Disturbed</td>
<td>Poor</td>
<td>0.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Crop/Pasture</td>
<td>Poor</td>
<td>0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>75.3</td>
<td>109.2</td>
</tr>
</tbody>
</table>
Revised impacts on aquatic habitat

As noted above, design refinement No R2 would result in additional construction adjacent to the existing highway at watercourses between Ch 89,250 and Ch 91,850. If unmanaged, construction erosion, sedimentation and water flow changes on these watercourses would result in additional temporary alteration of downstream habitats and flow patterns, although it is acknowledged that these watercourses are classified in accordance with Fairfull and Witheridge (2003) as Class 4 watercourses with unlikely fish habitat.

Erosion and sediment control measures outlined in the REF will be implemented to manage impacts on aquatic habitats during construction.

5.2.3 Environmental safeguards

No additional mitigation measures are required beyond those provided in the REF.

5.3 Supplementary Aboriginal heritage assessment

5.3.1 Summary

An addendum to the Aboriginal Archaeological Survey (Aboriginal cultural heritage consultation and investigation (PACHCI) Stage 2) report and a preliminary Aboriginal Cultural Heritage Assessment (PACHCI Stage 3) report have been prepared for the proposal.

The reports are presented in Appendix C and summarised below.

Addendum to the Aboriginal archaeological survey (PACHCI Stage 2) report

Additional Aboriginal survey field work was completed for the area impacted by the design modification R7 (see Table 4-1) which was not surveyed during the REF Aboriginal heritage investigations.

The Aboriginal survey field work was conducted on 21 February 2017 by Michael Lever and Alyce Haast (Artefact), Uncle Reg Haines, Malcolm McGrady and David McGrady (Toomelah Local Aboriginal Land Council), and Jeff Charlton (Roads and Maritime). The extent of the area surveyed is presented in Figure 5-2. The area surveyed was observed to be disturbed for about 20 metres westward from the western road edge of the Newell Highway. The survey found no new sites of Aboriginal cultural heritage, potential archaeological deposits, modified tress or lithic artefacts. The surveyed area was deemed to have low archaeological potential.

The survey team attempted to locate Aboriginal Artefact 1, Artefact 2 and Artefact 3 previously identified during the REF Aboriginal heritage investigations. Artefact 1 and Artefact 2 could not be found, and it was considered likely that these two Aboriginal artefacts were impacted by vehicular traffic and dislodged into the roadside vegetation. Artefact 3 was successfully located by the survey team and marked with a hi-visibility flag attached to a steel peg. The nearest roadside post to Artefact 3 was also marked to facilitate future location.

The survey team also inspected the proposed MacIntyre River pump site and confirmed the proposed works at this location would be contained in areas previously surveyed and determined to be of low archaeological potential as part of the PACHCI Stage 2 completed for the REF. Aboriginal test excavations are not required at this location.
Figure 5-2 Addendum PACHCI Stage 2 survey effort
A preliminary Aboriginal cultural heritage assessment (PACHCI Stage 3) report has been prepared to identify and assess Aboriginal heritage impacts resulting from the proposal refinements, document the Aboriginal community consultation for the assessment process, recommend further mitigation and management measures and seek an Aboriginal heritage impact permit (AHIP) from the OEH.

Roads and Maritime has commenced a Stage 3 PACHCI for the proposal in accordance with the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (Roads and Maritime, 2011). The following Stage 3 PACHCI tasks have been completed to date:

- identification of Aboriginal stakeholders with an interest in the proposal and who hold cultural knowledge about objects and places in the proposal area
- notification of these stakeholders by letter
- advertising in printed media
- preparation of a cultural heritage assessment report (this report is provided in Appendix C)
- preparation of an Aboriginal parties register, and provision of the register to the NSW Office of Environment and Heritage (OEH), the Gomeroi people and the Toomelah Local Aboriginal Land Council (LALC)
- preparation for an Aboriginal focus group meeting (scheduled for May 2017).

Roads and Maritime is currently inviting registered parties to an Aboriginal focus group meeting. The addendum to the Aboriginal Archaeological Survey (PACHCI Stage 2) and the Preliminary Aboriginal Cultural Heritage Assessment (PACHCI Stage 3) report will be provided to registered parties to give the opportunity to contribute cultural information about the proposal area as well as contributing to the proposed methodologies outlined in these reports.

5.3.2 Impacts of design refinements

The design refinements would impact three Aboriginal site locations that were described in the REF but not previously impacted (refer to Figure 5-3):

- design refinement R7 described in Table 3 1 and shown in Appendix A would impact Aboriginal site locations for Artefact 1 (AHIMS No 02-4-0086) and Aboriginal Artefact 3 (AHIMS No 02-4-0088)
- design refinement R3 described in Table 3 1 and shown in Appendix A would impact Aboriginal site location for Artefact 2 (AHIMS No 02-4-0087).

The change of type, degree and consequence of impact for each artefact is described in Table 5-5.
Figure 5-3 Impacted Aboriginal sites
### Table 5-5 Impacted Aboriginal sites

<table>
<thead>
<tr>
<th>Description</th>
<th>REF assessment</th>
<th>Revised assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Artefact 1</strong> (AHIMS No 02-4-0086)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material and colour – Grey &amp; yellow chert</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Dimensions – 20mm x 20 mm x 5 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description – Proximal flake fragment with cortex on platform</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Artefact 2</strong> (AHIMS No 02-4-0087)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material and colour – Fine pink silcrete</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Dimensions – 35 mm x 40 mm x 20 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description – Multipurpose core, 4 negative flake scars, cortex on dorsal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Artefact 3</strong> (AHIMS No 02-4-0088)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material and Colour – Yellow silcrete</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Dimensions – 30 mm x 35 mm x 7 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description – Medial flake fragment, 3 negative scars.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The three artefact locations that would be impacted are not associated with any areas of archaeological potential. As such, no archaeological test excavations are required at these locations.

An AHIP will be prepared and submitted for OEH approval for the three artefacts. The Aboriginal cultural heritage assessment report (Appendix C) will be updated and finalised with any AHIP approval conditions issued by OEH as well as with feedback received from registered parties.

On receipt of the AHIP approval, Roads and Maritime and registered parties will attempt to locate, and if successful, collect and curate or rebury the three artefacts. The execution of this task will be guided by the feedback received from registered parties as part of the Stage 3 PACHCI process.

If additional design refinements are likely to impact to any of the identified Scarred Trees 1, 2, 3, 4, 5 and 6 (AHIMS 02-4-0079, 02-4-0080, 02-4-0081, 02-4-0082, 02-4-0084 and 02-4-0083 respectively) from the proposal, an addendum Cultural Heritage Assessment Report and revised consultation with stakeholders, including a second Aboriginal Focus Group, will be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP where this impact is identified after issuance by OEH of the first Aboriginal heritage impact permit.

5.3.3 Environmental safeguards
The following additional management and mitigation measures will be included as part of the proposal:

- the final version of the Preliminary Aboriginal Cultural Heritage Assessment (PACHCI Stage 3) Report and accompanying documentation will be forwarded to registered Aboriginal parties and OEH with an Aboriginal heritage impact permit application
- an area-based Aboriginal heritage impact permit will be obtained for the proposal to permit salvage collection of identified isolated artefacts Artefact 1 (02-4-0086), Artefact 2 (02-4-0087) and Artefact 3 (02-4-0088), and to allow subsequent impact to their locations
- once the Aboriginal heritage impact permit is obtained, Roads and Maritime will arrange, in accordance with the recommendations of registered Aboriginal stakeholders and the OEH guidelines:
  - community collection of these artefacts
  - facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.

The following management and mitigation measures have been amended as part of the proposal (amendments are underlined):

- an appropriate exclusion zone will be established by a qualified arborist around Scarred Trees 1, 2, 3, 4, 5 and 6 (AHIMS 02-4-0079, 02-4-0080, 02-4-0081, 02-4-0082, 02-4-0084 and 02-4-0083 respectively). A barrier with visual markers and signage will be installed around each exclusion zone while construction is being undertaken
- an exclusion zone will be defined by a qualified archaeologist and a barrier with visual markers and signage will be erected around interface between the construction work zone and AHIMS 02-4-0024, AHIMS 02-4-0025 and MBC PAD01 Artefact 1, Artefact 2 and Artefact 3 while construction is being undertaken
- a heritage induction will be provided to workers before construction begins. It will inform them of access restrictions to exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work
- if unexpected archaeological finds or suspected human remains are discovered, Roads and Maritime’s Standard Management Procedure for Unexpected Heritage Items (2015) will be followed. In addition, the NSW Heritage Division will be notified of the discovery of a relic, in accordance with Section 146 of the NSW Heritage Act 1977.
5.4 Supplementary flooding assessment

5.4.1 Summary
A two-dimensional flood model was developed to determine whether the design refinements will achieve the proposal flood criteria. These criteria are:

- achieve zero afflux in the one in 100-year Average Recurrence Interval (ARI) flood event on surrounding properties unless agreed with affected property owners
- improve carriageway flood immunity up to a 20-year ARI for the upgraded highway, where feasible and reasonable.

5.4.2 Design refinements flood modelling results
The flood model prepared for the REF predicted the design will achieve the proposal flood criteria. However, the flood model for the design refinements predicts minor localised non-compliances with the flood criteria as discussed in the following sections.

Flood criteria non-compliances on private land
The flood model for the design refinements reveals minor localised afflux at the private properties listed in Table 5-6. Feasible and reasonable measures to avoid or mitigate afflux on these private lands will be investigated as the design progresses. Where afflux impacts cannot be avoided in a feasible and reasonable manner, agreement with affected property owners will sought by Roads and Maritime.
<table>
<thead>
<tr>
<th>Location</th>
<th>Lot / DP</th>
<th>Predicted afflux</th>
<th>Area impacted</th>
<th>Commentary</th>
<th>Mitigation approach to be investigated during detailed design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch 112,700 to Ch 113,800</td>
<td>Lot 221 DP 755980</td>
<td>Up to 10 mm</td>
<td>0.1</td>
<td>Afflux will be caused by the proposed embankment to the east (upstream) of the existing highway embankment. The afflux will be contained within the existing extent of inundation and consequently will not cause any significant impacts.</td>
<td>The afflux could be potentially mitigated by the construction of a small longitudinal channel to more efficiently move flow to the culvert at Ch 113,400. However, there is limited room between the proposed road embankment and the road reserve boundary at this location.</td>
</tr>
<tr>
<td>(refer to Figure 5-4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch 100,800 to Ch 101,800</td>
<td>Lot 3 and Lot 74/756007; Lot 72/455042</td>
<td>Up to 18 mm</td>
<td>42</td>
<td>Afflux will occur to the east (upstream) of the proposal due to the capacity of the proposed culvert.</td>
<td>Refinement of the culvert capacity could potentially eliminate this afflux impact.</td>
</tr>
<tr>
<td>(refer to Figure 5-5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch 94,800</td>
<td>East: Lot 1 DP 734288; West: Lot 10 DP 756031</td>
<td>Up to 50 mm downstream (east)</td>
<td>1.2 (east)</td>
<td>Up to 30 mm afflux will occur upstream (east) of the proposal due to higher upstream levels at the culvert located at Ch 94,860, resulting in a lower headwater depth at the culvert inlet, which will reduce the proposed culvert capacity as the water levels rise early in the ARI event. This effect will not be mitigated by the additional culvert capacity by the time the peak flow occurs. Up to 50 mm afflux will occur downstream (west) of the proposal due to increased flow later in the ARI event when culvert headwater levels are higher and can access the additional culvert capacity. This will deliver a greater downstream flow at the peak of the flood.</td>
<td>Afflux impacts could be potentially mitigated by lowering the upstream inlet level.</td>
</tr>
<tr>
<td>Ch 95,800</td>
<td></td>
<td>Up to 30 mm upstream (west)</td>
<td>0.9 (west)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Lot / DP</td>
<td>Predicted afflux¹ (mm)</td>
<td>Area impacted (Ha)</td>
<td>Commentary</td>
<td>Mitigation approach to be investigated during detailed design</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Ch 92,800 to Ch 93,000 (refer to Figure 5-7)</td>
<td>Lot 1 DP 1072927</td>
<td>Up to 90 mm</td>
<td>0.1</td>
<td>Upstream (east) afflux will be caused by minor changes to the flow distribution through the multiple culverts. Land impacted will be localised at the culvert outlet and within existing inundated areas.</td>
<td>No mitigation is proposed at this location as the land that will be impacted is within existing inundated areas.</td>
</tr>
<tr>
<td>Ch 90,100 to Ch 90,300 (refer to Figure 5-8)</td>
<td>Lot 12 DP 756031</td>
<td>Up to 125 mm</td>
<td>3.5</td>
<td>The downstream (west) afflux will occur due to up to 60 mm flow over the road in the ARI event.</td>
<td>These impacts will be avoided by altering the vertical alignment of the highway so the eastern (upstream) hinge point is a minimum of 227.5 m AHD, and by providing an increase in the culvert capacity at Ch 90,180.</td>
</tr>
</tbody>
</table>

Note: ¹ Afflux values represent the maximum increase of water level above normal depth.
Figure 5-4 Predicted afflux at location Ch 112,700 to Ch 113,800
Figure 5-5 Predicted afflux at location Ch 100,800 to Ch 101,800
Figure 5-6 Predicted afflux at location Ch 94,880 and Ch 95,800
Figure 5-7 Predicted afflux at location Ch 92,900 to Ch 93,000
Figure 5-8 Predicted afflux at location Ch 90,100 to Ch 90,300
Flood criteria non-compliances on the highway
The flood model for the design refinements reveals there will be sections of the proposal where the 20-year ARI flood immunity will not be achieved (Table 5-7).

Table 5-7 Over-road flow widths where carriageway does not achieve 20-year ARI flood immunity

<table>
<thead>
<tr>
<th>Location</th>
<th>20-year ARI over-road flow width for proposed carriageway (m)</th>
<th>Mitigation approach to be investigated during detailed design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch 91,500</td>
<td>70</td>
<td>This non-compliance could be potentially addressed by refining the culvert capacity at this location.</td>
</tr>
<tr>
<td>Ch 92,900</td>
<td>60</td>
<td>This non-compliance is deemed acceptable by Roads and Maritime as the flood depth over the proposed carriageway is predicted to decrease when compared to the existing carriageway.</td>
</tr>
<tr>
<td>Ch 97,000</td>
<td>175</td>
<td>This non-compliance is deemed acceptable by Roads and Maritime as the road flood width over the proposed carriageway is predicted to be less than that of the existing carriageway.</td>
</tr>
</tbody>
</table>

5.4.3 Environmental safeguards
During detailed design, the non-compliances documented above will be addressed as per environmental safeguard HY-1 in the REF, which requires Roads and Maritime to achieve the flood impact criteria for the surrounding properties where feasible and reasonable. Where the flood impact criteria cannot be met at surrounding properties, Roads and Maritime will reach agreement with affected landowners on impacts to their property. No additional mitigation measures are required beyond those provided in the REF.
6 Environmental management

The Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement review of environmental factors (Roads and Maritime, February 2017) (the REF) identified the framework for environmental management, including safeguards and management measures that will be adopted to avoid or reduce environmental impacts.

After consideration of the issues raised in the public submissions and the proposal refinements, the safeguard and management measures have been revised.

Should the proposal proceed, environmental management will be guided by the framework and measures outlined below.

6.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Construction Environmental Management Plan (CEMP) will be prepared to describe safeguards and management measures identified. These plans will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation. The plans will be prepared before construction of the proposal and must be reviewed and certified by the Roads and Maritime Environment Officer, western region, before starting any on-site work. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP will be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan) and the QA Specification G40 – Clearing and Grubbing.

6.2 Summary of safeguards and management measures

Chapter 7 of the REF identifies a range of environmental outcomes and management measures that would be required to avoid or reduce the environmental impacts.

After considering the issues raised in the public submissions and assessing the design refinements, the environmental safeguards and management measures have been revised. Should the proposal proceed, the environmental management measures in Table 6-1 will guide the subsequent development of the proposal.

In Table 6-1, additional and/or modified environmental safeguards and management measures to those presented in the REF are underlined and deleted measures, or parts of measures, have been struck out.
Table 6-1: Summary of environmental safeguards and management measures

<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Timing</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD-1</td>
<td>Removal of native vegetation, threatened plants, threatened species</td>
<td>A Biodiversity Offset Strategy will be developed in accordance with the Guideline for Biodiversity Offsets (Roads and Maritime, 2011) and implemented.</td>
<td>Pre-construction</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td></td>
<td>habitat and habitat procedures</td>
<td></td>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td>BD-2</td>
<td></td>
<td>Pre-clearing surveys will be undertaken in accordance with Guide 1: Pre-clearing Process of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011).</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
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<tr>
<td>BD-3</td>
<td></td>
<td>Vegetation removal will be undertaken in accordance with Guide 4: Clearing of Vegetation and Removal of Bushrock of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011).</td>
<td>During construction</td>
<td>Construction contractor</td>
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<tr>
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</tr>
<tr>
<td>BD-4</td>
<td></td>
<td>Native vegetation will be re-established in accordance with Guide 3: Re-establishment of Native Vegetation of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) and the Landscape Character and Visual Technical Paper (SMM 2016).</td>
<td>Post construction</td>
<td>Construction contractor</td>
</tr>
<tr>
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</tr>
<tr>
<td>BD-5</td>
<td></td>
<td>The unexpected species find procedure in the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011) will be followed if threatened ecological communities, threatened flora or threatened fauna not assessed in the biodiversity assessment are identified within the construction work zone.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
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</tr>
<tr>
<td>BD-6</td>
<td></td>
<td>Habitat will be replaced or re-instated in accordance with Guide 5: Re-use of Woody Debris and Bushrock and Guide 8: Nest Boxes of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
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</tr>
<tr>
<td>BD-7</td>
<td></td>
<td>Site inductions for construction staff will include a briefing on the limit of the areas allowed to be cleared for construction, the potential presence of threatened species and their habitat adjacent to the development footprint, their significance and locations, and the extents of no-go zones.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Timing</td>
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<tr>
<td>BD-8</td>
<td>Aquatic impacts</td>
<td>Aquatic habitat will be protected in accordance with <em>Guide 10: Aquatic Habitats and Riparian Zones of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</em> (RTA, 2011) and Section 3.3.2 Standard Precautions and Mitigation Measures of the <em>Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013</em> (DPI Fisheries NSW), 2013.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>BD-9</td>
<td>Fragmentation of identified habitat corridors and edge effects on adjacent native vegetation and habitat</td>
<td>Connectivity measures will be implemented in accordance with the <em>Wildlife Connectivity Guidelines for Road Projects</em> (RTA, 2011).</td>
<td>Detailed design, construction Post construction</td>
<td>Roads and Maritime Construction contractor</td>
</tr>
<tr>
<td>BD-10</td>
<td>Injury and mortality of native fauna</td>
<td>Exclusion zones will be set up at the limit of clearing in accordance with <em>Guide 2: Exclusion Zones of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</em> (RTA, 2011).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>BD-11</td>
<td>Noxious weeds</td>
<td>Native fauna found within the construction work zone will be managed in accordance with <em>Guide 9: Fauna Handling of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects</em> (RTA, 2011).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>BD-12</td>
<td>Noxious weeds</td>
<td>Noxious weeds will be managed in accordance with <em>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</em> (RTA 2011).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>NV-1</td>
<td>Noise impacts on sensitive receivers during construction</td>
<td>Management measures will be identified in construction environmental management documentation to minimise the potential noise impacts, in accordance with Appendix B of the <em>Construction Noise and Vibration Guidelines</em> (Roads and Maritime, 2016).</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>NV-2</td>
<td></td>
<td>A program of noise and vibration monitoring for sensitive receivers outside of standard construction work hours will be identified and incorporated in construction management documentation.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
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<tr>
<td>NV-3</td>
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<td>Unless negotiated with the community with consultation documented and approved by Roads and Maritime project manager or permitted under the proposal's Environmental Protection Licence, there should be no receiver exposed to noise emissions above the noise management levels over more than two consecutive nights.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>LV-1</td>
<td>Construction impacts</td>
<td>Once construction is complete – or progressively throughout the work, where feasible and reasonable – the ancillary facility sites will be returned to at least their pre-construction state.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>LV-2</td>
<td></td>
<td>Opportunities will be identified to retain existing trees within the ancillary facilities.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>LV-3</td>
<td></td>
<td>Temporary lighting will be screened or diverted to reduce unnecessary light spill on residences.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>LV-4</td>
<td>Landscape and visual impacts</td>
<td>The potential visual impact of earthwork will be minimised by integrating it with the adjoining landform. This will be achieved by gradually flattening the grades at the ends of fill embankments in order to avoid sharp transitions, where feasible and reasonable.</td>
<td>Detailed design</td>
<td>Roads and Maritime</td>
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<tr>
<td>LV-5</td>
<td></td>
<td>Cleared areas will be revegetated with grassland and woodland species (including grasses, groundcovers and shrubs, depending on sight line requirements) to match the landscape character to adjoining roadside areas and to screen the proposal from existing properties, where feasible and reasonable.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>LV-6</td>
<td></td>
<td>The proposed pump house at the Boggabilla boat ramp site will be screened with vegetation.</td>
<td>Detailed design</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>AH-1</td>
<td>Areas with no identified Aboriginal heritage values</td>
<td>In areas surveyed for this study where no Aboriginal heritage values have been identified, the proposed activity may commence without further formal archaeological assessment but must adhere to the CEMP.</td>
<td>Pre- construction</td>
<td>Roads and Maritime</td>
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<tr>
<td>AH-2</td>
<td>Salvage of impacted artefacts</td>
<td>An AHIP will be secured to permit salvage of the three isolated artefact sites (MBC Artefact 1 # 02-4-0086, MBC Artefact 2 02-4-0087, MBC Artefact 3 02-4-0088), and to permit any subsequent impacts to their locations. Roads and Maritime will arrange community collection of these artefacts and facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.</td>
<td>Pre-construction</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>AH-3</td>
<td>Avoiding impacts on scarred trees</td>
<td>An appropriate exclusion zone will be established by a qualified arborist around Scarred Trees 1, 2, 3, 4, 5 and 6 (AHIMS 02-4-0079, 02-4-0080, 02-4-0081, 02-4-0082, 02-4-0084 and 02-4-0083 respectively). A barrier with visual markers and signage will be installed around each exclusion zone while construction is being undertaken</td>
<td>Pre-construction</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>AH-4</td>
<td>Avoiding impacts on AHIMS sites, potential archaeological deposit and artefacts</td>
<td>An exclusion zone will be defined by a qualified archaeologist and a barrier with visual markers and signage will be erected around interface between the construction work zone and AHIMS 02-4-0024, AHIMS 02-4-0025 and MBC PAD01 Artefact 1, Artefact 2 and Artefact 3 while construction is being undertaken</td>
<td>Pre-construction</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>AH-5</td>
<td>Unexpected archaeological finds</td>
<td>A heritage induction will be provided to workers before construction begins. It will inform them of access restrictions to exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>AH-6</td>
<td>Unexpected archaeological finds</td>
<td>If unexpected archaeological finds or suspected human remains are discovered, Roads and Maritime’s Standard Management Procedure for Unexpected Heritage Items (2015) will be followed. In addition, the NSW Heritage Division will be notified of the discovery of a relic, in accordance with Section 146 of the NSW Heritage Act 1977.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
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<tr>
<td>NA-1</td>
<td>Unexpected archaeological finds</td>
<td>A heritage induction will be provided to workers before construction begins. It will inform them of access restrictions to exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
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<td></td>
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<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>NA-2</td>
<td>Unexpected archaeological finds</td>
<td>If unexpected archaeological finds or suspected human remains are discovered, Roads and Maritime’s Standard Management Procedure for Unexpected Heritage Items (2015) will be followed. In addition, the NSW Heritage Division will be notified of the discovery of a relic, in accordance with Section 146 of the NSW Heritage Act 1977.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
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<tr>
<td>TA-1</td>
<td>Road safety audit</td>
<td>Safety audits will be conducted during detailed design to identify and address potential safety issues associated with the operation of the proposal.</td>
<td>Detailed design</td>
<td>Roads and Maritime</td>
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<tr>
<td>TA-2</td>
<td>Construction traffic impacts</td>
<td>A Construction Traffic Management Plan will be developed. The plan will detail how the traffic associated with daytime and night-time construction activities will be managed in accordance with relevant Roads and Maritime standards, including Traffic Control at Work Sites (2010), AS1742.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
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<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-3</td>
<td>Impacts on the road network</td>
<td>The local community, road users and other stakeholders will be notified of changes to traffic conditions such as speed limit reductions and temporary lane closures.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
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<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-4</td>
<td></td>
<td>Residents will be notified of the start and duration of work where it impacts on property access and local road intersections.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-5</td>
<td></td>
<td>Traffic circulation along the proposal area will be maintained during construction at all times.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
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<td>Environmental safeguards</td>
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<tr>
<td>TA-6</td>
<td></td>
<td>Access to local roads and private properties will be maintained during construction at all times, where feasible and reasonable, unless otherwise agreed in advance by the relevant property owner or occupier.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-7</td>
<td></td>
<td>Pre-construction road dilapidation reports will be prepared for all local roads likely to be used by construction traffic. Post-construction road dilapidation reports will be prepared following the completion of construction for all roads assessed prior to construction. Dilapidation resulting from construction activity will be repaired. Copies of road dilapidation reports will be sent to the relevant roads authority.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-8</td>
<td>Impacts on existing bus stops</td>
<td>The school bus operator using the bus stops impacted by the proposal will be contacted before construction starts to find alternative pickup up and drop-off locations.</td>
<td>Pre-construction</td>
<td>Roads and Maritime contractor</td>
</tr>
<tr>
<td>TA-9</td>
<td></td>
<td>All bus stops temporarily removed or relocated during construction will be reinstated in a manner that provides equal or improved capacity and accessibility.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-10</td>
<td>Impacts on MacIntyre River access and traffic</td>
<td>Boggabilla residents and Moree Plains Shire Council will be notified of the start and duration of work associated with the Boggabilla boat ramp access road and the traffic and access restrictions associated with this work. Access to the ramp will be maintained at all times.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>TA-11</td>
<td>Impacts on flood evacuation routes</td>
<td>Emergency services will be notified of changes to traffic condition along the Newell Highway (eg reduced speed limits and temporary lane closures in some sections) at least one week before these changes take place.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
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</table>
| SW-1| Erosion and sediment control, and water quality | Industry standard erosion and sediment controls will be designed and implemented in accordance with the following specifications and guidelines:  
Roads and Maritime’s Erosion and Sedimentation Management Procedure (PN143)  
Roads and Maritime’s Soil and Water Management Specification (G38)  
The NSW Office of Water’s guidelines for controlled activities.  
These controls will be established before the start of construction and maintained in effective working order for the duration of the construction period and until the site is restored. | Construction | Construction contractor |
| SW-2| Contamination                         | The Guideline for the Management of Contamination (Roads and Maritime, 2013) will be applied to address any contamination issues and prevent any associated adverse impacts. | Detailed design  
Construction | Roads and Maritime  
Construction contractor |
| SW-3| Groundwater dependent ecosystems      | Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.                                                                                                    | Detailed design  
Construction | Roads and Maritime  
Construction contractor |
<p>| SW-4| Changes to hydrology                 | Changes to existing surface water flows will be minimised through detailed design.                                                                                                                                              | Detailed design | Roads and Maritime |
| SW-5| Stockpile management                 | Stockpiles will be managed in accordance with the Stockpile Site Management Guideline (RTA, 2008)                                                                                                                                 | Construction | Construction contractor |
| SW-6| Tannin-impacted water                | Tannin-rich leachate generated from mulch stockpiles will be managed in accordance with Roads and Maritime’s Environmental Direction – Management of Tannins from Vegetation Mulch (2012). | Construction | Construction contractor |
| SW-7| Impacts during operation             | The need to provide measures to manage emergency spills will be evaluated during detailed design.                                                                                                                                    | Detailed design | Roads and Maritime |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Environmental safeguards</th>
<th>Timing</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>HY-1</td>
<td>Impacts on flooding</td>
<td>Where feasible and reasonable, detailed design will achieve the flood impact criteria for the surrounding properties. Where the flood impact criteria cannot be met at surrounding properties, Roads and Maritime will reach agreement with affected landowners on impacts to property.</td>
<td>Detailed design</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>HY-2</td>
<td>Erosion and scouring</td>
<td>Scour protection will be installed upstream and downstream of culverts as required, on disturbed stream banks and waterfront land.</td>
<td>Detailed design</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>HY-3</td>
<td>Potential blockages of drainage lines</td>
<td>Culvert structures will be cleared of obstacles at regular frequencies and/or after large storm events.</td>
<td>Operation</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>SE-1</td>
<td>Impact on local community and businesses</td>
<td>The Community and Stakeholder Engagement Plan will be updated to address all community and stakeholder requirements during detailed design and construction.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>SE-2</td>
<td>Impact on roadside tributes</td>
<td>Roadside tributes impacted by the proposal will be removed, stored and relocated once the works are completed. The removal and relocation of roadside tributes will follow Roads and Maritime’s Roadside Tributes Policy (2016).</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>AQ-1</td>
<td>Air quality</td>
<td>Air quality management measures will be identified within the construction management documentation aimed at minimising dust dispersal beyond the proposal area.</td>
<td>Pre-construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>GG-1</td>
<td>Greenhouse gas emissions</td>
<td>The detailed design and construction planning will demonstrate that the extent of vegetation clearing within the proposal area has been minimised.</td>
<td>Detailed design</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>GG-2</td>
<td>Greenhouse gas emissions</td>
<td>The procurement strategy developed for the construction phase will demonstrate value for money and that it has considered opportunities to procure goods and services: From local suppliers, if available That are energy efficient or have low embodied energy That minimise the generation of waste That make use of recycled materials.</td>
<td>Construction</td>
<td>Construction Contractor</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Timing</td>
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<tr>
<td>WM-2</td>
<td></td>
<td>An emergency spill response procedure will be prepared to minimise the impact of any accidental spills. It will include details on the requirements for managing spills, disposing of any contaminated waste, and reporting of any such incidents.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-3</td>
<td>Generation of waste from construction</td>
<td>Waste material generated on site will be dealt with in accordance with the POEO Act and...</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-4</td>
<td></td>
<td>Millable timber will be harvested for offsite reuse where feasible and reasonable. All other felled timber will be reused on site for habitat recreation or mulch in landscaping and erosion and sedimentation controls. Where mulch cannot be reused on site, consideration will be given to making the mulch available to the public in accordance with Roads and Maritime’s <em>Environmental Direction 25</em> (2012) and the <em>Raw Mulch Exemption</em> (EPA, 2008).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-5</td>
<td></td>
<td>Chemical, fuel and lubricant containers, and solid and liquid wastes, will be disposed of in accordance with the requirements of <em>Waste Classification Guidelines Part 1: Classifying Waste</em> (DECCW, 2009).</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-6</td>
<td></td>
<td>Sediment removed from sedimentation basins will, where appropriate, be used on site in landscaping and/or flattening batters.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-7</td>
<td></td>
<td>Site inductions and onsite training will include waste minimisation principles and measures.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>No.</td>
<td>Impact</td>
<td>Environmental safeguards</td>
<td>Timing</td>
<td>Responsibility</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>WM-8</td>
<td></td>
<td>At site compounds, onsite recycling facilities will be provided for recycling paper, plastic, glass and other reusable materials. Liquid wastes, such as paints and solvents, will be disposed of in accordance with the <em>Waste Classification Guidelines Part 1: Classifying Waste</em> (DECCW, 2009) and the POEO Act.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-9</td>
<td></td>
<td>Regular visual inspections will be conducted to ensure work sites are kept tidy and to identify opportunities for reuse and recycling.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-10</td>
<td>Generation of wastewater</td>
<td>Water captured in excavations will be required to be either: Managed in accordance with industry standard erosion and sediment controls Reused for construction water or dust suppression.</td>
<td>Construction</td>
<td>Construction contractor</td>
</tr>
<tr>
<td>WM-11</td>
<td>Generation of waste from operation</td>
<td>All operational waste will be managed in accordance with Roads and Marine’s <em>Management of road construction and maintenance wastes</em> (2016) and Environmental Management System.</td>
<td>Operation</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>WM-12</td>
<td></td>
<td>Green waste from highway maintenance activities will be collected and, where possible, recycled for mulch within the road reserve.</td>
<td>Operation</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>WM-13</td>
<td></td>
<td>Roadside litter will be collected and removed in accordance with Roads and Maritime’s Environmental Management System.</td>
<td>Operation</td>
<td>Roads and Maritime</td>
</tr>
<tr>
<td>BF-1</td>
<td>Bushfire risk</td>
<td>Construction management documentation will include measures aimed at preparing for a bushfire event and preventing initiating a bushfire.</td>
<td>Pre-construction Construction</td>
<td>Construction contractor</td>
</tr>
</tbody>
</table>
### 6.3 Licensing and approvals

Table 6-2 summarises any licences and further approvals required for the proposal. Any changes from the REF are underlined.

#### Table 6-2: Summary of licensing and approval required

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Requirement</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roads Act 1993 (s138)</strong></td>
<td>The consent of Roads and Maritime’s regional traffic management officer will be required for traffic management during construction of the proposal within the existing road corridor.</td>
<td>Pre-construction</td>
</tr>
<tr>
<td><strong>Water Management Act 2000 (s92)</strong></td>
<td>The approval of Water NSW will be required for the installation of the proposed water pump and boreholes (if needed). The application must be accompanied by written permission from the current registered land owner (Moree Plains Shire Council).</td>
<td>Pre-construction of water supply infrastructure</td>
</tr>
<tr>
<td><strong>Protection of the Environment Operations Act 1997 [Schedule 2(16 and 19)]</strong></td>
<td>An Environmental Protection Licence will be required for the crushing, grinding or separation of processing materials at the proposed plants at ancillary facility No 2, and for the sourcing of extractive materials for the project construction.</td>
<td>Pre-construction</td>
</tr>
<tr>
<td><strong>Protection of the Environment Operations Act 1997 (s43)</strong></td>
<td>Environment protection licence (EPL) for non-scheduled activities for the purposes of regulating water pollution.</td>
<td>Pre-construction</td>
</tr>
<tr>
<td><strong>Crown Lands Act 1989 (s6)</strong></td>
<td>Approval under the Crown Lands Act 1989 will be required to grant Roads and Maritime an interest over part of Lot 291 DP727837 managed by Moree Plains Shire Council to access and operate the proposed water pump; and Council’s former borrow site (Lot 19 DP755991, Lot 7007 DP1059789 and Lot 7300 DP1129707) and access road reserve to access and operate ancillary facility No 2.</td>
<td>Pre-construction</td>
</tr>
<tr>
<td><strong>National Parks and Wildlife Act 1974 (S90)</strong></td>
<td>An Aboriginal Heritage Impact Permit (AHIP) will be sought from Office of Environment and Heritage for Aboriginal Artefact 1, Artefact 2 and Artefact 3.</td>
<td>Pre-construction</td>
</tr>
</tbody>
</table>
7 References

DPI (Fisheries NSW) (2013) *Standard Precautions and Mitigation Measures of the Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013*


Roads and Maritime (2011) *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*, Environment Branch, Roads and Maritime Services, North Sydney, NSW.


Roads and Maritime (2017) *Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement review of environmental factors*, Environment Branch, Roads and Maritime Services, North Sydney, NSW.


RTA (2011) *Guide 5: Re-use of Woody Debris and Bushrock*, RTA Environment Branch, Sydney, NSW


Appendix A

Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone

**LEGEND**
- Refined construction work zone
- REF construction work zone
- Ancillary facility
- Refined design
- REF design
- Indicative location of the MacIntyre water pump infrastructure
- Road alignment refinement
- Local road intersection alignment refinement
- Drainage refinement
- Watercourse
- Railway
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone
Refrined construction work zone

REF construction work zone

Ancillary facility

Refrined design

REF design

Indicative location of the MacIntyre water pump infrastructure

Road alignment refinement

Local road interaction alignment refinement

Drainage refinement

Watercourse

Railway

Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone

LEGEND
- Refined construction work zone
- REF construction work zone
- Ancillary facility
- Refined design
- REF design
- Indicative location of the MacIntyre water pump infrastructure
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- Local road intersection alignment refinement
- Drainage refinement
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Refinements to the REF design and construction work zone
Refinements to the REF design and construction work zone

LEGEND
- Refined construction work zone
- REF construction work zone
- Ancillary facility
- Refined design
- REF design
- Indicative location of the MacIntyre water pump infrastructure
- Road alignment refinement
- Local road intersection alignment refinement
- Drainage refinement
- Watercourse
- Railway
Appendix B

Supplementary biodiversity assessment report
NEWELL HIGHWAY
MUNGLE BACK CREEK TO
BOGGABILLA HEAVY DUTY
PAVEMENT UPGRADE
Supplementary Biodiversity
Assessment
May 2017
NEWELL HIGHWAY
MUNGLE BACK CREEK TO
BOGGABILLA HEAVY DUTY
PAVEMENT UPGRADE
Supplementary Biodiversity
Assessment
May 2017

Prepared by Arcadis

This report has been prepared for Roads and Maritime Services in accordance with the terms and conditions of appointment for the HW17 Mungle Back Creek to Boggabilla heavy duty pavement project dated February 2016. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.
<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
<th>Prepared by</th>
<th>Approved by</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>28/04/17</td>
<td>Draft Supplementary Biodiversity Assessment for client review</td>
<td>LH</td>
<td>JV</td>
</tr>
<tr>
<td>B</td>
<td>02/05/2017</td>
<td>Final Supplementary Biodiversity Assessment</td>
<td>KC</td>
<td>JV</td>
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</table>
Executive summary

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The study area is located in a highly modified landscape and is surrounded by broadacre crops contained within privately-owned land; primarily cotton, grains, fodder crops and oil seeds. A small number of rural dwellings are scattered along the length of the road corridor.

This supplementary biodiversity assessment has been prepared to assess the impacts of the refinements made to the proposal since the REF and inform the Submissions Report being prepared for the proposal.

In March 2017, Roads and Maritime engaged OzArk to undertake an independent review of the following findings of the REF biodiversity assessment (Arcadis 2017):

- Extent of Brigalow Endangered Ecological Community (EEC) in the proposal area
- The area of potential impact on Brigalow EEC and subsequently the requirement for offsetting this EEC to inform the biodiversity offset strategy as required by REF environmental safeguard BD-1

Arcadis identified five native vegetation communities in the study area, including one threatened ecological community. Brigalow-Belah Woodland of the study area is commensurate with Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions, listed as an EEC under the TSC Act, and Brigalow (*Acacia harpophylla* dominant and co-dominant), listed as an EEC under the EPBC Act.

OzArk’s review resulted in the refinements to Plant Community Types (PCTs) mapped by Arcadis (2016):

- One area at Ch87000 (southbound lane) was changed from Brigalow EEC to Popular Box Shrubby Woodland (refer to Figure 3-1)
- One area from Ch92500 to about Ch93250 adjacent to the south bound lane previously mapped as Belah Woodland was remapped as two separate communities (refer to Figure 3-2):
  - Half as Brigalow EEC
  - Half as Popular Box Shrubby Woodland.

Further, OzArk determined the following, with respect to Brigalow EEC:

- Maintained areas (defined as regularly mowed area immediately adjacent to sealed road surface, approximately seven metres wide) do no support vegetation commensurate with Brigalow EEC listed under either the TSC Act or EPBC Act.
- Table drains (defined as un-mowed but irregularly slashed areas approximately up to seven metres wide, on the outer side of the maintained road side area) support vegetation commensurate with Brigalow EEC listed under the TSC Act, but this area of EEC been changed from moderate-good condition to low condition (BBAM 2014) and is not commensurate with Brigalow EEC listed under the EPBC Act. OzArk consider that the EEC in this area is “not considered a viable population”.

• Areas more than 14 metres from the sealed road surface support native vegetation commensurate with Brigalow EEC listed under both the TSC Act and EPBC Act.

The revised area of Brigalow EEC to be cleared as a result of the refined proposal, incorporating the mapping refinements carried out by OzArk (2017), would be:

• Total of 10.2 hectares of Brigalow EEC as listed under the EPBC Act
• Total of 15.3 hectares of Brigalow EEC as listed under the TSC Act as follows:
  » 5.1 hectares in low condition
  » 10.2 hectares in moderate-good condition (which overlaps with the 10.2 hectares of Brigalow EEC as listed under the EPBC Act)

The proposal refinements have resulted in an increased footprint. Based on PCT mapping by OzArk, clearing of native vegetation from the study area would total 69.7 ha. This is a reduction of 5.5 ha from the 75.2 ha calculated to be cleared in the biodiversity assessment. This includes a reduction in clearing of Brigalow EEC, Belah woodland and Windmill Grass - Bluegrass derived grassland. Clearing of Poplar Box shrubby woodland and River Red Gum open woodland would increase.

Based on the proposal refinements, 109.2 hectares of fauna habitat will be cleared from the proposal comprising of approximately 64.8 hectares of grassland and 44.4 hectares of woodland. This represents an additional 33.9 hectares of fauna habitat to be cleared to what was assessed in the REF biodiversity assessment (Arcadis 2017). Sixteen hollow-bearing trees would require removal, which is five more than what was assessed in the REF biodiversity assessment (Arcadis 2017).

The increased area of fauna habitat to be removed has resulted in increased impacts to threatened species. While the nature of impacts is consistent with those assessed by the REF biodiversity assessment (Arcadis 2016), the extent of impacts has increased. Accordingly, assessments of significance were updated for the threatened species listed under the TSC Act and EPBC Significant Impact Assessments for those species listed under the EPBC Act. These assessments concluded that the threatened species and ecological communities would not be significantly impacted by the proposal.

Other impacts to biodiversity are considered largely consistent with those assessed in the REF biodiversity assessment (Arcadis 2017). No additional safeguards or mitigation measures are required beyond those identified in the REF biodiversity assessment (Arcadis 2017).
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## Glossary of terms

### Definitions

**Cumulative impact**
The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.

**Direct impact**
Where a primary action is a substantial cause of a secondary event or circumstance which has an impact on a protected matter (ref http://www.environment.gov.au/system/files/resources/0b0cfb1e-6e28-4b23-9a97-fdada0f111c/files/environment-assessment-manual.pdf).

**Habitat**
An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014).

**Indirect impact**

**Matters of NES**
A matter of national environmental significance (NES) protected by a provision of Part 3 of the EPBC Act

**Mitchell landscape**
Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2014).

**Mitigation**
Action to reduce the severity of an impact. (OEH 2014).

**Mitigation measure**
Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.

**Population**
All the individuals that interbreed within a given area.

**Proposal area/Proposal site**
The area of land that is directly impacted on by a proposed Major Proposal that is under the EP&A Act, including access roads, and areas used to store construction materials (OEH 2014).

**Study area**
The area directly affected by the development and any additional areas likely to be affected by the development, either directly or indirectly (OEH 2014).

**Target species**
A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBCC</td>
<td>BioBanking Credit Calculator</td>
</tr>
<tr>
<td>BVT</td>
<td>Biometric Vegetation Type</td>
</tr>
<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan</td>
</tr>
<tr>
<td>DP&amp;E</td>
<td>Department of Planning and Environment</td>
</tr>
<tr>
<td>DPI</td>
<td>Department of Primary Industries</td>
</tr>
<tr>
<td>EEC</td>
<td>Endangered ecological community</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>EPBC Act</td>
<td>Environmental Protection and Biodiversity Conservation Act 1999 (Federal).</td>
</tr>
<tr>
<td>FBA</td>
<td>Framework for Biodiversity Assessment</td>
</tr>
<tr>
<td>FM Act</td>
<td>Fisheries Management Act 1994 (NSW)</td>
</tr>
<tr>
<td>GDE</td>
<td>Groundwater dependent ecosystems</td>
</tr>
<tr>
<td>IBRA</td>
<td>Interim Biogeographically Regionalisation of Australia</td>
</tr>
<tr>
<td>MNES</td>
<td>Matters of National Environmental Significance</td>
</tr>
<tr>
<td>OEH</td>
<td>Office of Environment and Heritage</td>
</tr>
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<td>PCT</td>
<td>Plant Community Type</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>REF</td>
<td>Review of Environmental Factors</td>
</tr>
<tr>
<td>SEARs</td>
<td>Secretary's Environmental Assessment Requirements</td>
</tr>
<tr>
<td>SEPP</td>
<td>State Environmental Planning Policy</td>
</tr>
<tr>
<td>TECs</td>
<td>Threatened Ecological Communities</td>
</tr>
<tr>
<td>TSC Act</td>
<td>Threatened Species Conservation Act 1995 (NSW)</td>
</tr>
<tr>
<td>TSPD</td>
<td>Threatened Species Profile Database</td>
</tr>
<tr>
<td>VIS</td>
<td>Vegetation information system</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 The proposal

Roads and Maritime Services (Roads and Maritime) propose to provide heavy duty pavement over about 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). An overview of the proposal is presented in Figure 1-1.

The main features of the proposal are to:

- Provide heavy duty pavement
- Widen the road
- Provide dedicated overtaking lanes
- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity up to a 20-year average recurrence interval when feasible and reasonable
- Provide water supply infrastructure to facilitate the construction and maintenance of the proposal.

The project may involve a staged construction process, dependant on available funding.
Figure 1-1: Proposal overview
1.2 REF display and submissions report

Roads and Maritime prepared a Review of Environmental Factors (REF) in February 2017 to assess the environmental impacts of the proposal. The REF included a biodiversity assessment prepared by Arcadis in accordance with the *Environmental Impact Assessment Practice Note – Biodiversity Assessment (EIA-N06)* guideline document. The biodiversity assessment provided a description of the biodiversity values of the proposal’s study area, potential impacts on these values and how these impacts would be avoided, minimised or mitigated.

The REF was publicly displayed for 28 days between 28 February 2017 and 28 March 2017 and a number of submissions were received from members of the public and Government agencies during this time.

A Submissions Report has been prepared for the proposal to summarise and respond to the issues raised during the REF public display, identify refinements made to the proposal since the REF was displayed and document additional investigations and assessments conducted during, and following, the REF public display period. This supplementary biodiversity assessment supports the Submissions Report for the proposal.

1.3 Additional ecological assessment

During the REF display, Roads and Maritime engaged OzArk Environmental & Heritage Management Pty Ltd (OzArk) to undertake an independent review of potential impacts to Brigalow Endangered Ecological Community (EEC), as determined by Arcadis in the REF biodiversity assessment (Arcadis 2017), and to revaluate the requirement for offsetting this EEC. This additional assessment is presented in Appendix A and was based on field surveys carried out by OzArk on 19 to 20 March 2017.

1.4 Purpose of this technical paper

This supplementary biodiversity assessment has been prepared to support the Submissions Report for the proposal. The scope of works for this supplementary biodiversity assessment is:

- Identify refinements made to the proposal since the REF was publicly displayed.
- Describe the methodology and results of the vegetation assessment carried out by OzArk in March 2017.
- Determine the type and extent of potential impacts resulting from the refinements to the proposal and revised vegetation mapping arising from OzArk’s independent review.
- Revise environmental safeguards and management measures (relating to biodiversity) for the proposal.
2 Proposal refinements

Roads and Maritime has refined and further developed a number of aspects of the proposal as documented in the REF. These refinements have resulted in a revised construction work zone boundary. This section describes the refinements made to the proposal, including how the refinements differ in scope from the REF and the reasons for the refinements.

2.1 Refinements to road alignment and proposal extent

Refinements made to the alignment and proposal extent are described from south to north in Table 2-1 and shown in the maps in Appendix A of Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement Submissions Report.

Table 2-1 Road alignment refinements

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Ch 87,400</td>
<td>The southernmost limit of the proposal and corresponding construction work zone has been slightly shifted north from Ch 87,150 to Ch 87,400.</td>
<td>Facilitate the tie-in at the southern end of the proposal.</td>
</tr>
<tr>
<td>R2</td>
<td>Ch 89,250 – Ch 91,850</td>
<td>The road alignment in this section as described in the REF was within the existing highway’s footprint (online). Now, it is proposed to construct the road parallel (to the east) to the existing highway.</td>
<td>Minimise traffic disruptions and reduce construction timing and costs.</td>
</tr>
<tr>
<td>R3</td>
<td>Ch 94,200 – Ch 98,400</td>
<td>The road alignment has been shifted slightly to the west.</td>
<td>Avoid private property impacts.</td>
</tr>
<tr>
<td>R4</td>
<td>Ch 97,850 – Ch 98,950</td>
<td>The construction work zone has been widened slightly on both sides of the proposal.</td>
<td>Allow sufficient space for construction traffic staging near Whalan Creek Bridge.</td>
</tr>
<tr>
<td>R5</td>
<td>Ch 99,000 – Ch 99,500</td>
<td>The proposal both sides of the existing Whalan Creek Bridge approaches has been moved further from the bridge.</td>
<td>Facilitate construction traffic staging at Whalan Creek Bridge approaches.</td>
</tr>
<tr>
<td>R6</td>
<td>Ch 99,600 – Ch 102,450</td>
<td>The road alignment has been shifted slightly to the east.</td>
<td>Improve geometry between the two curves.</td>
</tr>
<tr>
<td>R7</td>
<td>Ch 102,450 – Ch 111,800</td>
<td>The road alignment in the REF was proposed to be constructed parallel to the existing highway to the east. Now, it is proposed to construct parallel to the existing highway to the west.</td>
<td>Avoid impact on existing high voltage transmission lines, minimise traffic disruptions and reduce construction timing and costs.</td>
</tr>
<tr>
<td>R8</td>
<td>Ch 114,600 – Ch 115,035</td>
<td>The northernmost limit of the proposal and corresponding construction work zone has been shifted slightly south from Ch 115,035 to Ch 114,600.</td>
<td>Facilitate the tie-in with the future Boggabilla bypass.</td>
</tr>
</tbody>
</table>
2.2 Refinements to improve local road intersections

The design development of local road intersections carried out since the preparation of the REF identified the need for greater space at the locations listed in Table 2-2 to improve the safety and function of various proposal elements. The location of these refinements is shown in Appendix A of Newell Highway Mungle Back Creek to Boggabilla heavy duty pavement Submissions Report.

Table 2-2 Local road intersection refinements

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Ch 94,700</td>
<td>The property access tie-in has been refined.</td>
<td>Allow removal of the existing embankment.</td>
</tr>
<tr>
<td>L2</td>
<td>Ch 98,350</td>
<td>The extension of the construction work zone on local road has been refined.</td>
<td>Allow upgrade of the local road connecting ancillary facility No 2 with the highway.</td>
</tr>
<tr>
<td>L3</td>
<td>Ch 98,400</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L4</td>
<td>Ch 100,500</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L5</td>
<td>Ch 113,500</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L6</td>
<td>Ch 114,700</td>
<td>The property access tie-in has been refined.</td>
<td>Provide adequate space for large vehicle paths.</td>
</tr>
<tr>
<td>L7</td>
<td>Ch 115,250</td>
<td>The extension of the construction work zone on the local road has been refined.</td>
<td>Allow upgrade of the local road connecting ancillary facility No 3 with the highway.</td>
</tr>
</tbody>
</table>

2.3 Refinements to improve drainage

The design development and modelling of the proposal drainage strategy carried out since the preparation of the REF identified the need for greater space to accommodate the drainage structures listed in Table 2-3.

Table 2-3 Drainage refinements

<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Refinement</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Ch 87,800</td>
<td>An additional open drain coming from existing culvert has been provided.</td>
<td>Convey runoff from the pavement surface</td>
</tr>
<tr>
<td>D2</td>
<td>Ch 88,400</td>
<td>An additional open drain coming from existing culvert has been provided.</td>
<td>Convey runoff from the pavement surface.</td>
</tr>
<tr>
<td>D3</td>
<td>Ch 89,750</td>
<td>Culvert sizes have been reduced.</td>
<td>Remove the need for safety barrier while still meeting drainage requirements.</td>
</tr>
<tr>
<td>No</td>
<td>Location</td>
<td>Refinement</td>
<td>Justification</td>
</tr>
<tr>
<td>----</td>
<td>----------</td>
<td>------------</td>
<td>---------------</td>
</tr>
<tr>
<td>D4</td>
<td>Ch 93,500</td>
<td>Allowance has been made for longitudinal drainage at a property access.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D5</td>
<td>Ch 96,400</td>
<td>Allowance has been made for longitudinal drainage at a property access.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D6</td>
<td>Ch 100,000</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D7</td>
<td>Ch 100,550</td>
<td>The existing embankment has been removed.</td>
<td>Reduce flooding impacts on adjacent land.</td>
</tr>
<tr>
<td>D8</td>
<td>Ch 101,200</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D9</td>
<td>Ch 102,300</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D10</td>
<td>Ch 103,100</td>
<td>The vertical alignment of the highway has been lowered.</td>
<td>Reduce flooding impacts on adjacent land.</td>
</tr>
<tr>
<td>D11</td>
<td>Ch 111,800</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D12</td>
<td>Ch 112,300</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D13</td>
<td>Ch 112,400</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
<tr>
<td>D14</td>
<td>Ch 112,500</td>
<td>An additional longitudinal drain has been provided.</td>
<td>Provide continuity for table drains and open channels.</td>
</tr>
</tbody>
</table>
3 Additional ecological assessment

3.1 Background
Five Plant Community Types (PCTs) were identified in the study area by Arcadis in 2016 including one EEC. Brigalow-Belah Woodland of the study area is commensurate with Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions, listed as an Endangered Ecological Community (EEC) under the NSW Threatened Species Conservation Act 1995 (TSC Act), and Brigalow (Acacia harpophylla dominant and co-dominant), listed as an EEC under the Commonwealth Environment Protection Biodiversity Conservation Act 1999 (EPBC Act). Refer to Section 3.2 of the REF biodiversity assessment (Arcadis 2017) for further detail.

3.2 Additional ecological assessment
In March 2017, Roads and Maritime engaged OzArk to undertake an independent review of the following findings of the REF biodiversity assessment (Arcadis 2017):

-Extent of Brigalow EEC in the proposal area
- The area of potential impact on Brigalow EEC and subsequently the requirement for offsetting this EEC to inform the biodiversity offset strategy as required by REF environmental safeguard BD-1

The assessment entitled Boggabilla Vegetation Assessment (OzArk 2017) is provided in Appendix A. Though OzArk addressed offsetting in this assessment, they are not the subject of this report and as such, are not discussed further.

3.3 Methodology

3.3.1 Desktop Review
OzArk’s assessment included a desktop review of the following resources:

- Biodiversity assessment for the proposal (Arcadis 2016)
- Roads and Maritime and state and commonwealth Brigalow EEC resources

3.3.2 Field Survey
Field surveys were carried out in the proposal study area on 19-20 March 2017 by OzArk’s Principal Ecologist Phillip Cameron (BioBanking and BioCertification Assessor Accreditation Number 0117). Field surveys involved the collection of data from eight biobanking plots, including:

- Vegetation data in accordance with NSW BioBanking Assessment Methodology (2014), to fulfil the requirements of the BioBanking Credit Calculator.
- Full floristic data including abundance information using the Braun Banquet cover abundance scale.

Biobanking plots were located in the following areas:

- Four plots in vegetation within maintained roadside areas (mapped as moderate-good Brigalow EEC by Arcadis (2016))
- Three plots in vegetation within table drains adjoining roadside areas (mapped as moderate-good condition Brigalow EEC by Arcadis (2016))
- One plot in the Belah Woodland community
3.4 Results

The results of OzArk’s field surveys, including detailed Biobanking plot data, are provided in Appendix A. A summary of OzArk’s findings is provided below. Maps showing the distribution of PCTs and EECs, mapped by OzArk are provided in Figure 3-1 to Figure 3-7.

3.4.1 Refinement of PCT mapping

In addition, the following refinements were made by OzArk to PCTs mapped by Arcadis (2016):

- One area at Ch87000 (southbound lane) was changed from Brigalow EEC to Popular Box Shubby Woodland (refer to Figure 3-1).
- One area from Ch92500 to about Ch93250 on the south bound lane previously mapped as Belah Woodland was remapped as two separate communities (refer to Figure 3-2):
  - Half as Brigalow EEC
  - Half as Popular Box Shubby Woodland.
- A reduction in the extent of PCTs that adjoin the highway shoulder. Arcadis mapped PCTs to the gravel shoulder for the length of the highway within the study area, while OzArk generally removed PCTs from maintained areas (a seven metre-wide corridor adjacent to the highway) for the length of the highway within the study area.

3.4.2 Recalculation of areas of PCTs

OzArk’s mapping refinements have been used to recalculate the areas of each PCT/non-native vegetation community that are mapped within the proposal study area (Table 3-1). As discussed above, OzArk generally removed PCTs from maintained areas for the length of the highway within the study area. For mapping/calculation purposes, these areas are assumed to be categorised as cleared and disturbed which has resulted in an increase in the extent of cleared and disturbed vegetation in the study area. Ozark mapped about 37 hectares less native vegetation. This has resulted in a reduction in the extent of all PCTs within the study area, of note are mapped areas of Brigalow EEC (reduced by about 7 hectares), Belah Woodland (reduced by about 4 hectares) and Windmill Grass - Bluegrass derived grassland (reduced by about 23 hectares).
Table 3-1: Plant Community Types (PCTs) and non-native vegetation communities mapped in the proposal study area (Arcadis 2017) and Submissions Report (OzArk 2017)

<table>
<thead>
<tr>
<th>Plant community type (PCT)/non-native vegetation community</th>
<th>Area (ha) in study area reported in the REF biodiversity assessment (Arcadis 2017)</th>
<th>Area (ha) in study area mapped by OzArk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brigalow-Belah woodland EEC</td>
<td>52</td>
<td>45</td>
</tr>
<tr>
<td>Belah woodland</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Poplar Box shrubby woodland</td>
<td>53</td>
<td>50</td>
</tr>
<tr>
<td>River Red Gum open woodland</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Windmill Grass - Bluegrass derived grassland</td>
<td>128</td>
<td>105</td>
</tr>
<tr>
<td><strong>Total native vegetation</strong></td>
<td><strong>253</strong></td>
<td><strong>216</strong></td>
</tr>
<tr>
<td>Cleared and disturbed</td>
<td>11</td>
<td>48</td>
</tr>
<tr>
<td>Crop/pasture</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
</tr>
</tbody>
</table>

3.4.3 Refinement of EEC distribution

OzArk determined the following, with respect to Brigalow EEC:

- Maintained areas (defined as regularly mowed area immediately adjacent to sealed road surface, approximately seven metres wide) do no support vegetation commensurate with Brigalow EEC listed under either the TSC Act or EPBC Act.

- Table drains (defined as un-mowed but irregularly slashed areas approximately up to seven metres wide, on the outer side of the maintained road side area) support vegetation commensurate with Brigalow EEC listed under the TSC Act, but this area of EEC been changed from moderate-good condition to low condition (BBAM 2014) and is not commensurate with Brigalow EEC listed under the EPBC Act. OzArk argue that the EEC in this area is “not considered a viable population”.

- Areas more than 14 metres from the sealed road surface support native vegetation commensurate with Brigalow EEC listed under both the TSC Act and EPBC Act.

These areas have been identified in Figure 3-1 to Figure 3-7.

OzArk has differentiated areas of vegetation that conform to Brigalow EEC as listed under the TSC Act to areas of vegetation that conform to EEC as listed under the EPBC Act within the construction work zone boundary. Arcadis considered that all Brigalow EEC mapped in the study area conformed to the definition of the EEC as listed under both the TSC Act and EPBC Act.
Figure 3-1: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 1 and 2)
Figure 3-2: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 3 and 4)
Figure 3-3: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 5 and 6)
Figure 3-4: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 7 and 8)
Figure 3-5: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 9 and 10)
Figure 3-6: Revised Plant Community Types (PCTs) and non-native vegetation communities (maps 11 and 12)
Figure 3-7: Revised Plant Community Types (PCTs) and non-native vegetation communities (map 13)
4 Consistency of ecological impacts

4.1 Construction impacts

4.1.1 Removal of vegetation

Due to design refinements and refined vegetation mapping provided by OzArk, impacts to PCTs and non-native vegetation communities have been recalculated in Table 4-1. The refined PCTs are mapped in Figure 3-1 to Figure 3-7.

Vegetation to be cleared from the revised construction work zone has been calculated based on vegetation mapping by Arcadis (2016) and vegetation mapping refined by OzArk (2017).

Table 4-1 illustrates that Arcadis considered all Brigalow-Belah Woodland to be of Moderate-Good condition and to conform with both the TSC and EPBC-listed EEC. OzArk has differentiated Low and Moderate-Good condition areas of the TSC-listed EEC, and considers only 5.1 ha conforms to the definition of the EPBC-listed EEC.

Table 4-1: Vegetation to be cleared

<table>
<thead>
<tr>
<th>Plant Community Type</th>
<th>Condition</th>
<th>Area to be cleared, as determined by the REF biodiversity assessment (Arcadis 2017) (ha)</th>
<th>Area to be cleared in revised construction work zone (ha)</th>
<th>Arcadis (2017) vegetation mapping</th>
<th>OzArk (2017) vegetation mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under TSC Act)</td>
<td>Low</td>
<td>0</td>
<td>0</td>
<td></td>
<td>5.1</td>
</tr>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under TSC Act)</td>
<td>Moderate-Good</td>
<td>17.5</td>
<td>20.8</td>
<td></td>
<td>10.2</td>
</tr>
<tr>
<td>Brigalow-Belah woodland (Brigalow EEC as listed under EPBC Act)</td>
<td>Moderate-Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belah woodland</td>
<td>Moderate-good</td>
<td>5.5</td>
<td>6.0</td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>Poplar Box shrubby woodland</td>
<td>Moderate-good</td>
<td>10.6</td>
<td>16.9</td>
<td></td>
<td>13.4</td>
</tr>
<tr>
<td>River Red Gum open woodland</td>
<td>Moderate-good</td>
<td>0.4</td>
<td>0.7</td>
<td></td>
<td>0.6</td>
</tr>
</tbody>
</table>
### Plant Community

<table>
<thead>
<tr>
<th>Plant Community Type</th>
<th>Condition</th>
<th>Area to be cleared, as determined by the REF biodiversity assessment (Arcadis 2017) (ha)</th>
<th>Area to be cleared in revised construction work zone (ha)</th>
<th>OzArk (2017) vegetation mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windmill Grass - Bluegrass derived grassland</td>
<td>Moderate-good</td>
<td>41.2</td>
<td>60.9</td>
<td>38.3</td>
</tr>
<tr>
<td><strong>Total native vegetation</strong></td>
<td></td>
<td><strong>75.2</strong></td>
<td><strong>105.3</strong></td>
<td><strong>69.7</strong></td>
</tr>
<tr>
<td>Cleared and Disturbed</td>
<td>Poor</td>
<td>0.1</td>
<td>3.9</td>
<td>39.5</td>
</tr>
<tr>
<td>Crop/Pasture</td>
<td>Poor</td>
<td>0</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>75.3</strong></td>
<td><strong>109.2</strong></td>
<td><strong>109.2</strong></td>
</tr>
</tbody>
</table>

The proposal refinements have resulted in an increased footprint. Based on PCT mapping by Arcadis (2016), a total of 105.3 ha of native vegetation would require removal from the study area. Based on PCT mapping by OzArk, clearing of native vegetation from the study area would total 69.7 ha.

This is a reduction of 5.5 ha from the 75.2 ha calculated to be cleared in the biodiversity assessment. This includes a reduction in clearing of Brigalow EEC, Belah woodland and Windmill Grass - Bluegrass derived grassland. Clearing of Poplar Box shrubby woodland and River Red Gum open woodland would increase.

#### 4.1.2 Impacts to threatened entities

**Loss of threatened ecological communities**

The REF biodiversity assessment (Arcadis 2017) determined that 17.5 hectares of Brigalow-Belah Woodland, commensurate with Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions, listed as an EEC under the TSC Act and Brigalow (*Acacia harpophylla* dominant and co-dominant), listed as an EEC under the EPBC Act, would be cleared for the proposal. The revised area of Brigalow EEC to be cleared, incorporating the mapping refinements carried out by OzArk (2017), would be:

- Total of 10.2 hectares of Brigalow EEC as listed under the EPBC Act
- Total of 15.3 hectares of Brigalow EEC (note that a proportion of this 15.3 ha overlaps with the 10.2 ha of vegetation that conforms to EEC listed under the EPBC Act) as listed under the TSC Act as follows:
  - 5.1 hectares in low condition
  - 10.2 hectares in moderate-good condition
Removal of threatened fauna habitat

The REF biodiversity assessment (Arcadis 2017) determined that a total of 75.3 hectares of fauna habitat would be cleared from the proposal construction work zone. (Table 4-2), although this included 41.3 hectares of grassland that offers limited habitat resources to fauna. Within the area of habitat to be removed, a total of 11 hollow-bearing trees would be cleared from the road corridor. Hollow-bearing trees that fall within the construction work zone are predominantly located between Ch.94900 and Ch.96900, within Brigalow - Belah Woodland and Poplar Box shrubby woodland. No hollow-bearing trees will be cleared as part of the works proposed at the Boggabilla boat ramp site.

Based on the refined construction work zone, 109.2 hectares of fauna habitat will be cleared from the proposal construction work zone, approximately 64.8 hectares of which is grassland and 44.4 hectares of which is woodland. This represents an additional 33.9 hectares of fauna habitat to what was assessed in the REF biodiversity assessment (Arcadis 2017). Sixteen hollow-bearing trees would require removal, which is five more than what was assessed in the REF biodiversity assessment (Arcadis 2017).

Table 4-2: Fauna habitat to be cleared

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Area in study area (ha)</th>
<th>Area to be cleared from REF construction work zone (ha)</th>
<th>Area to be cleared from revised construction work zone (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland</td>
<td>125.2</td>
<td>34.0</td>
<td>44.4</td>
</tr>
<tr>
<td>Grassland</td>
<td>141.8</td>
<td>41.3</td>
<td>64.8</td>
</tr>
<tr>
<td>Total</td>
<td>267.0</td>
<td>75.3</td>
<td>109.2</td>
</tr>
</tbody>
</table>

Assessments of significance

Assessments of Significance were undertaken in the REF biodiversity assessment (Arcadis 2017) for all relevant threatened species, populations and communities listed under the Threatened Species Conservation Act 1995 (TSC Act) that were recorded, or for which potential habitat occurs in the study area. The impacts in each Assessment of Significance have been reassessed in regard to the proposal refinements and, in the case of Brigalow EEC, OzArk’s updated mapping in Appendix B.

Significant Impact Assessments using the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Significant Impact Guidelines (DoE 2013) were undertaken in the REF biodiversity assessment (Arcadis 2017) for the threatened species and communities listed under the EPBC Act that were recorded or for which habitat occurs in the study area. The impacts in each Significant Impact Assessment have been reassessed in regard to the proposal refinements and, in the case of Brigalow EEC, OzArk’s updated mapping, in Appendix C.

The threatened species, populations and communities reassessed are listed in Table 4-3.
Table 4-3: Threatened species and ecological communities for which impact assessments have been undertaken

<table>
<thead>
<tr>
<th>Threatened entity</th>
<th>TSC Act Status</th>
<th>EPBC Act Status</th>
<th>Likelihood of occurrence</th>
<th>Credit status as defined in OEH’s Threatened Species Profile Database (TSPD)</th>
<th>Impacts of proposal refinements/OzArk EEC mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions Endangered Ecological Community</td>
<td>E</td>
<td>E</td>
<td>Known</td>
<td>N/A</td>
<td>Loss of 15.3 hectares (TSC Act) Loss of 10.2 hectares (EPBC Act)</td>
</tr>
<tr>
<td>Homopholis belsonii (Belson’s Panic)</td>
<td>E</td>
<td>V</td>
<td>High</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
</tr>
<tr>
<td>Desmodium campylocaulon (Creeping Tick-trefoil)</td>
<td>E</td>
<td>-</td>
<td>Moderate</td>
<td>Ecosystem</td>
<td>Loss of up to 64.8 hectares of potential habitat (offered by grassland communities)</td>
</tr>
<tr>
<td>Grey-crowned Babbler (Pomatostomus temporalis)</td>
<td>Known</td>
<td>E</td>
<td>E</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat</td>
</tr>
<tr>
<td>Magpie Goose (Anseranas semipalmata)</td>
<td>V</td>
<td>Moderate</td>
<td>E</td>
<td>Ecosystem</td>
<td>Potential degradation of potential habitat offered by Macintyre River</td>
</tr>
<tr>
<td>Glossy Black-Cockatoo (Calyptorhynchus lathami)</td>
<td>V</td>
<td>Moderate</td>
<td>E</td>
<td>Ecosystem</td>
<td>Loss of up to 16 hollow-bearing trees (marginal nesting habitat) Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
</tr>
<tr>
<td>Varied Sittella (Daphoenositta chrysoptera)</td>
<td>V</td>
<td>High</td>
<td>E</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
</tr>
<tr>
<td>Black-necked Stork (Ephippiorhynchus asiaticus)</td>
<td>E</td>
<td>High</td>
<td>E</td>
<td>Ecosystem</td>
<td>Potential degradation of potential habitat offered by Macintyre River</td>
</tr>
<tr>
<td>Painted Honeyeater (Grantiella picta)</td>
<td>V</td>
<td>V</td>
<td>High</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
</tr>
<tr>
<td>Little Eagle (Hieraeetus morphnoides)</td>
<td>V</td>
<td>Moderate</td>
<td>E</td>
<td>Ecosystem</td>
<td>Loss of up to 109.2 hectares of potential habitat (offered by woodland and grassland vegetation communities)</td>
</tr>
<tr>
<td>Pale Imperial Hairstreak (Jalmenus eubulus)</td>
<td>CE</td>
<td>Moderate</td>
<td>E</td>
<td>Ecosystem</td>
<td>Loss of up to 15.3 hectares of potential habitat (Brigalow-Belah woodland)</td>
</tr>
<tr>
<td>Threatened entity</td>
<td>TSC Act Status¹</td>
<td>EPBC Act Status²</td>
<td>Likelihood of occurrence</td>
<td>Credit status as defined in OEH’s Threatened Species Profile Database (TSPD)</td>
<td>Impacts of proposal refinements/OzArk EEC mapping</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Square-tailed Kite (<em>Lophoictinia isura</em>)</td>
<td>V</td>
<td>High</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
<td></td>
</tr>
<tr>
<td>Black-striped Wallaby (<em>Macropus dorsalis</em>)</td>
<td>E</td>
<td>Moderate</td>
<td>Ecosystem</td>
<td>Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
<td></td>
</tr>
<tr>
<td>Murray Cod (<em>Maccullochella peeli</em>)</td>
<td>V</td>
<td>High (in Macintyre River)</td>
<td>N/A</td>
<td>Potential degradation of potential habitat offered by Macintyre River</td>
<td></td>
</tr>
<tr>
<td>Corben's Long-eared Bat (<em>Nyctophilus corbeni</em>)</td>
<td>V</td>
<td>Moderate</td>
<td>Ecosystem</td>
<td>Loss of up to 10 hollow-bearing trees in suitable habitat (potential roosting habitat) Loss of up to 44.4 hectares of potential habitat (offered by woodland vegetation communities)</td>
<td></td>
</tr>
</tbody>
</table>

1. Conservation status under EPBC Act: V = Vulnerable
2. Conservation status under TSC Act: CE = Critically Endangered, E = Endangered, V = Vulnerable

The updated Assessments of Significance (Appendix B) and Significant Impact Assessments (Appendix C) found no change in the outcome compared to the REF biodiversity assessment (Arcadis 2017). The proposal refinements would not result in a significant impact to any threatened species, population or ecological community listed under the TSC Act and/or EPBC Act.

### 4.1.3 Aquatic impacts

As described in the REF biodiversity assessment (Arcadis 2017), construction activities and in particular drainage upgrades at watercourses would result in potential alteration and/or degradation of aquatic habitats located along the proposal alignment.

The proposal refinements would result in changes to drainage infrastructure. The changes are mostly minor in nature and would not result in any altered impacts to aquatic habitats from what was previously assessed. Changes to the works methodology of the culvert replacement at Wallaby Creek (Ch 90,250) is likely to result in a reduced impact to fish and aquatic habitats due to a shorter construction period.

### 4.1.4 Morella Watercourse / Boobera Lagoon / Pungbougal Lagoon - NSW095

Morella Watercourse is located approximately 100 metres west of the study area at Ch.113000 (at its closest point), in the northern extent of the study area, and occurs in proximity to the study area between Ch.112300 and Ch.113700. The wetland is listed as a Nationally Important Wetland under the EPBC Act. Water quality impacts to the wetland are possible as a result of bulk earthworks nearby. Impacts would not substantially change as result of the proposal refinements when compared with the impacts documented in the REF. The erosion and sediment control measures proposed in the REF are considered adequate to manage potential impacts.
4.1.5 Injury and mortality

Fauna injury or mortality assessed by the REF biodiversity assessment (Arcadis 2017) is unlikely to increase as a result of the proposal refinements, as the nature and extent of works are substantially the same as those previously assessed.

4.2 Indirect/operational impacts

Indirect and operation impacts assessed by the biodiversity assessment is unlikely to change in type or increase in magnitude as result of the proposal refinements, as the nature and extent of works are considered substantially the same as the works previously assessed.

4.3 Safeguards and mitigation measures

The safeguards and mitigation measures outlined in the REF biodiversity assessment (Arcadis 2017) considered adequate to manage the impacts to biodiversity as a result of the proposal refinements. No additional safeguards and mitigation measures are proposed beyond those identified in the in the REF biodiversity assessment (Arcadis 2017).
5 Conclusion

This supplementary biodiversity assessment has found that the biodiversity impacts as a result of the proposal refinements would not be substantially different to what was originally assessed in the REF. For the purposes of this supplementary biodiversity assessment OzArk was engaged to review the original vegetation mapping and refine Brigalow EEC boundaries in the proposal study area. This review resulted in a minor reduction in the calculated impacts to Brigalow EEC, Belah woodland and Windmill Grass - Bluegrass derived grassland. Impacts to Poplar Box shrubby woodland and River Red Gum open woodland have increased as a result of proposal refinements. The revised area of Brigalow EEC to be cleared, incorporating the mapping refinements carried out by OzArk (2017), would be:

- Total of 10.2 hectares of Brigalow EEC as listed under the EPBC Act
- Total of 15.3 hectares of Brigalow EEC as listed under the TSC Act as follows:
  - 5.1 hectares in low condition
  - 10.2 hectares in moderate-good condition (which overlaps with the 10.2 hectares of Brigalow EEC as listed under the EPBC Act)

Based on the proposal refinements, 109.2 hectares of fauna habitat will be cleared from the proposal construction work zone, approximately 64.8 hectares of which is grassland and 44.4 hectares of which is woodland. This represents a total of 33.9 hectares of fauna habitat to be cleared in addition to what was assessed in the REF biodiversity assessment (Arcadis 2017). Sixteen hollow-bearing trees would require removal, which is five more than what was assessed in the REF biodiversity assessment (Arcadis 2017).

Changes in fauna habitat impacts and the construction work zone boundary have resulted in increased impacts to threatened species. Accordingly, assessments of significance were updated for the threatened species listed under the TSC Act and EPBC Significant Impact Assessments for those species listed under the EPBC Act. These assessments concluded that the threatened species and ecological communities would not be significantly impacted by the proposal.

Other impacts to biodiversity are considered largely consistent with those assessed in the REF biodiversity assessment (Arcadis 2017). No additional safeguards or mitigation measures are required.
6 References


DoE (2013a) Brigalow (Acacia harpophylla dominant and co-dominant) ecological community Approved Conservation Advice. Conservation Advice was approved by the Delegate of the Minister on 17 December 2013


The Royal Botanic Gardens and Domain Trust (2014a) *PlantNET - The Plant Information Network System of The Royal Botanic Gardens and Domain Trust, Sydney, Australia (version 2.0).*
http://plantnet.rbgsyd.nsw.gov.au
24 March 2017
Jonathon Blizzard
Senior Environment Officer
NSW Roads and Maritime Services (F&RPO)
Mobile: 0476 863 490

Boggabilla vegetation assessment

Dear Jon,

Thank you for engaging OzArk Environmental & Heritage Management Pty Ltd (OzArk) to undertake an independent review and BioBanking calculations for the Newell Highway Mungle Back Creek to Boggabilla Heavy Duty Pavement Upgrade project.

The contentious issue for this proposal is the need to offset 17.5 ha of Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion endangered ecological community (EEC) affected by the proposal. As the ARCADIS 2016 biodiversity assessment report (BAR) shows, mapping of this EEC extending into table drains and maintained road side areas, Roads and Maritime Services requested independent advice about the impact to the Brigalow EEC and to revaluate requirements for biodiversity offsetting.

The letter covers for following tasks:

- **Task 1**: Review of the Biodiversity Assessment Report and data collected in the field provided by Roads and Maritime Services and determine the location of ground-truthing surveys to be undertaken.
- **Task 2**: Completed field survey results in accordance with the approved survey plan
- **Task 3**: Provide survey methods, effort and outcomes in a short letter report.

The following tasks are not part of this deliverable:

- **Task 4**: A separate short letter report prepared for offsets.

The following nomenclature is used in this short report (Figures 1 to 3):

- **Maintained roadside area** – This area is within the carriage way and the width of clearing. It is immediately next to the sealed road surfaced. This area is regularly mowed and is typically about seven metres wide from the roads painted edge line in areas mapped as the 2016 BAR but may vary in width depending on local constraints. The Arcadis mapping nomenclature equivalent in the BAR is “Cleared and Disturbed Areas”
- **Table drain** – This area is within the width of clearing and the width of stumping. The table drain is next to, and on the outer side of the maintained road side area. It is about five metres to 10 metres (or more) from the sealed road surfaced and may be up to 10 metres wide depending on local constraints. For the purposes of this report an average of seven metres width is used in Brigalow EEC areas. Table drains in many cases are not mowed but can be irregularly slashed. In woody vegetation types table drains may possess regrowth trees and shrubs. These are not able to grow to maturity due to routine
periodic maintenance i.e. yearly to once every five years, therefore, are not considered a viable population.

- Remnant vegetation – This area is outside the width of clearing and the width of stumping / limits of the table drain. Its width varies depending on local constraints but for the purposes of this report it is estimates to be more than 14 metres from the roads edge line. This area possesses a viable local population of remnant native woodland vegetation types ie it has the capacity to successfully complete each stage of the life cycle under normal conditions.

**Figure 1: Nomenclature used in this short report** (Source: http://www.fao.org/docrep/g3200e/g3200e07.htm)

- Maintained roadside area (seven metres from edge line)
- Table drain (seven metres to 14 metres from edge line)
- Remnant vegetation (more than 14 metres from edge line)

**Note:** This figure shows these widths can be variable

The assessment for this task was undertaken by Phillip Cameron (BioBanking and BioCertification Assessor Accreditation Number 0117) on 22 March 2017.
Figure 2: Application of nomenclature over the study area
Figure 3: Representative example of a maintained roadside area (Seven metres from edge line), Table drain (7 to 14 metres from edge line) and remnant vegetation (more than 14 metres from edge line)

Remnant native vegetation in moderate to good condition with a viable local population > 14 m from the road edge line

Native vegetation with an unviable local population >7 m and < 14 m from the road edge line

Exotic vegetation 0 to 7 m from the road edge line
Task 1

The following resources were review to write this deliverable:

- The ARCADIS 2016 Biodiversity Assessment Report (BAR) for the proposal
- Roads and Maritime and state and commonwealth Brigalow EEC resources
- Roads and Maritime Guideline for Biodiversity Offsets (2016).

OzArk concurs with Roads and Maritime, there is an argument to reconsider the quantity for biodiversity offsetting triggered by the proposal.

Definition of the Brigalow EEC

The first point to consider is definition of the Brigalow EEC:

- The NSW Threatened Species Conservation Act 1995 (TSC Act) EEC definition and its application in the 2016 BAR is defendable, however finer scale mapping is required to reapply the following NSW EEC identification criterion:
  - Is the site a woodland or forest dominated by Brigalow (*Acacia harpophylla*) with a sparse low shrub understorey and/or open forb and grass groundcover?
  - Does the site contain a combination of the diagnostic tree species marked in bold (in Table 1 of the OEH document - not shown here) of the NSW OEH publication titled *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions*?
- Similarly, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) definition and its application in the 2016 BAR is defendable but finer scale mapping is required as the Commonwealth defines the EEC differently. The relevant section of the Commonwealth SPRAT Profile and Threats Database for the EEC states ‘remnants of component regional ecosystems in poor condition be excluded from the listed Brigalow Belt community (Butler 2007)’. Where:
  - They have been comprehensively cleared in the past 15 years (not just thinned)
  - The ground stratum is more than 50% weedy in a 100x50m area
  - The size of the patch is less than 0.5 ha.

Survey effort (BioBanking plots)

Only one community mapped in the 2016 BAR (Belah Woodland PCT55) did not have BioBanking plot data in Appendix D of the 2016 BAR. All other mapped communities met the minimum plot to hectare ratio of survey effort.

A challenge in reviewing the 2016 BAR is there are no coordinates or PCT types assigned to the vegetation plot data or BioBanking plot summaries. This would have facilitated a quick and easy task to demonstrate the relationships between plot data, distance from the roads edge line and the survey effort. To manage this constraint vegetation maps in the 2016 BAR were annotated by hand using survey effort figures in earlier sections which show plot location. Appendix D of the 2016 BAR was also annotated to show plot to PCT relationships. These tasks did show survey effort and PCT relationships but did not resolve the plot placement issue and consequently fieldwork was recommended.

Condition of the EEC

The BAR states the EEC in all mapped areas are in moderate to good condition (as per BBAM 2014 definition). OzArk reviewed vegetation plot data for the six 2016 BAR plots (Plots 3 to 6 and 20 and 21) placed in the
Boggabilla vegetation assessment

Brigalow EEC against the PCTs benchmark and concurs with all but one plot. The difference being Plot 21 meets the definition of ‘low condition’ (previously identified as in Moderate to Good).

These data suggest Plot 21 is in a table drain as it does not have a tree canopy, is more than 50 per cent weedy and the density of shrubs is high. This flora composition is typical in table drains for acacia derived communities in the western region.

**Considerations of mapping the Brigalow EEC**

**Scale of mapping**

Scale of mapping, not quality of the information collected in the 2016 (BAR); and the relationship of plot distance from the roads edge line, are the likely causal factors for why so much EEC needs offsetting. The subsequent knock on effect is interpretation of Roads and Maritime Services Guidelines for Biodiversity Offsets (2016).

The 2016 BAR does not separate out remnant mature Brigalow EEC in the road corridor from regrowth in table drains and from maintained areas with an exotic ground cover. The result is one polygon covering all the areas of Brigalow was mapped as the EEC, this needed to be modified to remove maintained areas. Again, the challenge was absence of spatial data allowing GIS to make this distinction at a desk top review.

**Interpretation of the Roads and Maritime Guidelines for Biodiversity Offsets (2016)**

Guidelines of Biodiversity Offsetting (2016) were reviewed and some areas for improvement were identified which could assist in managing similar issues for future projects. The definition of triggers in Table 6-1 could be strengthened as follows:

- Section 2 “work on cleared land” could be redefined to include ‘table drains and maintained areas’ in any proposal (MWREF or Project REF) where offsetting is not triggered
- Section 5 “Threatened Ecological Communities in moderate to good condition” could be expanded to ‘Threatened Ecological Communities in moderate to good condition possessing a viable local population as defined by DECC, August 2007 as ‘the capacity to successfully complete each stage of the life cycle under normal conditions’.

To expand on a viable local population, there are a few EEC in the western region which respond to disturbance (i.e. thrive in table drains) but they do not possess a viable local population. My professional opinion is you do not need to replace or offset something that is not viable under its current state as ‘not net loss’ applies.

This course of action requires Roads and Maritime to change their offsetting policy. This is a timely procedure and will not occur in time for this project; however, it may benefit future projects.

**Methods for fieldwork**

As provided in the Request for Quote, OzArk proposed to place vegetation plots in areas mapped as the Brigalow EEC on maintained roadside area and table drains. Additional plots in remnant vegetation are not required as Appendix D in the 2016 BAR has robust plot data. The OzArk goal for the proposal impact footprint is to either:

- Remap the Brigalow EEC as “not EEC” where it’s more than 50 per cent weedy and without a mature or regenerating tree canopy
- Remap the Brigalow EEC as in ‘low condition’ following BBAM 2014
- Identify the Brigalow EEC as a community without a viable local population – thus questioning its eligibility to be offset
Concur it is the Brigalow EEC in ‘moderate to good condition’ following BBAM 2014. Vegetation plot data and a finer scale map has been provided in later sections of this short report as defendable evidence to challenge any changes of mapping in the 2016 BAR.

**TASK 2**

The purpose of this task was to complete field survey in accordance with the approved survey plan. Additional BioBanking plots were undertaken where required to fulfil the requirements of the BioBanking Credit Calculator and to calculate offset requirements for the EEC. Full floristic data including abundance information using the Braun Banquet cover abundance scale was collected for each plot completed.

The assessment for this task was undertaken by Phillip Cameron (BioBanking and BioCertification Assessor Accreditation Number 0117) on Sunday 19 to Monday 20 of March 2017.

**TASK 3**

The purpose of this task is to provide survey methods, effort and outcomes in a short letter report. In this the following deliverables were required:

- A map showing any areas of contention from that identified in the 2016 BAR
- A map showing the location of the TSC Act and EPBC Act listed community overlaid on the footprint
- A description of each patch of EEC identified (labelled on a map) showing consistency with NSW and Commonwealth listing advice and/or scientific determination
- Where the areas of EEC recorded differed from that presented in the 2016 BAR, the consultant was to prepare updated NSW TSC Act and Commonwealth EPBC Act listed communities.

**Survey methods and effort**

**Method:**

- The first day of the assessment was used to check the validity of vegetation communities mapped in the 2016 BAR. An annotated copy of the 2016 BAR was in hand while in a vehicle a laptop computer with a GPS function running GIS software showing the 2016 BAR vegetation communities layer was used to show the real time exact location of the area inspected. Each polygon mapped in the 2016 BAR was ticked or amended on the hard copy vegetation map as required (i.e. consistent, not consistent, vegetation plot required etc.)
- The approximate location of the 2016 BAR vegetation plots was assessed on foot using a copy of the 2016 BAR opened at Appendix C and D (Flora species list and BioBanking plot data). These data were compared to what was observed in the field
- The second day of the assessment was informed by the preceding day to refine where BioBanking plots needed to be located
- The NSW BioBanking Assessment Methodology (2014) was used to collected data in each BioBanking plot assessed in the field ensuring the minimum number of plots and transects following BBAM (2014) were employed. In doing this the following areas were targeted:
Vegetation within maintained roadside areas (n=4)
- Vegetation within table drains (n=3)
- One plot in Belah Woodland community, a data deficient community.

- These data were processed using the OEH VIS website community benchmarks page to assign its condition (as defined per BBAM 2014)
- The distance and width of the maintained areas, table drains and remnant native vegetation was measured from the road edge line in 12 areas mapped as Brigalow EEC
  - These measurements were averaged to provide an informed acceptable width of across the mapped extent of the Brigalow EEC
  - The actual width varies however the average used for mapping is representative.
- The width for each area was used to make a GIS shapefile clipped to the construction footprint to determine impact to the EEC. Once the original Arcadis shapefiles were clipped GIS geometry tools were used to add number of hectares affected and their perimeters (for later Biobanking linear infrastructure calculations).

**Effort:**
- Two full days were spent in the field, the day first to critique the existing veg map and BioBanking plots and the second day to complete additional BioBanking plots
- Eight BioBanking vegetation plots were completed. Of these:
  - Seven were in the mapped extent of the Brigalow EEC as per the 2016 BAR:
    - Maintained areas: Plots B (less than eight metres), Plot D (less than 20 m), Plot E (less than eight metres) and Plot F (less than six metres) from the road edge line
    - Table drain: Plot A was placed in vegetation mapped as part of the Brigalow EEC next to a parking bay and Plots C (more than eight metres and less than 20 m) and G (more than six metres and less than 13 m)
  - One in remnant native vegetation: One was within a Belah Woodland community mapped as per the 2016 BAR. No plots in this community was provided in the 2016 BAR. One plot in this community is needed for any future BioBanking calculations.

Note the variable widths of the maintained areas.

**Outcomes**

**Biobank plot data and vegetation list**

These data have been provided on Tables 1 to 3.
Table 1: OzArk Biobank plot data summary

<table>
<thead>
<tr>
<th>Plot name</th>
<th>Native plant species</th>
<th>Native overstory cover</th>
<th>Native mid-story cover</th>
<th>Native groundcover grasses</th>
<th>Native groundcover shrubs</th>
<th>Native ground cover other</th>
<th>Exotic plant cover</th>
<th>Number of tree hollows</th>
<th>Coverstory regeneration</th>
<th>Fallen logs &gt;10cm</th>
<th>Zone</th>
<th>GDAE</th>
<th>GDAN</th>
<th>PCT</th>
<th>Comment</th>
<th>Condition</th>
<th>Comment Benchmark note</th>
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<td>56</td>
<td>233137</td>
<td>6815600</td>
<td>N/A</td>
<td>Parking area (unsealed) &lt;40m from EL</td>
<td>Low</td>
</tr>
<tr>
<td>B</td>
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<td>56</td>
<td>229665</td>
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<td>&lt;8m of EL. 5th bound lane</td>
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<tr>
<td>C</td>
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<td>&lt;20m of EL. Nth bound lane</td>
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<tr>
<td>E</td>
<td>5</td>
<td>0</td>
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<td>1</td>
<td>0</td>
<td>56</td>
<td>230304</td>
<td>6809127</td>
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<td>4m total strip (two 2m parts) over 600m. Nth bound lane</td>
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</tr>
<tr>
<td>F</td>
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<td>&lt;6m from Rd EL. Nth bound lane.</td>
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</tr>
<tr>
<td>G</td>
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<td>15</td>
<td>40</td>
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<td>ID35</td>
<td>6m &gt; 13m from Rd EL. Non-viable local population.</td>
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### Table 2: Flora plot data summary

<table>
<thead>
<tr>
<th>Plot ID</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
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<tbody>
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<td>13</td>
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<td>5</td>
<td>10</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Exotic sp</td>
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<td>9</td>
<td>5</td>
<td>7</td>
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<td>4</td>
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<td>71.43</td>
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**Note:** flora plot summary data is different to Biobanking plot summary data i.e. the percentage of weeds in a 20x20 metre plot is different to the percentage of weeds along a 50 metre transect.
Table 3: Flora plot data

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<th>Cover</th>
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<td>Represented by a solitary item (&lt;5% cover)</td>
</tr>
<tr>
<td>0.5</td>
<td>Represented by a few (&lt;5) items (&lt;5% cover)</td>
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<tr>
<td>1</td>
<td>Represented by &gt;5 items (&lt;5% cover)</td>
</tr>
<tr>
<td>2</td>
<td>Represented by many (&gt;5) items (5-25% cover)</td>
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<tr>
<td>3</td>
<td>Represented by many items (25 - 50% cover)</td>
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<td>4</td>
<td>Represented by many items (50-75% cover)</td>
</tr>
<tr>
<td>5</td>
<td>Represented by many items (75-100% cover)</td>
</tr>
</tbody>
</table>

L Lower stratum
M Mid stratum
U Upper stratum

* denotes an introduced species
+ denotes a species listed on the schedules of the Threatened Species Conservation Act (TSCA)
? denotes a ROTAP listed species
‡ denotes a gazetted weed.

<table>
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<th>Genus</th>
<th>Species</th>
<th>Common name</th>
<th>Status</th>
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<th>Plot C</th>
<th>Plot D</th>
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Boggabilla vegetation assessment
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<tr>
<td></td>
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<td>*‡</td>
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<td>Boobiala</td>
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<tr>
<td>Glandularia</td>
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<td>Maynes Pest</td>
<td>*</td>
<td></td>
<td>L(1)</td>
<td>L(1)</td>
<td>L(1)</td>
<td>L(1)</td>
<td>L(2)</td>
<td>L(2)</td>
<td>L(1)</td>
</tr>
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</table>
Finer scale mapping in areas mapped as Brigalow EEC

- The maintained area:
  - The average width from the edge of the roads sealed surface was seven metres, but varied from five metres to 20 m
  - Plots B, D, E and F data showed maintained areas are more than 50 per cent weedy and do not have a native over story or mid-stratum
  - All plots were not within bench marks for the PCT
  - Vegetation in this area has been re mapped as ‘not native’.

- The table drain:
  - The average width of the table drain was seven metres (seven metres from the edge line to 14 metres from the edge line), but varied from five metres to 30 m
  - Plots A, C and G were placed in table drains (or equivalent for Plot A)
    - Plot A data was later discarded as was unrepresentative – it was a road side rest area).
  - Plots C and G were identified as part of the NSW listed EEC in Low Condition as per BBAM (2014) but were 50 per cent and 60 per cent weedy respectively.
    - Plot C was identified as a native community as it possessed 50 per cent native species (i.e. because it did not have more than 50 per cent native species)
    - Plot G (60 per cent weedy) was considered a native community due to regenerating Brigalow shrubs (as per the NSW EEC definition).

- Remnant native vegetation: The average distance to remnant native vegetation was estimated to be more than 14 metres from the edge line. On site checks of the 2016 BAR confirmed the data was accurate and representative. These data determined that all Brigalow areas remapped by OzArk greater than 14 metres for the edge line should be the NSW listed EEC.

A map showing any areas of contention from that identified in the 2016 BAR

Figures 4 to 6 show areas that differ from mapping provided in the 2016 BAR. For the purposes of this deliverable it is easier to demonstrate areas of mapped EEC that have not changed. Figures 7 to 17 show where changes have been.

The major changes were to areas mapped in the 2016 BAR Brigalow EEC in maintained areas and table drains now described by OzArk. Vegetation mapping provided in Figures 7 to 17 show (by absence of mapping immediately next to the road) the extent of maintained areas, these have been redefined as ‘not native vegetation’. Brigalow EEC mapped in the table drains remains mapped as Brigalow EEC however it has been redefined as in Low Condition (from moderate to good).

Three polygons in the 2016 BAR were changed.

- One area at Ch87000 (southbound lane) was changed from Brigalow EEC to Popular Box Shrubby Woodland
- One polygon from Ch92500 to about Ch93250 on the south bound lane mapped as Belah Woodland was remapped as two separate communities:
  - Half as Brigalow EEC
  - Half as Popular Box Shrubby Woodland.
A map showing the location of the TSC Act and EPBC Act listed community overlaid on the footprint.

A description of each patch of EEC identified (labelled on a map) showing consistency with NSW and Commonwealth listing advice and/or scientific determination has been provided as Figures 7 to 17 show:

- The maintained areas are no longer mapped as Brigalow EEC
- Table drains remain mapped as Brigalow EEC but have been changed from Moderate to Good condition to Low Condition (BBAM 2014). This area is regarded as an unviable local population
- Areas mapped as remnant EPBC Brigalow EEC have been reduced accordingly.

Remapping of the Brigalow EEC showed 6.86 ha is in the study area (Table 4). Of this:

- 4.23 ha meets the criterion to be the EPBC and TSC community. This community is more than 14 metres from the road edge line
- 2.63 ha meets the criterion to be the NSW listed EEC. This community is more than seven metres and less than 14 metres from the road edge line.

Table 4: Amended quantum of Brigalow EEC in the study area

<table>
<thead>
<tr>
<th>Total EEC</th>
<th>BBAM (2014) condition</th>
<th>TSC Act</th>
<th>EPBC Act</th>
<th>Significant impact?</th>
<th>Offsetting triggered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected viable local population (&lt; 14 m from edge line)</td>
<td>Moderate to good</td>
<td>4.23</td>
<td>x</td>
<td>x</td>
<td>Yes for the EPBC EEC (&gt;1 ha affected).</td>
</tr>
<tr>
<td>Affected unviable local population (7 to 14 m from edge line)</td>
<td>Low</td>
<td>2.63</td>
<td>x</td>
<td>No</td>
<td>No for the TSC EEC (No SIS, and No after not including the 2.63 ha of not viable local population)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No (no SIS, &lt; 5ha affected)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.86</td>
</tr>
</tbody>
</table>

Where the areas of EEC recorded differed from that presented in the 2016 BAR,

Figures 4 to 6 and Figures 7 to 17 demonstrate this difference effectively.
Figure 4: Areas of contention from that identified in the 2016 BAR #1
Figure 5: Areas of contention from that identified in the 2016 BAR #2
Figure 6: Areas of contention from that identified in the 2016 BAR #3
Figure 7: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #1

Legend
- Construction footprint
- Table duum NSW Eco (140 m from SL, not visible local pop) in impact footprint
- EPBC Remnant eligible (100 m from SL)
- Sealed road surface (BR)
Figure 8: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #2
Figure 9: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #3
Figure 10: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #4
Figure 11: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #5
Figure 12: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #6
Figure 13: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #7
Figure 14: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #8
Figure 15: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #9
Figure 16: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #10
Figure 17: Location of the TSC Act and EPBC Act listed community overlaid on the footprint #11
Conclusion

Remapping of the Brigalow EEC showed 6.86 ha is in the study area. Of this:

- 4.23 ha meets the criterion to be the EPBC and TSC community. This community is more than 14 metres from the road edge line. Offsetting for this EEC is required following Guidelines for Biodiversity Offsets.
- While 6.86 ha of NSW listed Brigalow EEC has been mapped in the study area only 4.23 ha is in Moderate to Good Condition. 2.63 ha is in Low Condition, is not a viable local population and not eligible as an offsetting candidate. Consequently, offsetting for this EEC is not required following Guidelines for Biodiversity Offsets and advice from Roads and Maritime environmental officers as fewer than five hectares of EEC eligible for offsetting is affected.

Phillip Cameron
Principal Ecologist OzArk EHM
Appendix B – Assessments of Significance
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions

Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions Endangered Ecological Community (Brigalow EEC) occurs in the south of the study area, in patches between Ch. 87,500 and Ch.96,750, and adjacent to the eastern margin of the North Star rest area. At the northern end of its extent, Brigalow EEC intergrades with Poplar Box Shrubby Woodland, and with Belah Woodland at its southern extent.

Brigalow EEC of the study area occurs as narrow linear patches of vegetation, generally restricted to within the road corridor, and separated by expanses of grassy groundcovers from which canopy trees are absent. Brigalow EEC that occurs along the road verge generally supports only characteristic shrub species and groundlayer species; canopy trees are absent. Canopy trees may have previously been removed from the road verge to achieve required lines of sight, particular from the inside of curves.

Brigalow-Belah Woodland to be removed from the study area is highly fragmented, is degraded by edge effects, and supports a diversity of exotic and noxious weeds throughout. However, sampling of this community with vegetation quadrats found there was less than 50% exotic cover, and native cover values were generally within or exceeded benchmark values for the corresponding PCT. As such, the TEC is considered to be in Moderate to Good condition, despite being degraded, and also falls within the EPBC condition thresholds.

Frequently recorded exotic species include *Paspalum dilatatum* (Paspalum), *Rapistrum rugosum* (Turnip Weed), *Glandularia aristigera* (Mayne’s Pest), *Hypochaeris spp.* (Catsear), *Lepidium bonariense* (Peppergrass) *Medicago polymorpha* (Burr Medic), and noxious weed species such as *Harrisia sp.* (Harrisia cactus), *Opuntia stricta* (Prickly Pear) and *Lycium ferocissimum* (African Boxthorn).

Brigalow EEC of the study area maintains minimal vegetative connectivity with any remnants of native vegetation outside of the study area, as land adjoining the extent of Brigalow EEC has been heavily cleared for agricultural purposes, and supports very little native vegetation.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable. Brigalow EEC is not a threatened species.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable. Brigalow EEC is not a threatened population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed action involves the removal of up to 15.3 hectares of Brigalow EEC for the heavy duty pavement upgrade of the Newell Highway. This area represents the maximum area to be cleared and there may be opportunities to reduce the clearing work zone during the remaining stages of detailed design. A total of 30.9 hectares of Brigalow EEC will be retained in the study area. The proposed action is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The composition of Brigalow EEC to be removed from the study area, specifically from the existing edge of the Newell Highway, has been modified by the absence of canopy trees (the community persists as characteristic scattered shrubs and groundcovers), the presence of a diversity of exotic species, including noxious weeds, and degradation resulting from edge effects.

The composition of Brigalow EEC to be retained in the study is unlikely to be substantially modified, although widening of the highway pavement may result in a shift in edge effects, and further spread of exotic species. However, mitigation measures outlined in Section 6 of this report would be implemented during construction, to minimise potential impacts associated with the introduction and spread of weeds into patches of Brigalow EEC to be retained.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposed action involves the removal of up to 15.3 hectares of Brigalow EEC for the heavy duty pavement upgrade of the Newell Highway. A total of 30.9 hectares of Brigalow EEC will be retained in the study area.

A total of 3,444 hectares of Brigalow EEC has been mapped within 10 kilometres of the study area (Eco Logical 2008). Brigalow EEC in the surrounding locality generally occurs as narrow linear remnants contained within road corridors, with some large patches occur within private property, particularly to the south-east of the study area. The removal of up to 15.3 hectares of Brigalow EEC (that is degraded by edge effects and persists with a modified structure along the existing road edge) does not comprises a significant proportion of Brigalow EEC that has been mapped in the surrounding locality.
Brigalow EEC occurring between Ch.88500 and Ch.89750, in the southern extent of the study area, maintains connectivity with a larger linear remnant of Brigalow EEC that adjoins the eastern boundary of the study area. This patch has been mapped as covering 272 hectares (Eco Logical 2008). Similarly, Brigalow EEC occurring between Ch.90250 and Ch.91500 maintains connectivity with a larger linear remnant of Brigalow EEC that adjoins the eastern boundary, mapped as covering 83 hectares (Eco Logical 2008). Much of the Brigalow EEC of the study area forms the edge-effect western margin of these two larger patches. Brigalow EEC occurring between Ch.94000 and Ch.96600 does not maintain connectivity with any other patches of Brigalow EEC mapped in the surrounding locality. Brigalow EEC occurring within the study area is currently fragmented by the Newell Highway. Widening of the highway pavement will not significantly increase this existing fragmentation, and will not result in the fragmentation of Brigalow EEC from the two larger linear remnants of Brigalow EEC that adjoin the eastern boundary of the study area.

Brigalow EEC to be removed from the study area, specifically from the existing edge of the Newell Highway, has been modified by the absence of canopy trees (the community persists as characteristic scattered shrubs and groundcovers), the presence of a diversity of exotic species, including noxious weeds, and degradation resulting from edge effects. Brigalow EEC to be retained in the study is unlikely to be substantially modified, although widening of the highway pavement may result in a shift in edge effects, and further spread of exotic species. However, mitigation measures outlined in Section 6 of this report would be implemented during construction, to minimise potential impacts associated with the introduction and spread of weeds into patches of Brigalow EEC to be retained.

The long-term survival of Brigalow EEC in the locality, including Brigalow EEC to be retained in the study area, is unlikely to be impacted by the proposed action.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No area has been designated as ‘critical habitat’ under the TSC Act 1995 for Brigalow EEC.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no specific Recovery Plan in place for Brigalow EEC. There are no Threat Abatement Plans currently in operation for any Key Threatening Processes threatening Brigalow EEC. OEH is currently developing a targeted approach for managing Ecological Communities. In the interim, the following management actions have been identified for this community.

- Determine optimal management regimes for management of high quality remnants (e.g. fire regimes).
- Produce map of predicted pre-1750 extent.
- Identify key sites to be acquired or targeted for conservation incentive payments.
- Encourage consent authorities to apply best practice standards and develop site management guidelines.
- Disseminate information on this EECs to landholders and promote recovery.
- Encourage land managers to employ best management practice standards in controlling noxious weed or pest species in EECs.
- Develop a database of EEC sites on private land and determine site specific management strategies.
- Collate mapping data and implement on ground mapping of this EEC to fill gaps.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The TSC Act defines a ‘key threatening process’ as ‘a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities’. Schedule 3 of the TSC Act provides a list of the ‘key threatening processes’ (KTPs). The proposed action may contribute to or exacerbate existing KTPs listed below:

- Clearing of native vegetation: A total of 15.3 hectares of Brigalow EEC will be cleared from the study area
- Invasion of native plant communities by exotic perennial grasses: Disturbed areas during and following construction would be susceptible to the establishment and spread of exotic perennial grasses, some of which already occur in the study area

Potential impacts of the proposed action will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction, as outlined in Section 6 of this report.

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on Brigalow EEC as a result of the proposed action, as:

- The proposal is unlikely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the ecological community; and
- The proposal does not significantly contribute to any KTP threatening the ecological community.

Consequently, a Species Impact Statement is not required to be prepared.
Homopholis belsonii (Belson's Panic)

Belson's Panic is a perennial grass growing to 0.5 m high that occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. It also occurs in Queensland, mainly in the Brigalow Belt South bioregion.

In NSW, Belson's Panic is found on poor soils in dry woodlands, such as Belah Woodland, generally on higher, well-drained rises at elevations ranging from 200–520 m. The species appears to be shade-dependant, as it has been found in greatest abundance in shady area beneath or between trees (DoE 2016). Three general types of habitat which support Belson's Panic:

Rocky, basaltic hills supporting Eucalyptus albens (White Box)/Geijera parviflora (Wilga) woodland with assorted shrubs and a number of grass species. It was generally found among fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences.

Flat to gently undulating alluvial areas supporting Casuarina cristata (Belah) forest and sometimes Acacia harpophylla (Brigalow) or G.parviflora (Wilga). Understorey varied from the presence of only Belson's Panic to a mixture of shrubs, sub-shrubs and grasses. Many of the C. cristata sites were subject to intermittent inundation.

Drainage lines supporting C. cristata and sandy country dominated by Cypress Pine-Bloodwood-Ironbark-She-Oak Forest.

Belson's Panic was not identified in the study area during the March and August survey period. However, all woodland communities offer potential habitat to this species.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Belson's Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.

The proposed action is not considered likely to result in an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable. The TSC Act defines an ‘endangered population’ as ‘a population specified in Part 2 of Schedule 1’ of the Act. Belson’s Panic is not part of an ‘endangered population’, as defined under the TSC Act.
(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Belson’s Panic is not an endangered or critically endangered ecological community.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area. The long-term survival of the Belson’s Panic in the locality is unlikely to be adversely affected by the proposed action.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No area has been designated as ‘critical habitat’ under Part 3 of the TSC Act 1995 for Belson’s Panic.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no Recovery Plan in place for the Belson’s Panic. There are no Threat Abatement Plans currently in operation for any Key Threatening Processes threatening the Belson’s Panic.

Belson’s Panic has been assigned to the site-managed species management stream under the OEH Saving our Species program; a form of management for which threatened species are best managed by targeting management actions at key management sites. OEH has established 2 management sites where conservation activities need to take place to ensure the conservation of this species: Kirramingly Nature Reserve and Gurley Road in Moree Plains LGA. Both of these sites are located south of Moree township, and over 150 kilometres south of the study area (OEH...
The management objective is to secure the species in the wild for 100 years and maintain its conservation status under the TSC Act.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The TSC Act defines a ‘key threatening process’ as ‘a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities’. Schedule 3 of the TSC Act provides a list of the ‘key threatening processes’ (KTPs). The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation: a total of 44.4 hectares of potential habitat, offered by woodland PCTs, will be removed from the study area.

Potential impacts of this KTPs will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction, as outlined in Section 5 of this report.

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on Belson’s Panic as a result of the proposed action, as:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.
Desmodium campylocaulon (Creeping Tick-trefoil)

Creeping Tick-trefoil is a prostrate twining herb or erect perennial forb to one metre high, known primarily from the Collarenebri and Moree districts in the north-western plains of NSW.

Distribution of the species is confined to grassland on clay soils, usually with Astrebla and Iseilema species and in NSW, grows on cracking black soils in the Narrabri, Moree and Walgett LGAs. Associated species include Acacia harpophylla, Astrebla pectinata and Sorghum, Dichanthium and Panicum species. Creeping Tick-trefoil flowers summer and autumn.

Creeping Tick-trefoil was not identified in the study area during the March and August survey period. However, Windmill Grass - Bluegrass derived grassland occurs across much of the northern portion of the study area offers potential habitat to this species.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Creeping Tick-trefoil was not identified in the study area during the March and August survey period. The proposed action involves the removal of 60.9 hectares of Windmill Grass - Bluegrass derived grassland that offers potential habitat to Creeping Tick-trefoil. A total of 66.9 hectares of potential habitat will be retained in the study area.

The proposed action is not considered likely to result in an adverse effect on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable. The TSC Act defines an ‘endangered population’ as ‘a population specified in Part 2 of Schedule 1’ of the Act. Creeping Tick-trefoil is not part of an ‘endangered population’, as defined under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable. Creeping Tick-trefoil is not an endangered or critically endangered ecological community.

(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Creeping Tick-trefoil was not identified in the study area during the March and August survey period. The proposed action involves the removal of 60.9 hectares of Windmill Grass - Bluegrass derived grassland that offers potential habitat to Creeping Tick-trefoil. A total of 66.9 hectares of potential habitat will be retained in the study area.

The long-term survival of the Creeping Tick-trefoil in the locality is unlikely to be adversely affected by the proposed action.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No area has been designated as ‘critical habitat’ under Part 3 of the TSC Act 1995 for Creeping Tick-trefoil.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no Recovery Plan in place for the Creeping Tick-trefoil. There are no Threat Abatement Plans currently in operation for any Key Threatening Processes threatening the Creeping Tick-trefoil.

Creeping Tick-trefoil has been assigned to the partnership species management stream under the Saving our Species program, a form of management which recognises that security of a species depends on populations outside NSW and may be better managed by, or with, other federal, state or territory governments. Less than 10% of Creeping Tick-trefoil’s total population occurs within NSW (OEH 2016e). Conservation proposals are being developed for partnership species that:

- Are listed nationally as threatened under the Environmental Protection and Biodiversity Conservation Act 1999;
- Have key populations in NSW;
- Have important breeding sites in NSW; or
- Have a declining population.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The TSC Act defines a ‘key threatening process’ as ‘a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or...
ecological communities’. Schedule 3 of the TSC Act provides a list of the ‘key threatening processes’ (KTPs). The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation: a total of 60.9 hectares of potential habitat offered by Windmill Grass - Bluegrass derived grassland will be removed from the study area.

Potential impacts of this KTPs will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction, as outlined in Section 5 of this report.

**Conclusion**

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on Creeping Tick-trefoil as a result of the proposed action, as:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required to be prepared.
Wetland Birds

The following two species have been combined in one assessment of significance because of similarities in habitat preference. No wetland habitats will be impacted by the Proposal, however, these species have moderate potential of occurring within the study area due to the proximity of floodplain wetland habitat in the locality.

**Magpie Goose** (*Anseranas semipalmata*)

Listed as Vulnerable under the NSW TSC Act.

Mainly found in shallow wetlands (less than one metre deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off. Most breeding now occurs in monsoonal areas; breeding is unlikely in south-eastern NSW.

The closest database record situates the Magpie Goose within 8 kilometres of the study area in 1992.

**Black-necked Stork** (*Ephippiorhynchus asiaticus*)

Listed as Endangered under the NSW TSC Act.

Widespread in coastal and subcoastal northern and eastern Australia; in NSW, the species becomes increasingly uncommon south of the Northern Rivers region. Rarely occurs south of Sydney. Found in association with wetlands, swamps, billabongs, estuaries and surrounding vegetation. Forages in shallow still water, for small vertebrates and crustaceans. Nests in a tall live tree, including paddock trees and paperbarks.

The closest database record situates the Black-necked Stork within 7 kilometres of the study area in 2007.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The abovementioned wetland birds were not detected in the study area during the ecological survey. Other wetland birds were observed in wetland habitats outside the study area within the locality, which indicates they have the potential to occur nearby. The likelihood of occurrence would increase during times of flooding following periods of high rainfall within the catchment since much of the surrounding area is floodplain.

No breeding habitat resources were identified in the study area and the construction and operational activities of the Proposal are unlikely to disturb the species in adjacent habitats. As such, the Proposal is not considered likely to result in an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.
(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The clearing work zone for the Proposal and the associated activities will not directly or indirectly impact core wetland habitat for the target species. The Proposal, which follows the alignment of the existing Newell Highway, would not fragment or impact adjacent wetland habitats within the locality and connectivity will not be impacted for these highly mobile species. The species have potential to forage or roost in the study area on occasion, as such, both woodland and grassland habitats in the study area constitute marginal foraging/roost habitat for the target species. These habitats are not considered important to these wetland birds. The Proposal will involve the removal of up to 109.2 hectares of this marginal habitat. A further 143.8 hectares of this habitat will be retained adjacent to the construction work zone and these habitats are common in the locality.

The proposal is not considered to impact on important habitats or the connectivity of those habitats. The survival of the species will not be affected by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.
(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for either of these species however each have been identified as Partnership managed species under OEH’s Saving Our Species program. The Proposal will not impact on known threats or activities to assist the species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation.
- Loss of hollow-bearing trees

An abundance of similar quality native vegetation will be retained within the locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on these to wetland bird species as a result of the proposed action, as:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Woodland Birds

The following four species have been combined in one assessment of significance because of similarities in habitat preference. Although slightly different in size, behaviour and usage of habitat resources, each of these birds are likely to be associated with the same woodland habitats throughout the study area. There was 125 hectares of suitable woodland habitat identified within the study area, 44.4 hectares of which are likely to be directly impacted by the Proposal.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

Listed as Vulnerable under the NSW TSC Act.

Occurs from the coast inland to the southern tablelands and central western plains of NSW. Inhabits forests and woodlands supporting Casuarina and Allocasuarina species, the seeds of which Glossy-Black Cockatoos feed upon almost exclusively. Requires large hollow-bearing eucalypts for nesting habitat.

The closest database record situates the Glossy Black-Cockatoo within 7 kilometres of the study area in 2007.

Varied Sittella (*Daphoenositta chrysoptera*)

Listed as Vulnerable under the NSW TSC Act.

Widespread throughout mainland Australia, where it is found in eucalypt woodlands and forests, most commonly in areas of rough-barked eucalypts. Forages for insects in rough-bark eucalypts such as ironbark and stringybarks. Nests in a tree branch or fork.

The closest database record situates the Varied Sittella within 3 kilometres of the study area in 2008.

Grey-crowned Babbler (*Pomatostomus temporalis temporalis*)

Listed as Vulnerable under the NSW TSC Act.

Occurs along the east coast of Australia. In NSW, species is known from western slopes of Great Dividing Range, western plains, Hunter Valley and north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains where it forages for invertebrates. Roosts and nests in shrubs or sapling eucalypts. Generally unable to cross large open areas.

The closest database record situates the Grey-crowned Babbler within the study area in 2008. A group of six Grey-crowned Babblers were observed in the study area during the ecological surveys.

Painted Honeyeater (*Grantiella picta*)

Listed as Vulnerable under both the NSW TSC Act and EPBC Act.
A nomadic species that occurs at low densities throughout its range, most commonly found on the inland slopes of the Great Dividing Range in NSW. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests where it forages for the fruits of mistletoes growing on woodland eucalypts and acacias. Nests within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.

The closest database record situates the Painted Honeyeater within the study area in 2008.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The abovementioned woodland birds have high to moderate likelihood of occurring within the study area. The woodland communities which constitute the known habitat for these species constitute breeding and foraging habitat although these fauna are adaptable and able to relocate nest to secure areas as required. In addition, the targeted species are highly mobile and able to move away from areas of disturbance to avoid direct mortality. Although the proposal is expected to directly impact up to 44.4 hectares of potential foraging and breeding habitat a further 80.8 hectares of equal or better quality habitat will be retained in the study area and these habitats also occur more widely throughout the locality.

As such, the Proposal is not considered likely to result in an adverse effect on the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment core habitat for the highly mobile target species. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Proposal will involve the removal of up to 44.4 hectares of core breeding and foraging habitat. A further 80.8 hectares of this habitat will be retained adjacent to the construction work zone and these habitats occur more widely in the locality.

The Proposal will impact on known habitat for the target species, however, the importance of these habitats is lessened by the fact that they are edge effected habitats and because greater quality woodland vegetation occurs within the locality beyond the construction work zone. As such, the survival of these species will not be affected by the proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for either of these species however each have been identified as Landscape managed species under OEH's Saving Our Species program. The Proposal will impact on known listed threats for the species including the clearing of extant woodland vegetation, hollow-bearing trees and roadside vegetation. The impact of these threats will not significantly affect the lifecycle of the species or affect their persistence in the locality.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation.
- Loss of hollow-bearing trees
An abundance of similar quality native vegetation will be retained within the locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

**Conclusion**

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on these woodland bird species as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Raptors

The following two raptor species have been combined in one assessment of significance because of similarities in habitat preference and behaviour. The entire study area constitutes potential foraging habitat for both species. The woodland communities within the study area offer potential roost and nesting sites for both species, however, the riparian corridor adjacent to the Macintyre River presents the only core habitat for the two species.

Little Eagle (*Hieraaetus morphnoides*)

Listed as Vulnerable under NSW TSC Act.

Widespread throughout mainland Australia, often observed over woodland, forested land and open country. Appears to avoid rainforest and dense forest. Hunts for small terrestrial and arboreal mammals. Nests in a large living tree in open woodland or tree-lined watercourses.

The closest database record situates the Little Eagle within 7 kilometres of the study area in 1985.

Square-tailed Kite (*Lophoictinia isura*)

Listed as Vulnerable under NSW TSC Act.

A resident of the north, north-east and along the major west-flowing river systems of NSW and a summer breeding migrant to the south-east of the state. Known from dry woodlands and open forests with a preference for timbered watercourses. Hunts for smaller birds and insects. Nests in a fork or on large horizontal limbs of trees along or near watercourses.

The closest database record situates the Square-tailed Kite adjacent to the study area (along the Macintyre River) in 1986.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The abovementioned raptors have moderate to high likelihood of occurring within the study area. However, these rare species are more likely to occur along the riparian corridor of the Macintyre River than anywhere else in the study area. The potential impacts of the Proposal in this area are minimal with vegetation clearing being limited to understorey and ground covers within the ancillary site. The proposal activities at this site, which include upgrade of the access track to the river, frequent truck movements and pumping of water from the river may provide minor disturbance to these fauna during the construction of the Proposal. However, nesting and breeding activities for the Square-tailed Kite are likely to occur high up in the canopy of the riparian river gums along the river and should not be adversely impacted by the Proposal. The Little Eagle may utilise woodland trees for nesting throughout the woodland vegetation of the study area. The Proposal will remove some of these nesting resources, however, ample habitat will be retained in the study area and in
the wider locality. It is thus expected that the Proposal will not adversely impact the lifecycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment core habitat for the highly mobile target species. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Proposal will involve the removal of up to 109.2 hectares of foraging habitat including 44.4 hectares of woodland and 64.8 hectares of grassland habitat. A further 157.8 hectares of this habitat will be retained adjacent to the construction work zone and these habitats occur more widely in the locality. As such, the survival of these species will not be affected by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.
(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for either of these species however each have been identified as Landscape managed species under OEH’s Saving Our Species program. The Proposal will impact on known listed threats for the species including the clearing of extant woodland vegetation. The impact of these threats will not significantly affect the lifecycle of the species or affect their persistence in the locality given that there is ample habitat retained adjacent to the construction work zone in the road reserve and wider locality.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation.
- Loss of hollow-bearing trees

An abundance of similar quality native vegetation will be retained in the road reserve and the wider locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on these raptor species as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Five-clawed Worm-skink (Anomalopus mackayi)

Listed as Endangered under NSW TSC Act and Vulnerable under the Commonwealth EPBC Act.

Habitat is close to or on the lower slopes of slight rises in grassy White Box woodland on moist black soils, and River Red Gum-Coolibah-Bimble Box woodland on deep cracking loose clay soils. May also occur in grassland areas and open paddocks with scattered trees. Lives in permanent deep tunnel-like burrows and deep soil cracks, coming close to the surface under fallen timber and litter, especially partially buried logs.

The closest database record situates the Five-clawed Worm-skink more than 70 kilometres away from the study area in 2003.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Anomalopus mackayi is a data-deficient species and little is known about its biology and diet. It is known to burrow under loose soil, humus and leaf litter. Reproduction is little understood. As a burrower, the species is assumed to be relatively sedentary and confined to a restricted range. Without evidence for its occurrence within the study area it is assumed to have potential to occur throughout the study area. The potential habitats which include grassland and woodland within the study area are abundant and occur widely beyond the impact area of the Proposal. The species is assumed to occur in all potential habitat within the study area and for this reason it is unlikely that the proposal will place any potential local population at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for *Anomalopus mackayi* within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Proposal will involve the removal of up to 44.4 hectares of woodland and 64.8 hectares of grassland habitat. A further 157.8 hectares of these habitats will be retained adjacent to the construction work zone and these habitats occur more widely in the locality. As such, the survival of the species will not be affected by the Proposal.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for this species however the species has been identified as a Data-deficient species under OEH’s Saving Our Species program. The Proposal will impact on known listed threats for the species including the clearing of vegetation and disturbance of soil through cropping relates to the earthworks activities of the Proposal. The impact of these threats will not significantly affect the persistence of this species in the locality (should it occur there at all) given that there is ample habitat retained adjacent to the construction work zone in the road reserve and wider locality.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation
- Loss of hollow-bearing trees
An abundance of similar quality native vegetation will be retained in the road reserve and the wider locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on Anomalopus mackayi as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Pale Imperial Hairstreak (*Jalmenus eubulus*)

Listed as Critically Endangered under NSW TSC Act.

The Pale Imperial Hairstreak (*Jalmenus eubulus*) is found in Queensland and NSW. In Queensland it is restricted to the seasonally sub-humid central and southern areas of the state. In NSW it is found only in brigalow-dominated open forests and woodlands in northern areas of the state. Suitable habitat is dominated by brigalow, *Acacia harpophylla* and Buloke, *Casuarina cristata* on clay soils on flat to gently undulating plains, usually with scattered emergent euclypts such as Poplar Box, *Eucalyptus populnea* and low trees of Wilga, *Geijera parviflora*. Only known to breed in old-growth forest or woodland and does not appear to colonise regrowth habitats following clearing or other major disturbance.

The closest database record situates the Pale Imperial Hairstreak within 5 kilometres of the study area in 2013.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Pale Imperial Hairstreak is known from the locality. It breeds in brigalow woodland, its caterpillars feed exclusively on brigalow leaves and benefit from an obligate relationship with a select genus of ants that co-occur in this habitat. For this reason the species are only known to breed in old-growth habitats since regrowth communities do not adequately reproduce the unique conditions required for the species' complete lifecycle. The Proposal will impact on edge effected patches of brigalow habitat only which as a disturbed habitat will not provide the necessary attributes to support the lifecycle of the Pale Imperial Hairstreak. Consequently it is not expected that the Proposal has the potential to place the local population at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for the Pale Imperial Hairstreak within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Brigalow woodland within the study area has potential to provide marginal habitat for the Pale Imperial Hairstreak. The majority of the mapped Brigalow within the study area is disturbed edge-effected habitat that would provide little habitat potential for the species. The Proposal will involve the removal of up to 15.3 hectares of this edge-effected Brigalow woodland. A further 44.4 hectares of this habitat will be retained adjacent to the construction work zone within the study area and more Brigalow lies directly adjacent to the study area and also occurs more widely in contiguous undisturbed patches in the nearby locality. As such, the survival of the species will not be affected by the Proposal since the impact area is considered unimportant marginal habitat and better quality habitat occurs within the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for this species however the species has been identified as a Data-deficient species under OEH’s Saving Our Species program. The single listed threat for the species includes the “loss and disturbance to old growth brigalow (Acacia harpophylla) dominated woodland”. The Proposal involves the removal of up to 15.3 hectares of brigalow woodland, however, the condition of this impacted woodland does not meet the condition of undisturbed old-growth habitat. The impact of the Proposal will not significantly affect the persistence of this species in the locality (should it occur there at all) given that there is ample habitat retained adjacent to the construction work zone in the road reserve and wider locality. The one listed recovery activity to protect the species involves protecting the known locations from all disturbance, including illegal collection of specimens. The Proposal does not impact on known locations for the Pale Imperial Hairstreak.
(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation
- Loss of hollow-bearing trees

An abundance of similar quality native vegetation will be retained in the road reserve and the wider locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

**Conclusion**

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on the Pale Imperial Hairstreak as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Black-striped Wallaby (*Macropus dorsalis*)

Listed as Endangered under NSW TSC Act.

From the Townsville area in Queensland to northern NSW where it occurs on both sides of the Great Divide. On the northwest slopes of NSW it occurs in Brigalow remnants to south of Narrabri. On the north coast it is confined to the upper catchments of the Clarence and Richmond Rivers. Preferred habitat is characterised by dense woody or shrubby vegetation within three metres of the ground. This dense vegetation must occur near a more open, grassy area to provide suitable feeding habitat. On the northwest slopes, associated with dense vegetation, including brigalow, ooline and semi-evergreen vine thicket. On the north coast, closely associated with dry rainforest but also occur in moist eucalypt forest with a rainforest understorey or a dense shrub layer. Much of the habitat for the Black-striped Wallaby has been either completely removed or heavily modified, thus earning it ‘pest’ status as most of its remaining habitat occurs within agricultural or pastoral areas.

The closest database record situates the Black Striped Wallaby within 4 kilometres of the study area in 1981.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Black-striped Wallaby is known to be a shy species that is dependent on patches of dense scrubby woodland or rainforest in close proximity to open grassy areas for grazing. During the day the species takes cover under dense vegetation and forages between dusk and dawn. Within the study area some sections of woodland vegetation would meet the habitat requirements of the species, however, much of the woodland vegetation lacks the necessary density of understorey to provide suitable shelter habitat. The species breeds throughout the year. The species is known from recent records in the Border Rivers catchment management area, however, no records later than 1981 have been recorded within 10km of the study area. The woodland vegetation that will be impacted by the Proposal provides marginal, edge effected habitat for the species at best thus it is considered unlikely that the Proposal has the potential to place the species at risk of extinction in the locality.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for the Black-striped Wallaby should it occur within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Black-striped Wallaby is most likely to associate with the brisalow woodland within the study area of which 51 hectares were recorded. More Brigalow woodland lies directly adjacent to the study area and in larger contiguous patches in the wider locality. The Proposal will involve the removal of up to 15.3 hectares of edge effect woodland that would serve as marginal shelter habitat only. This vegetation is not considered important habitat for the species and the Proposal will therefore not impact on the long-term survival of the species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for this species however the species has been identified as a partnership managed species under OEH’s Saving Our Species program. An identified activity to assist the species is to “protect known and potential habitat from clearing, fragmentation and isolation”. The proposal involves the removal of marginal habitat for the species however fragmentation and isolation to this habitat will not occur. The habitat that will be impacted by the proposal is not considered important habitat nor is it known habitat for the species thus the Proposal is not considered to contravene the listed activities to assist the species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.
Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation
- Loss of hollow-bearing trees

An abundance of similar quality native vegetation will be retained in the road reserve and the wider locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

Conclusion

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have "a significant effect" on the Black-striped Wallaby as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Corben's Long-eared Bat (*Nyctophilus corbeni*)

Listed as vulnerable under both NSW TSC Act and Commonwealth EPBC Act.

Occurs throughout the Murray Darling Basin, most commonly within the Pilliga Scrub region. Occurs in association with box/ironbark/cypress-pine vegetation of the western slopes and plains, but also known from mallee, *Allocasuarina leuhmanni* and box eucalypt dominated communities. Roosts in tree hollows, crevices, and under loose bark. Hunts for non-flying invertebrates within the understorey.

The closest database record situates the Corben's Long-eared Bat approximately 50 kilometres away from the study area in 2001.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Corben’s Long-eared bat is associated with Poplar box woodland vegetation, which occurs in the study area for the Proposal. It roosts in crevices and under loose bark and breeding maternity colonies utilise tree cavities during Spring and Summer. The species is thought to spend some of its time on the ground and it is known to forage among the dense understorey and leaf litter to feed on ground-dwelling insects as well as capturing flying insects while in flight. Up to ten hollow-bearing trees will be removed from within the Poplar-box vegetation community for the Proposal which will result in a small loss of potential breeding habitat. However, 36 additional hollow-bearing trees which were recorded in the study area will be retained and a greater amount remains in vegetation directly adjacent to the study area. The Proposal will remove up to 16.9 hectares of potential foraging and roost habitat but a further 36.1 hectares will be retained in the study area and a greater amount occurs within the wider locality. The Proposal will have a minor impact on potential habitat for Corben’s Long-eared bat and is thus considered unlikely to effect the lifecycle of the species such that a local population is placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to a habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Proposal, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for the Corben’s Long-eared bat should it occur within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

The Proposal will remove up to 16.9 hectares of potential foraging and roost habitat but a further 36.1 hectares will be retained in the study area and a greater amount occurs within the wider locality. Four hollow-bearing trees which provide potential breeding habitat will be removed for the Proposal, however, greater than 36 hollow-bearing trees will be retained in the study area in appropriate habitat for the species. The majority of potential habitat to be cleared is roadside edge-effected woodland that is lacking in understorey density to provide quality foraging habitat for Corben’s Long-eared bat. Due to the availability of habitat in the wider locality and the marginal state of the impacted vegetation the habitat to be removed is considered unimportant for the long term survival of the species in the locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Director General of the Office of Environment and Heritage. No critical habitat has been listed for these species. No areas within the survey area are considered critical to the survival of this species.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has not been prepared for this species however the species has been identified as a Landscape managed species under OEH’s Saving Our Species program. Listed activities to assist the species include retain remnant woodland and retain hollow-bearing trees and provide for hollow tree recruitment. The Proposal is inconsistent with the listed activities to assist the species however the majority of potential habitat including woodland vegetation and hollow-bearing trees will be retained in adjacent areas.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act. At present there are 38 listed key threatening
processes under the TSC Act. The following KTPs are likely to result from, or may be exacerbated by, the proposed action:

- Clearing of native vegetation
- Loss of hollow-bearing trees

An abundance of similar quality native vegetation will be retained in the road reserve and the wider locality. The relative number of hollow-bearing trees to be impacted by the Proposal is low in relation to the availability within the wider study area. Potential impacts of these KTP will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

**Conclusion**

In light of the consideration of the above seven factors (1-7), the proposed activity is unlikely to have “a significant effect” on the Corben’s Long-eared Bat as a result of the proposed action, since:

- The proposed action will not adversely affect the life cycle of the species;
- The proposed action will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the species.

Consequently, a Species Impact Statement is not required.
Appendix C – EPBC Significant Impact Assessments
Brigalow (Acacia harpophylla dominant and co-dominant)

Brigalow (Acacia harpophylla dominant and co-dominant) Endangered Ecological Community (Brigalow EEC) occurs in the south of the study area, in patches between Ch. 87,500 and Ch. 96,750, and adjacent to the eastern margin of the North Star rest area. At the northern end of its extent, Brigalow EEC intergrades with Poplar Box Shrubby Woodland, and with Belah Woodland at its southern extent.

In accordance with the definitions provided in the Biobanking Glossary (OEH 2016b), the condition of this EEC is moderate-good. However, Brigalow EEC of the study area occurs as narrow linear patches of vegetation, generally restricted to within the road corridor, and separated by expanses of grassy groundcovers from which canopy trees are absent. Brigalow EEC that occurs along the road verge generally supports only characteristic shrub species and groundlayer species; canopy trees are absent. Canopy trees may have previously been removed from the road verge to achieve required lines of sight, particular from the inside of curves.

While the sparse shrub layer supports a moderate diversity of characteristic species, the groundlayer is degraded by the abundance of exotic species, disturbance along the road verge resulting from regular mowing, enriched run-off from the pavement and dumping of rubbish. Exotic groundcovers occur throughout the groundlayer, particularly along the disturbed edges, including the road verge and the margins of the PCT that adjoin agricultural land.

Frequently recorded exotic species include Paspalum dilatatum (Paspalum), Rapistrum rugosum (Turnip Weed), Glandularia aristigera (Mayne's Pest), Hypochaeris spp. (Catsear), Lepidium bonariense (Peppercress) Medicago polymorpha (Burr Medic), and noxious weed species such as Harrisia sp. (Harrisia cactus), Opuntia stricta (Prickly Pear) and Lycium ferocissimum (African Boxthorn).

Brigalow EEC of the study area maintains minimal vegetative connectivity with any remnants of native vegetation outside of the study area, as land adjoining the extent of Brigalow EEC has been heavily cleared for agricultural purposes, and supports very little native vegetation.

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

Reduce the extent of an ecological community

A total of 3,444 hectares of Brigalow EEC has been mapped within 10 kilometres of the study area (Eco Logical 2008). Brigalow EEC in the surrounding locality generally occurs as narrow linear remnants contained within road corridors, with some large patches occur within private property, particularly to the south-east of the study area.

The removal of up to 10.2 hectares of Brigalow EEC (that is degraded by edge effects and persists with a modified structure along the existing road edge) does not comprise a significant proportion of Brigalow EEC that has been mapped in the surrounding locality.

Fragment or increase fragmentation of an ecological community
Brigalow EEC occurring between Ch.88500 and Ch.89750, in the southern extent of the study area, maintains connectivity with a larger linear remnant of Brigalow EEC that adjoins the eastern boundary of the study area. This patch has been mapped as covering 272 hectares (Eco Logical 2008). Similarly, Brigalow EEC occurring between Ch.90250 and Ch.91500 maintains connectivity with a larger linear remnant of Brigalow EEC that adjoins the eastern boundary, mapped as covering 83 hectares (Eco Logical 2008). Much of the Brigalow EEC of the study area forms the edge-effected western margin of these two larger patches. Brigalow EEC occurring between Ch.94000 and Ch.96600 does not maintain connectivity with any other patches of Brigalow EEC mapped in the surrounding locality. Brigalow EEC occurring within the study area is currently fragmented by the Newell Highway. Widening of the highway pavement will not significantly increase this existing fragmentation, and will not result in the fragmentation of Brigalow EEC from the two larger linear remnants of Brigalow EEC that adjoin the eastern boundary of the study area.

**Adversely affect habitat critical to the survival of an ecological community**

No habitat critical to the survival of Brigalow EEC has been identified within the study area.

**Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community’s survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

The action will result in an increase in impermeable surfaces (due to widening of pavement) within the study area. This modification is unlikely to significantly affect current runoff and flow regimes. Current nutrient levels and soil will largely remain unchanged. Groundwater levels are unlikely to be modified by the action.

**Cause a substantial change in the species composition of an occurrence of an ecological community**

The species composition of Brigalow EEC to be removed from the study area, specifically from the existing edge of the Newell Highway, has been modified by the absence of canopy trees (the community persists as characteristic scattered shrubs and groundcovers), the presence of a diversity of exotic species, including noxious weeds, and degradation resulting from edge effects.

The composition of Brigalow EEC to be retained in the study is unlikely to be substantially modified, although widening of the highway pavement may result in a shift in edge effects, and further spread of exotic species. Potential impacts relating to the establishment and spread of weeds will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction, as outlined in Section 6 of this report, minimising the likelihood of a change in species composition resulting from the introduction of new exotic species.

However, mitigation measures outlined in Section 6 of this report would be implemented during construction, to minimise potential impacts associated with the introduction and spread of weeds into patches of Brigalow EEC to be retained.

**Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
Assisting invasive species, that are harmful to the listed ecological community, to become established, or

Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

Interfere with the recovery of an ecological community

Potential impacts of invasive species will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction, as outlined in Section 5 of this report. Regular mobilisation of fertilisers, herbicides or other chemicals or pollutants is highly unlikely to occur within the study area.

Conclusion

The proposed action is unlikely to have a significant impact on Brigalow EEC.
**Homopholis belsonii (Belson’s Panic)**

Belson’s Panic is a perennial grass growing to 0.5 m high that occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. It also occurs in Queensland, mainly in the Brigalow Belt South bioregion.

In NSW, Belson’s Panic is found on poor soils in dry woodlands, such as Belah Woodland, generally on higher, well-drained rises at elevations ranging from 200–520 m. The species appears to be shade-dependant, as it has been found in greatest abundance in shady area beneath or between trees (DoE 2016). Three general types of habitat which support Belson’s Panic:

- Rocky, basaltic hills supporting *Eucalyptus albans* (White Box)/*Geijera parviflora* (Wilga) woodland with assorted shrubs and a number of grass species. It was generally found among fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences.

- Flat to gently undulating alluvial areas supporting *Casuarina cristata* (Belah) forest and sometimes *Acacia harpophylla* (Brigalow) or *G.parviflora* (Wilga). Understorey varied from the presence of only Belson’s Panic to a mixture of shrubs, sub-shrubs and grasses. Many of the *C. cristata* sites were subject to intermittent inundation.

- Drainage lines supporting *C. cristata* and sandy country dominated by Cypress Pine-Bloodwood-Ironbark-She-Oak Forest.

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of an important population of a species**

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.

The proposed action will not lead to a long-term decrease in the size of an important population of a species.

**Reduce the area of occupancy of an important population**

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.
The proposed action will not reduce the area of occupancy of an important population of Belson’s Panic.

**Fragment an existing important population into two or more populations**

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.

The proposed action will not fragment an existing important population into two or more populations

**Adversely affect habitat critical to the survival of a species**

No habitat critical to the survival of a species has been identified in the study area.

**Disrupt the breeding cycle of an important population**

Belson’s Panic was not identified in the study area during the March and August survey period. The proposed action involves the removal of 44.4 hectares of woodland PCTs that offer potential habitat to Belson’s Panic. A total of 80.8 hectares of potential habitat will be retained in the study area.

The proposed action is unlikely to disrupt the breeding cycle of an important population of Belson’s Panic.

**Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Potential habitat (woodland vegetation) to be removed from the study area, specifically from the existing edge of the Newell Highway, has been modified by the presence of a diversity of exotic species, including noxious weeds, and degradation resulting from edge effects. Potential habitat to be retained in the study is unlikely to be substantially modified, although widening of the highway pavement may result in a shift in edge effects, and further spread of exotic species. However, mitigation measures outlined in Section 6 of this report would be implemented during construction, to minimise potential impacts associated with the introduction and spread of weeds into patches of Brigalow EEC to be retained.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat**

Invasive species, including exotic grasses and noxious weeds, occur commonly throughout potential habitat for Belson’s Panic. Widening of the highway pavement may result in a shift in edge effects, and further spread of exotic species. However, mitigation measures outlined in Section 6 of this report would be implemented during construction, to minimise potential impacts associated with the introduction and spread of weeds into potential habitat (woodland) to be retained.
Introduce disease that may cause the species to decline, or

The proposal has the potential to increase the spread of pathogens that threaten native biodiversity values. The soil-borne pathogen *Phytophthora cinnamomi* (Phytophthora) is known to occur in the Border Rivers-Gwydir Catchment Management Region, although it is not known to be associated with the any of the vegetation communities in the study area. Precautionary measures are recommended during construction, as described in Section 6 of this report.

**Interfere substantially with the recovery of the species.**

The proposed action is unlikely to interfere substantially with the recovery of Belson’s Panic.
Painted Honeyeater (*Grantiella picta*)

Listed as Vulnerable under both the NSW TSC Act and EPBC Act.

A nomadic species that occurs at low densities throughout its range, most commonly found on the inland slopes of the Great Dividing Range in NSW. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests where it forages for the fruits of mistletoes growing on woodland eucalypts and acacias. Nests within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.

The closest database record situates the Painted Honeyeater within the study area in 2008.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Lead to a long-term decrease in the size of an important population of a species**

The woodland communities which constitute the known habitat for this species constitute breeding and foraging habitat although the species is adaptable and able to relocate nests to secure areas as required. In addition, the Painted Honeyeater is highly mobile and able to move away from areas of disturbance to avoid direct mortality. The Proposal will only impact marginal edge-effected habitat and this minor impact is not expected to cause a long-term decline in the local population size.

**Reduce the area of occupancy of an important population**

The study area is situated within the known distribution range for the species. Records of the species occur both within and throughout the locality and it thus unlikely that the Proposal will reduce the area of occupancy for a local or important population of the species.

**Fragment an existing important population into two or more populations**

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for the species within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

**Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for this species under the EPBC Act.

**Disrupt the breeding cycle of an important population**

The woodland vegetation within the study area presents ample breeding habitat for the species. More than 91 hectares of this vegetation will be retained in the study area and additional breeding habitat is situated directly adjacent to the study area. The species is flexible and can relocate away from disturbance and thus the Proposal is unlikely to disrupt the breeding cycle of the local population.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Although the proposal is expected to directly impact up to 44.4 hectares of potential foraging and breeding habitat a further 91 hectares of equal or better quality habitat will be retained in the study area and these habitats also occur more widely throughout the locality. Ample habitat resources will be retained in the study area and the proposal itself will only impact on marginal edge effected habitats. As such, the species is not considered likely to decline as a result of the Proposal.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat

There is potential for disturbed areas resulting from earthworks and vegetation clearing to be susceptible to invasion by exotic species. Potential impacts will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

Introduce disease that may cause the species to decline, or

The Proposal is highly unlikely to introduce disease that may cause the species to decline.

Interfere with the recovery of the species

There is no current recovery plan in place for the Painted Honeyeater.

Conclusion

The Proposal is unlikely to have a significant impact on including the Painted Honeyeater.
Corben's Long-eared Bat (*Nyctophilus corbeni*)

Listed as vulnerable under both NSW TSC Act and Commonwealth EPBC Act.

Occurs throughout the Murray Darling Basin, most commonly within the Pilliga Scrub region. Occurs in association with box/ironbark/cypress-pine vegetation of the western slopes and plains, but also known from mallee, Allocasuarina leuhammadii and box eucalypt dominated communities. Roosts in tree hollows, crevices, and under loose bark. Hunts for non-flying invertebrates within the understorey.

The closest database record situates the Corben's Long-eared Bat approximately 50 kilometres away from the study area in 2001.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Lead to a long-term decrease in the size of an important population of a species**

Direct mortality of Corben's Long-eared bat is not expected to occur as a consequence of the Proposal and ample breeding habitat will be retained within the study area and the wider locality. It is thus considered unlikely that the Proposal will result in long-term decline in the size of a resident population.

**Reduce the area of occupancy of an important population**

The Poplar-box woodland vegetation within the study area will be reduced from 53 to 36.1 hectares as a consequence of the Proposal. The impacted area is unlikely to constitute important quality habitat for the species since it is edge-effected and lacks suitable cover in the understorey. Thus the vegetation removal associated with the Proposal does not equate to a reduction in the area of occupancy for the species.

**Fragment an existing important population into two or more populations**

The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for the Corben’s Long-eared bat should it occur within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

**Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for this species under the EPBC Act.

**Disrupt the breeding cycle of an important population**

The vegetation to be removed by the Proposal is considered at best to be marginal habitat for the species and ten hollow-bearing trees will be removed in this vegetation community. Ample breeding habitat in the form of hollow-bearing trees will be retained in the study area and adjacent
areas of vegetation within the locality. The Proposal may remove marginal breeding habitat but will not disrupt the breeding cycle of the population as a whole.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Proposal will remove up to 16.9 hectares of potential foraging and roost habitat but a further 36.1 hectares will be retained in the study area and a greater amount occurs within the wider locality. Ten hollow-bearing trees which provide potential breeding habitat will be removed for the Proposal, however, greater than 36 hollow-bearing trees will be retained in the study area in appropriate habitat for the species. The majority of potential habitat to be cleared is roadside edge affected woodland that is lacking in understorey density to provide quality foraging habitat for Corben’s Long-eared bat. Due to the availability of habitat in the wider locality and the marginal state of the impacted vegetation the habitat to be removed is considered unimportant for the long term survival of the species in the locality. Consequently the loss of habitat will not result in decline of the species in the locality.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat**

There is potential for disturbed areas resulting from earthworks and vegetation clearing to be susceptible to invasion by exotic species. Potential impacts will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

**Introduce disease that may cause the species to decline, or**

The Proposal is highly unlikely to introduce disease that may cause the Corben’s Long-eared bat to decline.

**Interfere with the recovery of the species**

The draft National Recovery Plan for the South-eastern Long-eared Bat (Schulz & Lumsden 2010) lists a series of activities to facilitate the recovery of Corben’s Long-eared bat. The Proposal does not interfere with any of the proposed recovery actions detailed in the draft recovery plan.

**Conclusion**

The Proposal is unlikely to have a significant impact on Corben’s Long-eared bat.
**Cryptic Reptiles**

The following two reptile species have been combined in one assessment of significance because of similarities in habitat preference. They are considered to have low likelihood of occurrence within the study area but have been assessed here as a precautionary measure because their cryptic nature makes them difficult to survey for without significant effort. Both the woodland and grassland within the study area has been nominated as potential habitat for these species.

**Collared Delma (Delma torquata)**

Listed as Vulnerable under Commonwealth EPBC Act.

The Collared Delma normally inhabits eucalypt-dominated woodlands and open-forests in Queensland Regional Ecosystem Land Zones (Brigalow Belt Reptiles Workshop 2010). The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100 mm thick) appears to be an essential characteristic of the Collared Delma microhabitat and is always present where the species occurs. Whilst Collared Delmas are often found associated with small rocks, the presence of small rocks is not an essential habitat characteristic.

There are no database records for the Collared Delma within NSW.

**Five-clawed Worm-skink (Anomalopus mackayi)**

Listed as Endangered under NSW TSC Act and Vulnerable under the Commonwealth EPBC Act.

Habitat is close to or on the lower slopes of slight rises in grassy White Box woodland on moist black soils, and River Red Gum-Coolibah-Bimble Box woodland on deep cracking loose clay soils. May also occur in grassland areas and open paddocks with scattered trees. Lives in permanent deep tunnel-like burrows and deep soil cracks, coming close to the surface under fallen timber and litter, especially partially buried logs.

The closest database record situates the Five-clawed Worm-skink more than 70 kilometres away from the study area in 2003.

**An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:**

**Lead to a long-term decrease in the size of an important population of a species**

Neither species is considered likely to occur in the study area. The habitat within the study area is marginal and outside of the known range of the species. An important population is not considered to occur within the study area and thus the Proposal will not lead to a long term decrease in size.

**Reduce the area of occupancy of an important population**

The study area is situated outside of the known distribution range for each species and it thus unlikely that the Proposal will reduce the area of occupancy for any population of the species.

**Fragment an existing important population into two or more populations**
The Proposal, which follows the alignment of the existing Newell Highway, would not serve to further fragment any potential habitat for either species within the study area. Clearing for the Proposal will impact already edge-effected habitats along the roadside only.

**Adversely affect habitat critical to the survival of a species**

No critical habitat is listed for this species under the EPBC Act.

**Disrupt the breeding cycle of an important population**

The study area is thought to contain marginal habitat at best. The study area is outside of the known distribution for both species and thus is it is considered unlikely that an important breeding population occurs in the study area.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Proposal will involve the removal of up to 44.4 hectares of woodland and 64.8 hectares of grassland habitat. These habitats are not considered to constitute quality habitat for the species since they are outside of the known distribution for the species. A further 157.8 hectares of these habitats will be retained adjacent to the construction work zone and these habitats occur more widely in the locality. As such, the species if present in the study area is not considered likely to decline as a results of the Proposal.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat**

There is potential for disturbed areas resulting from earthworks and vegetation clearing to be susceptible to invasion by exotic species. Potential impacts will be reduced and mitigated through the implementation of appropriate controls and mitigation measures during and following construction.

**Introduce disease that may cause the species to decline, or**

The Proposal is highly unlikely to introduce disease that may cause either reptile species to decline.

**Interfere with the recovery of the species**

A recovery plan for the Queensland Brigalow Belt Reptiles, including the Five-clawed Worm-skink and Collared Delma, was drafted by WWF-Australia in 2006 (Richardson 2006). The Recovery Plan lists a series of activities to facilitate the recovery of the species and the Proposal does not interfere with any of the recovery actions that it details.

**Conclusion**

The Proposal is unlikely to have a significant impact on including the Five-clawed Worm-skink or Collared Delma.
Murray Cod (*Maccullochella peelii*)

Listed as Vulnerable under the Commonwealth EPBC Act.

The Murray Cod was historically distributed throughout the Murray-Darling Basin, which extends from southern Queensland, through New South Wales, the Australian Capital Territory and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution up to approximately 1000 m above sea level.

The Murray Cod utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Murray Cod are frequently found in the main channels of rivers and larger tributaries. Murray Cod tend to occur in floodplain channels and anabranches when they are inundated, but the species’ use of these floodplain habitats appears limited. Juveniles less than one year old have been found in main river channels where it appears they settle at a late larval (newly born) stage.

The Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod. River Red Gum open woodland occurring within the riparian corridor associated with the Macintyre River, and within the Boggabilla boat ramp site, offers structural habitat features such as in-stream woody debris and snags.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of an important population of a species**

No aquatic field surveys were undertaken during the March or August survey periods; the Macintyre River was not explicitly surveyed for the presence of Murray Cod. However, the Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod.

The proposed action at the Boggabilla boat ramp site involves: the installation of temporary fencing around riparian vegetation; treatment of the boat ramp access road surface; widening of the boat ramp access road at the ramp end to enable safe water trucks access and turning movements; installation, testing and commissioning of the water pump and construction of a pump house.

The proposed action is unlikely to a long-term decrease in the size of an important population of a species.

**Reduce the area of occupancy of an important population**

The Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod. The proposed action does not involve the removal of potential habitat. Mitigation measures outlined in section 6 of this report and in the project REF will minimise potential indirect impacts on habitat, relating to water quality and sedimentation and erosion.

The proposed action will not reduce the area of occupancy of an important population of Murray Cod.
Fragment an existing important population into two or more populations

No aquatic field surveys were undertaken during the March or August survey periods; the Macintyre River was not explicitly surveyed for the presence of Murray Cod. However, the Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod. As the proposed action does not involve the removal of potential habitat, the proposed action will not fragment an existing important population into two or more populations.

Adversely affect habitat critical to the survival of a species

No habitat critical to the survival of a species has been identified in the study area.

Disrupt the breeding cycle of an important population

The Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod. The proposed action does not involve the removal of potential habitat. The proposed action is unlikely to disrupt the breeding cycle of an important population of Murray Cod.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Macintyre River that adjoins the Boggabilla boat ramp site offers potential habitat for the Murray Cod. The proposed action does not involve the removal of potential habitat. Mitigation measures outlined in section 6 of this report and in the project REF will minimise potential indirect impacts on habitat, relating to water quality and sedimentation and erosion. The proposed action is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that Murray Cod is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species’ habitat

The proposed action does not involve the removal of potential habitat. Mitigation measures outlined in section 6 of this report and in the project REF will minimise potential indirect impacts on habitat, relating to water quality and sedimentation and erosion. The proposed action is unlikely to introduce invasive fish species to the Macintyre River, such as Eastern Mosquito-fish (Gambusia holbrooki), Common Carp (Carp), Redfin/English Perch (Perca fluviatilis), Brown Trout (Salmo trutta) and Rainbow Trout (Oncorhynchus mykiss) (Trout species), and tGoldfish (Carassius auratus auratus).

Introduce disease that may cause the species to decline

The proposed action does not involve the removal of potential habitat. Mitigation measures outlined in section 6 of this report and in the project REF will minimise potential indirect impacts on habitat, relating to water quality and sedimentation and erosion. The proposed action is unlikely to introduce diseases and pathogens of concern for the Murray Cod, such as waterborne Epizootic Haematopoietic Necrosis (EHN) virus, Viral Encephalopathy and Retinopathy, Goldfish Ulcer Disease, Asian Fish Tapeworm (Bothriocephalus acheilognathis) and Parasitic Copepod Anchorworm (Anchorworm) (Lernaea cyprinacea).
Interfere substantially with the recovery of the species.

The proposed action is unlikely to interfere substantially with the recovery of Murray Cod.

**Conclusion**

The Proposal is unlikely to have a significant impact on including the Murray Cod.
Appendix C

Preliminary Aboriginal cultural heritage assessment report
HW17 Mungle Back Creek to Boggabilla heavy duty pavement project

PRELIMINARY PACHCI Stage 3 Aboriginal Cultural Heritage Assessment

Report to Roads and Maritime Services

Artefact project 151204

6 May 2017
EXECUTIVE SUMMARY

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are to:

- Provide a heavy duty pavement
- Widen the existing highway or construct a new two lane highway adjacent to the existing highway
- Provide dedicated overtaking lanes
- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity when feasible and reasonable
- Provide water supply infrastructure to help build and maintain the proposal.

Artefact Heritage was engaged by Arcadis to carry out an Aboriginal archaeological survey and assessment of the proposed design areas in accordance with Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) guidelines (Artefact Heritage, 2017; 2017a). This heritage assessment formed part of the Review of Environmental Factors (REF) that was prepared for Roads and Maritime in accordance with the requirements of Part 5 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

Artefact Heritage has been engaged by Arcadis on behalf of Roads and Maritime to conduct statutory consultation and a cultural heritage assessment report (CHAR) prepared in accordance with Stage 3 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). The proposal area of this Stage 3 PACHCI is the sum of areas reported on by Artefact Heritage in the PACHCI Stage 2 assessment and addendum (Artefact Heritage, 2017; 2017a).

This report has also been prepared in accordance with the OEH Guide to Investigating and Reporting on Aboriginal Cultural Heritage in NSW 2010 (herein referred to as the Guide) and the OEH Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010 (herein referred to as the Code of Practice).

This report addresses the areas surveyed by Artefact in accordance with mapping made available to Artefact prior to archaeological survey. Any new locations of build outside of surveyed areas will require separate heritage assessment.

Overview of findings

- There are three Aboriginal sites located within the proposal area. These are isolated artefacts MBC Artefact 3 # 02-4-0088, MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087
- There are eight Aboriginal sites including one Potential Archaeological Deposit (PAD) located near to the proposal area. These comprise:
  - One Potential Archaeological Deposit (PAD) – MBC PAD01 #02-4-0085. at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development
Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees; MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. These are outside, but close to the current planned development

One previously recorded site, The Rocks Site 1 #02-4-0024, is an artefact scatter near the proposal area in the ancillary area at the old Council borrow pit

Table 1: Sites identified during PACHCI Stage 2 survey

<table>
<thead>
<tr>
<th>Previous Identity</th>
<th>AHIMS identity</th>
<th>Easting (GDA 94/56)</th>
<th>Northing (GDA 94/56)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBC PAD01</td>
<td>02-4-0085</td>
<td>242607</td>
<td>6832098</td>
<td>Potential Archaeological Deposit – Boggabilla Boat Ramp</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>02-4-0086</td>
<td>240237</td>
<td>6828491</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>02-4-0087</td>
<td>233140</td>
<td>6815782</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>02-4-0088</td>
<td>239137</td>
<td>6827049</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>02-4-0079</td>
<td>237704</td>
<td>6825550</td>
<td>Bimble Box culturally scarred tree.</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>02-4-0080</td>
<td>238921</td>
<td>6826738</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 3</td>
<td>02-4-0081</td>
<td>233351</td>
<td>6817630</td>
<td>Scarred Bimble Box, dead face of scar fallen to ground.</td>
</tr>
<tr>
<td>MBC Scarred Tree 4</td>
<td>02-4-0082</td>
<td>233362</td>
<td>6817469</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 5</td>
<td>02-4-0084</td>
<td>2333256</td>
<td>6816436</td>
<td>Bimble Box Small cultural scar.</td>
</tr>
<tr>
<td>MBC Scarred Tree 6</td>
<td>02-4-0083</td>
<td>238756</td>
<td>6826673</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>The Rocks Site 1</td>
<td>02-4-0024</td>
<td>Per mapping</td>
<td></td>
<td>The Rocks Site 1</td>
</tr>
</tbody>
</table>
Recommendations

The following recommendations are based on consideration of:

- Legislative, policy and procedural requirements for the assessment of Aboriginal cultural heritage
- The recommendations of the ASR
- ESD principles
- The views and information provided by registered Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- There are three recorded Aboriginal sites located within the proposal area which would be directly impacted by the proposal. One of these sites, MBC Artefact 3 #02-4-0088 is located within the proposal area, while two sites MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087 are so close as to effectively be within the proposal area.
- There are eight Aboriginal sites including one PAD located near to the proposal area. These comprise:
  - One Potential Archaeological Deposit (PAD) – MBC PAD01 #02-4-0085. at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development
  - Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees; MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. These are outside, but close to the current planned development
  - One previously recorded site, The Rocks Site 1 #02-4-0024, is an artefact scatter near the proposal area in the ancillary area at the old Council borrow pit One previously recorded site, The Rocks Site 2, 02-4-0025 was previously thought to be near the proposal area, but has been determined not to be in the vicinity of the study area.

It is therefore recommended that:

- In areas surveyed for this study where no Aboriginal heritage values have been identified, the proposed activity may commence without further formal archaeological assessment. The proposed activity must adhere to the CEMP and accompanying unexpected finds policy as outlined below.
- An AHIP will be secured for known impacts to Aboriginal heritage in the areas surveyed for this study. The AHIP will be secured to permit salvage of the three isolated artefact sites (MBC Artefact 1 #02-4-0086, MBC Artefact 2 02-4-0087, MBC Artefact 3 02-4-0088), and to permit any subsequent impacts to their locations. Connected with this, it is recommended Roads and Maritime arrange, in accordance with the recommendations of registered Aboriginal stakeholders and OEH guidelines:
Community collection of these artefacts

Facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.

Roads and Maritime arrange for inspection of the locations of the six scarred trees identified in this study (MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083) by an arborist or other suitably qualified specialist, to determine the size of buffer required to protect these trees, their canopies and root-balls from impact by the proposed activities. Appropriately robust barriers must be placed between proposed works and the buffer zone advised for each tree while construction is being undertaken. Where additional design refinements are likely to impact to any of the identified scarred trees from the proposal, an addendum CHAR and revised consultation with stakeholders, including a second AFG, would be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP application where this impact is identified subsequent to issuance by OEH of the first AHIP.

Although unlikely to be impacted in the course of works, an exclusion zone will be defined by a qualified archaeologist and a barrier will be erected around interface between the construction work zone and MBC PAD01 and The Rocks Site 1 #02-4-0024 while construction is being undertaken.

A heritage induction will be provided to workers before construction begins. It will inform them of exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.

A CEMP and accompanying unexpected finds procedure will provide a method to manage potential heritage constraints and unexpected finds during construction works. Aspects of site and cultural area protection that should be included in the CEMP include:

- Establishing no-harm areas where appropriate. Depending on the nature and timing of works in the vicinity of identified Aboriginal sites or cultural areas that will not be impacted by the proposed works, it may be appropriate to establish visual markers around no-harm areas with appropriate signage to avoid inadvertent impacts.

- Nature of the visual markers around no-harm areas. The CEMP should document what type of visual marker will be put in place, such as temporary fencing, high visibility tape, and temporary signage.

- Provide clear guidance to all site workers on access restrictions to no-harm areas including site inductions and tool box talks.

- Unexpected finds procedure in accordance with the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.

If any suspected human remains are located during any stage of the proposed works, work should stop immediately and the procedures outlined in the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.
• Should any changes be made to the proposed works that would involve additional impacts to Aboriginal heritage or areas outside of the proposal area, these changes should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups and further investigation may be necessary.

• The final version of this CHAR and accompanying documentation should be forwarded to registered Aboriginal stakeholders and OEH with an AHIP application.
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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are to:

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- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity when feasible and reasonable
- Provide water supply infrastructure to help build and maintain the proposal.

The alignment of the proposal area and its ancillary areas is shown in Figure 1 below.
Figure 1: Location of the proposal area
1.2 Background to this Assessment

Artefact Heritage was engaged by Arcadis to carry out an Aboriginal archaeological survey and assessment of the proposed design areas in accordance with Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) guidelines (Artefact Heritage, 2017; 2017a). This heritage assessment formed part of the Review of Environmental Factors (REF) that was prepared for Roads and Maritime in accordance with the requirements of Part 5 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

Artefact Heritage (2017) carried out a PACHCI Stage 2 survey of approximately 28 km of roadway, road reserve, and ancillary areas. Fieldwork for this was carried out in late 2016, and reporting was finalised in February 2017. This survey identified ten new sites, comprising one PAD, six scarred trees, and three isolated artefacts. This survey also reidentified and clarified the extent of an existing recorded site near the study area – The Rocks Site 1 02-4-0024. The ten newly identified sites have been recorded with OEH on the Aboriginal Heritage and Inventory Management System (AHIMS). All sites identified during survey are listed below in Table 2.

Table 2: AHIMS listing of identified sites near the proposal area

<table>
<thead>
<tr>
<th>Previous Identity</th>
<th>AHIMS identity</th>
<th>Easting (GDA 94/56)</th>
<th>Northing (GDA 94/56)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBC PAD01</td>
<td>02-4-0085</td>
<td>242607</td>
<td>6832098</td>
<td>Potential Archaeological Deposit – Boggabilla Boat Ramp</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>02-4-0086</td>
<td>240237</td>
<td>6828491</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>02-4-0086</td>
<td>233140</td>
<td>6815782</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>02-4-0088</td>
<td>239137</td>
<td>6827049</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>02-4-0079</td>
<td>237704</td>
<td>6825550</td>
<td>Bimble Box culturally scarred tree.</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>02-4-0080</td>
<td>238921</td>
<td>6826738</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 3</td>
<td>02-4-0081</td>
<td>233351</td>
<td>6817630</td>
<td>Scarred Bimble Box, dead face of scar fallen to ground.</td>
</tr>
<tr>
<td>MBC Scarred Tree 4</td>
<td>02-4-0082</td>
<td>233362</td>
<td>6817469</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 5</td>
<td>02-4-0084</td>
<td>2333256</td>
<td>6816436</td>
<td>Bimble Box Small cultural scar.</td>
</tr>
<tr>
<td>MBC Scarred Tree 6</td>
<td>02-4-0083</td>
<td>238756</td>
<td>6826673</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>The Rocks Site 1</td>
<td>02-4-0024</td>
<td>Per AHIMS mapping</td>
<td></td>
<td>The Rocks Site 1</td>
</tr>
</tbody>
</table>
An Addendum (Artefact Heritage, 2017a) to the PACHCI Stage 2 was carried out to examine an additional 4.5 km of road and road reserve that had been identified as impacted by design refinements that were not assessed in the REF.

During both phases of survey (Artefact Heritage, 2017; 2017a) surface visibility was low due to thick vegetative cover, roadside gravel and road surface. Based on previous archaeological studies in the area, background information including geomorphology and the indications of field survey, both Artefact (2017) and Artefact (2017a) found that their proposal areas were of low likely archaeological potential.

No new items of Aboriginal heritage significance were identified during the Addendum investigation, and the proposal area concerned was identified as likely wholly disturbed through the construction of a wide table drain that ran alongside the roadway in this location.

1.3 Proposal area

The proposal area comprises approximately 28 kilometres of Newell Highway road corridor, proposed sites for ancillary areas and the Boggabilla boat ramp site. The proposal area extends between Roads and Maritime chainages 87,400 to 114,900. For the purposes of this report, the proposal area is defined as the extent of the area required for construction and operation of the proposal. This includes provision of new pavement, road widening or new roadway, overtaking lanes, road intersection improvements, improvements to private property access, road signage, delineation and roadside furniture, drainage upgrades, water supply infrastructure, construction work zones, erosion and sediment controls, stockpile areas and ancillary facilities.

The linear extents of the proposal area are: (see Figure 1):

- An area of approximately 500 metres in length at the eastern end of South Street, Boggabilla, Roads and Maritime proposed to construct a turnaround area and water pumping facility at this location
- Approximately 28 kilometres along the Newell Highway from Boggabilla to Mungle Back Creek.

The non-linear extents of the proposal area are: (see Figure 1):

- Ancillary Facility 1 is a polygon measuring 380 m² to the east of the Newell Highway adjacent to Boggabilla Cemetery.
- Ancillary Facility 2 is a polygon measuring 4.4 hectares at former Council borrow site east of the Newell Highway below Dolgetti-Boggabilla Road.
- Ancillary Facility 3 is a polygon measuring 300m² at the north-east corner of the intersection of North Star Road and the Newell Highway.

1.4 The proposal

The main features of the proposal are:

- Provide heavy duty pavement
- Widen the road
• Provide dedicated overtaking lanes
• Upgrade intersections
• Improve access to private property
• Provide road delineation, sign posting and roadside furniture
• Upgrade drainage to improve the Newell Highway flood immunity to a 20-year average recurrence interval when feasible and reasonable
• Provide water supply infrastructure to facilitate the construction and maintenance of the proposal.

1.4.1 Proposal refinements

Following the preparation of the REF, Roads and Maritime have refined and further developed several aspects of the proposal that have resulted in a revised design and construction work zone boundary. These refinements were related to road alignment and local road intersection and drainage improvements. The Aboriginal heritage impacts documented in this report relate to the revised design and construction work zone boundary.

1.5 Objectives of this Aboriginal Cultural Heritage Assessment

The objectives of this report are to:

• Assess the Aboriginal cultural heritage values of the proposal area, including archaeological and community cultural values, and the significance of identified values.
• Identify Aboriginal cultural heritage values that may be impacted by the revised proposal design and construction work zone, including consideration of cumulative impacts, and measures to avoid significant impacts.
• Ensure appropriate Aboriginal community consultation in the assessment process.
• Identify any recommended further investigations, mitigation and management measures required.

This CHAR has been prepared in accordance with:

• Roads and Maritime PACHCI
• Guide to Investigating and Reporting on Aboriginal Cultural Heritage in NSW 2010 (the Guide)
• Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010 (the Code of Practice)
• Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (the Consultation Requirements).

This report includes:

• A description of the scope of the project and the extent of the proposal area
• A description of Aboriginal community involvement and Aboriginal consultation
• A significance assessment of the proposal area including cultural and archaeological values
• A description of the statutory requirements for the protection of Aboriginal heritage
• An impact assessment for recorded Aboriginal sites and areas of archaeological potential
• Provision of measures to avoid, minimise, and if necessary, offset the predicted impacts on Aboriginal heritage values.

1.6 Authorship

This CHAR was prepared by Michael Lever. Josh Symons (Principal) provided management input and review.

1.7 Statutory Requirements


The NPW Act, administered by the OEH provides statutory protection for all Aboriginal ‘objects’ (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the Act, and for ‘Aboriginal Places’ (areas of cultural significance to the Aboriginal community) under Section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only AHIP available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.

As part of the administration of Part 6 of the Act, OEH regulatory guidelines on Aboriginal consultation are in place, which are outlined in the Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010). Guidelines are also in place for the processes of due diligence as outlined in the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (2010) in accordance with the 2010 amendment to the Act.

There are no gazetted Aboriginal Places within the proposal area. All Aboriginal objects, whether recorded or not are protected under the Act.

1.7.2 Native Title Act (1994)

The NSW Native Title Act 1994 was introduced to work in conjunction with the Commonwealth Native Title Act 1993. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

A search of the National Native Tribunal applications register was undertaken for this assessment. The entirety of the proposal area of this report is located within lands subject to the Registered Native Title Claim NC2011/006 by the Gomeroi People, filed on 20/12/2011 (Gomeroi People NC2011/006, 2012). However, the terms of this claim (par. 3) stipulate that any public works commenced before 23 December 1996 are excluded from Native Title Claim NC2011/006. The proposed works may therefore be excluded from the Gomeroi People Native Title Claim NC2011/006.
1.7.3 Aboriginal heritage investigation guidelines

The current investigation adheres to Stage 3 of the Roads and Maritime PACHCI and the OEH Code of practice. Stage 3 includes comprehensive Aboriginal stakeholder consultation, archaeological test excavation (where required), an AFG meeting, and preparation of a CHAR to support an AHIP. Stage 4 of the PACHCI involves any mitigation measures required following approvals, such as archaeological salvage excavation or surface collection prior to impacts.
2.0 CONSULTATION PROCESS

Aboriginal stakeholder consultation is being conducted by Roads and Maritime in accordance with the Roads and Maritime PACHCI and the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (herein referred to as the Consultation Requirements). The consultation log and all consultation documentation supplied by Roads and Maritime is provided in Appendices A to C.

An initial site survey was conducted of the original proposal area in March 2016 (see Appendix B) by representatives of Artefact Heritage and Roads and Maritime. The indications of this survey were that Aboriginal sites were likely to be present in the proposal area, and that a formal PACHCI Stage 2 should be initiated.

A PACHCI Stage 2 survey was conducted with representatives from TLALC and Gomeroi People on the 28th November 2016 to 2nd December 2016. The findings of this report were finalised in February 2017 and were provided to Roads and Maritime for their comment and provision to TLALC and Gomeroi People. An addendum to the PACHCI Stage 2 was undertaken to survey additional areas not included in the PACHCI Stage 2. Survey for the addendum report took place on 21 February 2017 with the participation of TLALC, Gomeroi People and Roads and Maritime Aboriginal Cultural Heritage Officer, Jeff Charlton.).

Roads and Maritime are currently in the process of inviting Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal significance of Aboriginal object(s) in the area of the proposed project to register an interest in a process of community consultation with Roads and Maritime regarding the proposal.

The following section will be completed once information from the community consultation process, including an Aboriginal Focus Group (AFG), is available.

**Table 3: Registered Stakeholders to date**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toomeelah Local Aboriginal Lands Corporation</td>
<td><a href="mailto:Toomeelahlandcouncil@gmail.com">Toomeelahlandcouncil@gmail.com</a></td>
</tr>
<tr>
<td>Gomeroi People</td>
<td><a href="mailto:ngnulu@optusnet.com.au">ngnulu@optusnet.com.au</a></td>
</tr>
</tbody>
</table>

**Table 4: Stakeholder attendees at first AFG**

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 5: Comments from registered Aboriginal parties regarding the draft CHAR**

<table>
<thead>
<tr>
<th>Name</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.0 SUMMARY AND ANALYSIS OF BACKGROUND INFORMATION

3.1 Environmental Context

3.1.1 Geology & geomorphology

The proposal area is predominantly located within two distinct geological formations, which are divided at Whalan Creek. To the north of Whalan Creek, the landscape is generally level or mildly undulating and consists of extensive floodplains incised by drainage channels. The substrate is Qa - Quaternary alluvials, consisting of river deposited mud, silt, sand and gravel dating from 2.5 million years ago (mya) to the present. Soils within this subregion are dominated by the grey and brown clays on the plains, and brown loamy sands on the rises of former levees and channels (NSW Geology Plus, 2016).

South of the Whalan Creek geology consists primarily of Ks – Cretaceous sedimentary rocks. These are sandstone, calcareous sandstone, siltstone and shale which were deposited in a shallow marine environment between 66 to 145 million years ago. The area is frequently incised by waterways and overlain by alluvial fans. The topography is characterised by sloping plains. Soils within the subregion are dominated by red loams and heavy brown clays (NSW Geology Plus, 2016; eSpade, 2015). The course of Mungle Back Creek is on an extent of Qa (Quaternary alluvials). The proposal area includes small extents of Qc (Quaternary colluvial deposits) in its southern extreme.

In both parts of the proposal area lithology is characterised by river-deposited or colluvial sediments up to a depth of 20m. Typically, this comprises of a soft alluvium to a depth of 3-4m underlain by compacted alluvial clays and gravels. These clays are subject to considerable shrink-swell cycles which results in their characterisation as self-mulching soil (Artefact Heritage, August 2016). The archaeological potential for identification of surface artefacts on these soils is impacted by the soil’s shrink swell properties which swallows surface material as the sediment contracts during dry periods. Artefacts may fall down cracks in the soil profile when the soil is dry, and soil heaving when wet may disturb archaeological context (Kibblewhite, Toth, & Hermann, 2015).

3.1.2 Water

Watercourses in the local area comprise predominantly of ephemeral watercourses and shallow incised tributaries of nearby major watercourses. In the section north of Whalan Creek, and from north to south, it is crossed by a tributary of the Morella Watercourse, a tributary of Maynes Lagoon, and several unnamed drainage lines which are likely man-made, or altered natural drainage lines.

Whalan Creek is not within the proposal area. Immediately south of Whalan Creek, the Mobbindry Creek passes close to the north of the proposal area. The proposal area crosses Wallaby Creek and several unnamed drainage lines which are likely man-made, or altered natural drainage lines. The linear extent of the proposal area terminates approximately 300m north of Mungle Back Creek. An ancillary facility is located approximately 400m south of Mungle Back Creek.

Culverts along the Newell Highway appear likely to often result from the need to drain waters which may otherwise pool along the elevated embankment of the highway, and may not reflect the presence of prior natural waterways.
Prior to European colonisation the vegetation of the Moree Plains would have consisted of open riverine woodland and grassland (Heritage Concepts, 2009).

3.2 Aboriginal Land Use

The proposal area is located within lands of the Goomeroi / Kamilaroi People (Heritage Concepts, 2009).

The alignment of traditional Aboriginal groupings in the wider region of the proposal area have been subject to some debate (Heritage Concepts, 2009, p. 32). It is generally understood that the speakers of the Kamilaroi language group extended over an extremely large area of northern NSW.

Many Aboriginal tribal boundaries in Australia have been determined from linguistic evidence. They are therefore only approximations. Simply identifying a named group of Aboriginal people who were once observed to inhabit an area may not provide much real insight to concepts or practices of land use at the time. Social interaction, tribal boundaries and linguistic evidence may not always correlate. Further, a western understanding of the nature of borders and boundaries appears incompatible with Aboriginal behaviours described by authors including W. Stanner (1905-1981).

A large part of the destruction of Aboriginal culture may not have occurred through war with the British, or through British decimation of Aboriginal groups, but instead through disease and forced removal from traditional lands. The small pox epidemic of 1789 had a profound effect on the population of New South Wales, and would have impacted disastrously on Aboriginal groups (Karskens, 2010).

Historically, Aboriginal people have often been depicted as largely nomadic and predominantly living in ephemeral huts or shelters. In the past decade research, has indicated that these descriptions may be both inaccurate and written to serve a colonialist imperative. Through depicting Aboriginal people as transient and without established settlements or villages, authors may have sought to enhance notions of European ownership of Australia, and to diminish Aboriginal territorial claims. Recent re-examination of works by first white explorers such as Mitchell, and also recent archaeological investigations support the proposal that at first encounter with Europeans, many Australian Aboriginal groups lived in what explorers described as ‘villages’ of relatively robust huts (Pascoe, 2014; Memmott, 2007; McDonald, J-The Australian, 2016; Government, 2016).

An early account describes two villages in the Moree Plains region:

*Each hut was semi-circular, or circular, the roof conical, and from one side a flat roof stood forward like a portico, surrounded by two sticks. Most of them were close to the trunk of a tree, and they were covered, not as in other parts, by sheets of bark, but with a variety of materials, such as reeds, grass and boughs. (Mitchell, 1839).*

Food

Heritage Concepts (2009) note that Mitchell (1839) primarily described the utilisation of riverine resources in the Moree Plains area. This included the use of fish traps and nets. Other observers noted widespread consumption of yams, water yams, melons and other fruits, berries, roots and tubers. The observation by Balme (1986) of spears and kangaroo cloaks clearly indicates that macropod species were a hunted. Strict ritual codes applied to the gathering and consumption of foods.
3.3 Historical Land Use

From the 1830’s pastoral settlers, primarily squatters, started to move into the Moree Plains Region. The town of Moree was gazetted in 1844 and formal sales of land in the region commenced in 1862 (Heritage Concepts, 2009). Boggabilla and surrounds first grew due to local pastoralism, and as a staging point for cattle en-route from Moree to Queensland. Artesian wells were drilled around Boggabilla to service passing cattle and drovers (Somerville, 2013).

A main Travelling Stock Route (TSR) was located along the northern section of the proposal area, and frequently corresponds to the current alignment of road reserves. The effects of trampling by large numbers of cattle will have resulted in some disturbance to the soils of the proposal area that once comprised part of a TSR.

The section of the Newell Highway within the proposal area was developed after the 1970s when the road was bitumenised. The level, swampy and well-watered proposal area can be prone to flooding, and in-fill was imported to build up the road. Much of the road has been laid on large quantities of imported road base, after extensive compression of the unsealed gravel surface in the road corridor (Ozroads, 2016).

3.4 Aboriginal Material Culture

The location of Aboriginal sites is considered culturally sensitive information. It is advised that the information in this section, including the AHIMS data appearing on the heritage map for the proposal, be removed from this report if it is to enter the public domain.

OEH maintains the Aboriginal Heritage Information Management System (AHIMS), a database of registered sites in NSW. A search of the AHIMS database was undertaken on 8 January 2016, for the following area, which returned the details listed below in Table 6 and illustrated on Figure 2 below. A second AHIMS search was carried on 9 January 2017 out for the Addendum report (Artefact Heritage 2017a). No new sites were identified in the second AHIMS search.

No Aboriginal sites listed on the OEH AHIMS site register are located within the proposal area.

A total of 27 Aboriginal sites are recorded near the proposal area within the AHIMS site register search area (see Figure 2). OEH lists 20 standard site features that can be used to describe a site registered with AHIMS, and more than one feature can be used for each site. The frequency of recorded site types is summarised in Table 1 below and illustrated in Figure 2. The 28 sites identified within the search area comprise the following types:

Table 6: Frequency of site features from AHIMS data.

<table>
<thead>
<tr>
<th>Site feature</th>
<th>Number</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified tree (carved or scarred)</td>
<td>21</td>
<td>75</td>
</tr>
<tr>
<td>Artefact</td>
<td>7</td>
<td>25</td>
</tr>
</tbody>
</table>
Figure 2: AHIMS site locations relative to the proposal area
3.4.1 Recorded Aboriginal Sites in the Vicinity of the Proposal area

In accordance with the OEH code of practice, this section outlines a summary of recorded Aboriginal sites listed on the AHIMS site register in the vicinity of the proposal area.

Four groups of registered sites are located in proximity to the proposal area, outlined below, from south to north.

**Mungle Back Creek**

These five sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study (see Section 3.1.3 below). The complex is located on either side of Mungle Back Creek, adjacent to the southern end of the proposal area, to the east of the Newell Highway. The recorded locations place the scarred trees on the north side of the Mungle Back Creek, and the artefact scatter on the south.

- AHIMS No. 02-4-0039 (Mungle Creek Scarred Tree 1). Bimble box, one scar (137x26cm)
- AHIMS No. 02-4-0040 (Mungle Creek Scarred Tree 2). Bimble box, one scar (123x30cm)
- AHIMS No. 02-4-0041 (Mungle Creek 3). Surface scatter comprising over 200 artefacts, consisting largely of silcrete and quartz but also including quartzite, chert, chalcedony, tuff and silicified sandstone. Much of the site was covered with sediment from flooding, but there were areas of wash-out with high visibility
- AHIMS No. 02-4-0048 (Mungle Creek Scarred Tree 5). Bimble box (dead), one scar (115x20cm)
- AHIMS No. 02-4-0056 (Mungle Creek Scarred Tree 4). Bimble box (dead), one scar (79x32cm)

**Mungle Creek Tributary**

These two sites were recorded during fieldwork undertaken for the Brigalow Belt South Bioregion study. They are located on the east side of the Highway, adjacent to a first-order tributary of Mungle Creek. This was described as an ephemeral tributary or drainage depression, at the time of the recording.

- AHIMS No. 02-4-0049 (Whalan Creek 15). Artefact scatter on a gentle slope, comprising an estimated 20-50 artefacts over an area of 170x80m². The raw material was predominantly silcrete.
- AHIMS No. 02-4-0050 (Whalan Creek Scarred Tree 16). Bimble box with one scar.

**The Rocks**

Three scarred trees and two artefact scatters were identified during a survey undertaken prior to proposed extension of former Council borrow site located to the east of the proposal area, just south of the intersection with the Dolgelly-Boggabilla Road. This gravel pit currently sits largely within areas previously recorded as Aboriginal site AHIMS Artefact Scatter 02-4-0024 and possibly AHIMS Artefact Scatter 02-4-0025.

The associated report for these sites is not available through AHIMS. However, from site cards it appears that the surface scatters (AHIMS Nos. 02-4-0024 and 02-4-0025) are likely to originally have been one site, partly destroyed by the historical use of the gravel pit. AHIMS site 02-04-0025 is not
well defined on the site card (and appears to possibly overlap partially with the proposed ancillary facility at The Rocks. The location given for AHIMS No. 02-4-0024 on the site card map indicates the location of artefacts in close proximity to the proposal area.

- AHIMS No. 02-4-0023 (The Rocks Site 1). Site card not available. The general layout of The Rocks is reproduced from the AHIMS site card in Figure 4. This shows that the western perimeter of The Rocks is defined as well outside the proposal area of this report.

- AHIMS No. 02-4-0024 (The Rocks Scarred Tree 1). Bimble box (alive) with one scar of coolamon shape (100x11cm). This item appears to be a duplication of AHIMS No 02-4-0024 which is a large artefact scatter, described below.

- AHIMS No. 02-4-0025 (The Rocks Site 2). Stone artefact scatter, consisting of at least 46 artefacts of silcrete, chert, quartz and petrified wood, located on the highest part of the ridge. The site was deflating in parts, with areas destroyed by the gravel pit and a service trench for an optic fibre line. Although the AHIMS coordinates for this site place it close to the proposal area, the site description and site card map indicate that 02-4-0025 is at closest 100m east of the proposal area (Figure 4).

- AHIMS No. 02-4-0026 (The Rocks Scarred Tree 2). Probable bimble box (dead), with one scar of canoe shape (240x800cm).

AHIMS No. 02-4-0027 (The Rocks Scarred Tree 3). Probable bimble box (dead, fallen), with one scar of shield shape (140x15cm).

Figure 3: Sketch of sites recorded at The Rocks (from AHIMS No. 02-4-0024 site card, red marking added for this report).
Whalan Creek

These six sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study. The recorded locations are on the west side of the Highway; the artefact scatter and four of the trees are located on the south side of Whalan Creek, and the fifth tree is on the north side of the Creek.

- AHIMS No. 02-4-0055 (Whalan Creek 1). Artefact scatter consisting of over 10,000 artefacts across an area of 2km x 100m. Dominant raw materials are silcrete and quartzite, with petrified wood, chert, chalcedony, tuff and quartz also present. Artefacts are visible on tracks and in erosion scars.
- AHIMS No. 02-4-0057 (Whalan Creek Scarred Tree 2). Bimble box (dead) with one scar (120x85cm).
- AHIMS No. 02-4-0058 (Whalan Creek Scarred Tree 3). Bimble box with two scars (120x30cm and 68x10cm).
- AHIMS No. 02-4-0059 (Whalan Creek Scarred Tree 4). Bimble box with one scar (56x29cm).
- AHIMS No. 02-4-0060 (Whalan Creek Scarred Tree 5). Bimble box (dead) with one scar (102x6cm).
- AHIMS No. 02-4-0061 (Whalan Creek Scarred Tree 6). Bimble box with one scar (148x30cm).

Figure 4: AHIMS map of The Rocks Site 2, 02-4-0025 outlined in red showing Newell HWY in bold black at least 100m distant
Figure 5: AHIMS extensive search results detail map 1
Figure 6: AHIMS extensive search results detail map 2
Figure 7: AHIMS extensive search results detail map 3
3.5 Background Reports

A preliminary report for the proposal was undertaken by Artefact in early 2016 (Artefact Heritage, August 2016). This identified a number of sites and reidentified a number of AHIMS registered sites. However, none of the sites identified during this investigation are within the proposal area. Registered sites reidentified in this previous report have been listed in the AHIMS section above. The sections of the current alignment which were previously examined in Artefact in August 2016 have been resurveyed for the current report.

In addition to Artefact (August 2016), a number of previous archaeological studies have been undertaken in the local area, and the available reports are summarised below.

**Boggabilla Common** (Dennison, 1985)

A survey of Boggabilla Common was undertaken as part of a training program for the TLALC, in conjunction with Tranby College. The survey began at the corner of South Street and the Bruxner Highway, and extended south along the western side of the Highway for a distance of approximately 1.5km.

The survey resulted in the identification of 25 scarred trees and 28 scars in total. Twelve of the scars were interpreted as resulting from the manufacture of canoes, eight from shields, and three from coolamons, and five were unidentified in the report. Maximum dimensions of some of the scars are given. These are recorded in millimetres, but review of the photographs suggests that the units are likely to be centimetres:

- **Canoe** 140x30, 215x60, 250x75
- **Shield** 160x50, 120x30, 150x40, 90x30, 150x30, 150x40
- **Coolamon** 110x15, 44x20

The survey also resulted in the identification of a hammer stone, and another stone artefact at the base of one of the scarred trees. Campsites were also noted in the general area, but were not recorded as they were not within the proposal area.

**S87 Seismic Program Area** (Bonhomme, 1987)

This investigation covered an area south of Bruxner Road, approximately 23km to the west of the present proposal area. It involved targeted survey along proposed seismic lines. It was found that artefacts occurred as continuous scatters around the lagoons and as isolated sites along the creek. Most of the sites recorded were small, consisting of fewer than 10 artefacts; however, sites consisting of hundreds of artefacts were identified in places along the creek and around the lagoons.

It was suggested that the focus of activities in these areas was the rich food resources and also the exposure of high quality gravels suitable for flaking. Bonhomme noted that there was evidence of the use of gravels in Whalan Creek as sources of stone for flaking. And the presence of grindstone fragments near watercourses, as a result of grinding vegetable foods. Bonhomme noted that watercourses were probably the main lines of communication across the plains.

Consultation was undertaken with representatives of the North West Regional Aboriginal Land Council, Toomelah Local Aboriginal Land Council, the Gomeroi People and Moree Local Aboriginal Land Council. These representatives informed the archaeologist of the presence of known archaeological sites along Whalan Creek, and Mosquito Creek.
It was noted that the most archaeologically sensitive areas will be creek lines, lagoons, and prior stream levees. The management recommendations indicated that areas within 100m of watercourses should be considered to be archaeologically sensitive. However, open sites were likely to be covered by alluvial deposit, as the region is largely floodplain. As a result, these types of sites are likely to be found only in areas that have been disturbed or eroded or in areas which are not regularly flooded.

The report included a list of site types that may be present within the region:

- Open campsites. Usually recorded on eroded areas of floodplain and on areas not frequently flooded.
- Bora rings. None survive today, but carved trees may remain to mark the presence of a ceremonial ground.
- Burials. Including Aboriginal burials associated with contact sites, including the Old Toomelah Mission cemetery, and older burials, which could be expected to occur in sand along creeks and watercourses and prior stream levees.
- Scarred trees.
- Carved trees. Most have been destroyed or removed to museums or private collections, and it is not expected that any more are present.
- Natural mythological site. Boobera Lagoon.
- Contact sites. Euraba Mission site, Old Toomelah Mission and Cemetery.
- Waterhole / well. Two waterholes have been identified on Whalan Creek, and were tentatively identified as Aboriginal wells. Bonhomme suggests that digging wells near dry watercourses may have been part of the water procurement strategy in the otherwise waterless plain.

**Brigalow Belt South Bioregion** (NSW National Parks and Wildlife Service, 2002)

A broad Aboriginal cultural heritage assessment of the Brigalow Belt South Bioregion, which includes the southern part of the present proposal area, was undertaken to inform broad-based land use planning and allocation issues. The approach taken was intended to identify patterns between landform and site distribution. The association between site location and water that is found more generally across NSW was confirmed in the proposal area. However, the distance from water varied depending on the nature of the watercourse – the stream order appeared to be relevant, as did the type.

The project also included a process of oral history recording among the local Aboriginal community, which touched on many themes of relevance to the proposal area. With regard to heritage specifically, the following points were made:

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This section includes community members’ views on the management of physical and documentary heritage including the importance of Aboriginal involvement and control of the management process. There are also expressions of concern about the destruction that has occurred historically, and continues to occur, of cultural heritage sites and items. The need to preserve the physical landscapes, particularly rivers and forests, as the necessary location for the transmission of cultural knowledge is highlighted.

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Moree Plains Local Government Area (Heritage Concepts, 2009)

An Aboriginal heritage study was undertaken as part of the review of the Moree Plains Shire Local Environmental Plan. The report contained the following assessment of the archaeological resource of the area, with regard to environmental characteristics (29-30):

*To sum up, flat flood plain areas are likely to quickly cover over any archaeological materials, which are subsequently only exposed through erosion of the soil, whether through sheet wash associated with flooding, stream bank destabilisation or wind erosion. The former two types of erosion are also more likely to remove artefacts depending on the strength of the flood waters.*

*Areas not frequently inundated are more likely to retain surface artefacts as they are not carried away by flood waters or covered over with flood deposits. Erosion on these high points in the landscape is more likely to create lag deposits owing to the flat topography. Conversely, sites located on the shallow soils of the higher slopes are more likely to be translocated downhill through colluvial and/or fluvial erosive events. Sites are also expected along the prior stream formations; however, sand quarrying of these areas has been extensive. Lastly, a general under-representation of surface archaeological remains on the alluvial deposits is expected owing to the intensive forms of agriculture occurring throughout the Moree district.*

It was suggested that archaeological site patterning could be expected to be different for the two biophysical regions within the LGA; the Northern Outwash province of the Brigalow Belt South and the Castlereagh Barwon province of the Darling Riverine Plains. Proximity to water has been found to be a significant factor affecting site location. However, evidence suggests that sites in the western sector of the LGA, more subject to flooding, tend to be located away from the flood zones of rivers and streams, and situated on slightly higher, well drained areas.

Moree Solar Farm (New South Wales Archaeology, 2009)

This assessment covered an area of 120 hectares to the southeast of Moree, approximately 80km south of the proposal area. The investigation did not result in the identification of any Aboriginal objects, and it was considered that any undetected or subsurface artefacts would be disturbed and present in very low densities.

**Archaeological Implications**

Previous archaeological investigations in the locality have demonstrated that significant numbers of scarred trees are present, particularly in relatively protected areas such as road reserves.

Artefact scatters are present in the area, ranging from low to high densities. These tend to be associated with proximity to creeks or lagoons and would result from open camping activities. However, the area is subject to at-times major flooding, and flood waters are likely to move artefact deposits or obscure them with silt. Therefore, artefacts are more likely to be detected on localised high points or ridges, beyond the reach of floodwaters. There do not appear to have been any subsurface archaeological investigations in the locality of the proposal area.

Burials are unlikely to occur in the proposal area, as they are characteristically constrained to sandy rises. These have not been identified within the proposal area. Nevertheless, the possibility exists that burials may be located in a variety of landform and environmental settings.
3.6 Predictive Model

Prior to commencement of PACHCI investigations for the proposal, no recorded Aboriginal sites had been identified within the proposal area nor had any areas of archaeological sensitivity or potential been delineated within it. However, the locations of two previously recorded sites were not clearly identified in their original recording. These are AHIMS sites 02-4-0024 and 02-4-0025 which from (poor) mapping may be located in the ancillary area at the old Council borrow pit. Identifying the location of these sites was a task allocated to the site survey stage of this report.

Based on information from the OEH AHIMS site register search, previous archaeological investigations in the local area, landscape and regional context, the most likely site types to occur within the proposal area include:

**Modified Trees (Carved or Scarred):** Modified trees are generally associated with ceremonial sites or burial grounds. According to previous studies in the area, this is most likely to occur within low gradient slopes or flat landforms in areas suitable for habitation or ceremonial practice. Land clearance and timber extraction will have likely removed or destroyed a large number of modified trees, lowering the likelihood of encountering them in this region.

**Artefact sites:** Open artefact sites and areas of PAD may occur in areas not subject to high levels of erosion and generally in proximity to watercourses. Larger watercourses are likely to be associated with denser deposits of artefacts. Elevated landforms proximal to larger watercourses are most likely to be associated with such denser artefact deposits. Lower density artefact deposits may occur at any point in the landscape. Stone artefact material is likely to consist predominantly of silcrete, chert and quartzite.

3.7 Site surveys

3.7.1 Site surveys – PACHCI Stage 2

Archaeological survey of the proposal area in accordance with Stage 2 of the PACHCI and the OEH code of practice was conducted on foot on the 28th, 29th and 30th of November 2016 and the 1st and 2nd of December 2016. The survey was undertaken by Michael Lever (Senior Heritage Consultant, Artefact Heritage) and Alyce Haast (Heritage Consultant, Artefact Heritage). Lever and Haast were accompanied by elders and representatives of TLALC and Gomeroi People.

The proposal area was divided into five survey units shown overall in Figure 8. These survey units are depicted in detail in Figures 9 to 3 and are described below. The width of survey units varied according to the accessibility and visibility of ground surfaces. This is reflected in mapping of survey units in Section 5 below.

- **Survey Unit One** is the extent of South Street Boggabilla and its adjoining graded roadway that terminates at a boat ramp on the Macintyre River. This area is located on the levee, swale and terrace of a major waterway. This landform markedly differs from landforms in the rest of the proposal area. Survey extent in this area was approximately 20 meters either side of the center of the graded access roadway.
- **Survey Unit Two** is the ancillary facility in the reserve adjacent to Boggabilla Cemetery, and also the northern section of the Newell Highway and its reserves from below Boggabilla to Whalan Creek. These areas are situated on the same geological formation and appear likely to have undergone similar processes of clearance and grading.
• Survey Unit Three is the extent of the Newell Highway south of Whalan Creek, to the terminus of the proposed roadworks north of Mungle Back Creek.

• Survey Unit Four is the ancillary facility located east of the Newell Highway at the former Council borrow site. This area is distinct from other locations in the proposal area in that while it has been subject to intensive excavation, its roads have not been directly impacted through sealed road construction and it is situated within what appears to be preserved bushland.

• Survey Unit Five is the proposed ancillary facility on the north-east corner of the Newell Highway and North Star Road. This area may not have been impacted by road construction.

The proposal area was subject to comprehensive and effectively total archaeological survey, with the exception of Survey Unit Five (see below). The survey team numbered between five and nine which allowed for good coverage of ground surface. The team spread out evenly and walked each survey unit in a systematic fashion. Any areas of surface exposure or old growth trees were inspected in detail. Overall surface visibility was generally low, meaning that the opportunity for identification of stone artefacts on the ground surface was limited.

Surface visibility in Survey Unit Five was nil due to dense grass cover. This vegetation was frequently up to 1m high, rendering it impossible to assess safe footing. Survey Unit Five could not be surveyed. Based on information from the desktop report, and from survey of local landform similar to Survey Unit Five, it was determined that Survey Unit Five was of low likely archaeological sensitivity.

Detailed mapping of survey areas is provided below. These figures illustrate design provided by the client on 23 March 2017. This design contains a number of areas outside survey units. Areas of design outside the survey units are not assessed in this report.

The figures below incorporate detailed illustrations of survey areas where Aboriginal sites are immediately near to the study area.
Figure 8: Survey unit index map
Figure 9: Survey detail map 1
Figure 12: Survey detail map 4
Figure 13: Survey detail map 5

Legend
- Proposal Area
- Survey Unit 2
- Chainages

Newly Identified Sites
△ Artefact

Survey Units
Detail Map 5
151204 Mungle Back Creek to Boggabilla
LGA: Gwydir

SCALE       SIZE       DATE
1:5,000     @A4        7/04/2017

0  75  150  300
Metres
Figure 16: Survey detail map 8
Figure 17: Survey detail map 9
Figure 18: Survey detail map 10
Figure 19: Survey detail map 11
Figure 20: Survey detail map 12
Figure 21: Survey detail map 13
Figure 22: Survey detail map 13
Figure 23: Survey detail map 15
Figure 25: Survey detail map 17
Figure 26: Survey detail map 18
Figure 27: Survey detail map 19
Figure 28: Survey detail map 20
Figure 29: Survey detail map 21
Figure 30: Survey detail map 22
Figure 31: Survey detail map 23
Figure 32: Survey detail map 24
3.7.2 Site survey – addendum to PACHCI Stage 2

Following PACHCI Stage 2 archaeological survey in November 2016, design refinements made after the survey necessitated additional PACHCI Stage 2 survey of one side of the Newell Highway along a transect measuring approximately 4.5km. This was surveyed on 21 February 2017. Survey was carried out by Michael Lever and Alyce Haast (Artefact), Jeff Charlton (Roads and Maritime), and Uncle Reg Haines, Malcolm McGrady and David McGrady of TLALC. The extent of the addendum survey area is indicated on mapping above relative to other survey coverage (Figure 16 to Figure 21), and is shown in greater detail in mapping below (Figure 33 to Figure 36).

The entire length of the 4.5km transect was surveyed as one survey unit with participants walking spaced approximately 1 m abreast where ground conditions allowed. Road gravel and dense grass and shrubs provided a high level of ground surface cover, with low ground surface visibility in most places. Any areas of soil exposure were investigated, and all old-growth native trees were inspected for evidence of cultural modification. Although soil surfaces were generally concealed, evidence for robust soil disturbance could be detected in the readily apparent artificial landform associated with drainage.

No new sites of Aboriginal cultural heritage were identified during survey. No areas of PAD were identified. The proposal area appears to have been wholly disturbed for a distance of 20m westward from the western fog line of the Newell Highway. This disturbance consists of impacts associated with the visible structure of the Newell Highway and its graded and gravelled margins, and is also associated with a table drain that has been excavated to depths of .5m to .5m adjacent to the Newell Highway throughout the proposal area.
Figure 33: Detail map 1 of addendum survey area
Figure 34: Detail map 2 of addendum survey area
Figure 35: Detail map 3 of addendum survey area
Figure 36: Detail map 4 of addendum survey area
3.7.3 Areas not covered by the surveys

Most of the land occupied by the refined design and construction work zone has been covered by the PACHCI Stage 2 and the addendum to PACHCI Stage 2 surveys. There are however some areas that are being impacted by the refined design and construction work zone that have not been covered by the survey effort undertaken to date. These areas are listed in Table 7. A desktop assessment has been undertaken to assess the proposal impacts on these areas.

Table 7: Unsurveyed areas

<table>
<thead>
<tr>
<th>Location</th>
<th>Approximate width outside surveyed area</th>
<th>Figure showing area extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch 114,600 – Ch 114,000</td>
<td>2-8 metres</td>
<td>Figure 10</td>
</tr>
<tr>
<td>Ch 108,950 – Ch 108,150</td>
<td>2-15 metres</td>
<td>Figure 15</td>
</tr>
<tr>
<td>Ch 98,350 – Ch 98,070</td>
<td>2-12 metres</td>
<td>Figure 23</td>
</tr>
<tr>
<td>Ch 97,400 – Ch 97,050</td>
<td>2-10 metres</td>
<td>Figure 24</td>
</tr>
<tr>
<td>Ch 97,000 – Ch 96,850</td>
<td>2-10 metres</td>
<td>Figure 24</td>
</tr>
<tr>
<td>Ch 91,450 – Ch 91,000</td>
<td>2-13 metres</td>
<td>Figure 29</td>
</tr>
</tbody>
</table>

3.8 Summary of Aboriginal Archaeological Sites identified during survey

The Aboriginal sites identified during survey are listed in Table 7 below, and are shown in detail mapping (Figures 9 to 32 above). The sites and their locations have been individually mapped and photographically recorded relative to the proposed construction of the Newell Highway. These maps and photographs are located in the PACHCI Stage 2 ASR which is attached to this document in Appendix D.

MBC Artefact 1 #02-4-0086

This site is a single grey/yellow chert proximal flake fragment. MBC Artefact 1 was located by Aboriginal elders in road gravel approximately one metre east of the fog line of the Newell Highway. MBC Artefact 1 is located one metre to two metres west of the new design for the Newell Highway. It is effectively in the proposal area of the new design. The artefact is located approximately 370m north of Maynes Lagoon, which is the nearest waterbody. The surrounds are level or slightly inclined landform with effectively zero soil visibility. It is almost certain that this artefact has been transported to its current position either within imported road gravel, or as a result of disturbance to local soils during road construction. The material of MBC Artefact 1 (chert) is not one that has been identified as common in the region of the proposal area.

MBC Artefact 2 #02-4-0087

MBC Artefact 2 is a single fine-grained pink silcrete core which was located by Aboriginal elders in road gravel approximately one metre from the eastern fog line of Newell Highway. The surrounds are level or slightly inclined landform with effectively zero visibility. MBC Artefact 2 was located on road gravel. MBC Artefact 2 is located one metre to two metres west of the new design for the Newell Highway. It is effectively in the proposal area of the new design. It is almost certain that MBC Artefact 2 has been transported to its current position either within imported road gravel, or as a result of
MBC Artefact 3 #02-4-0088

MBC Artefact 3 is a single yellow silcrete medial flake fragment. It was located by Aboriginal elders in road gravel approximately one metre from the western fog line of the Newell Highway. MBC Artefact 3 is located within the footprint of the new design proposal. MBC Artefact 3 is located approximately 100m north of Maynes Lagoon. The surrounds are level or slightly inclined landform with effectively zero soil visibility. MBC Artefact 3 was located on road gravel. It is almost certain that MBC Artefact 3 has been transported to its current position either within imported road gravel, or as a result of disturbance to local soils during road construction. Summary of Aboriginal Archaeological Sites immediately near the proposal area

The sites identified during survey as being immediately near the proposal area are listed in Table 7 below and are shown in mapping below relative to the proposed construction of the Newell Highway.

MBC PAD01 #02-4-0085

This PAD is located on the level plateau of a river terrace immediately adjacent to the McIntyre River to its east. It is located approximately 40 metres north of proposed build in the riverside ancillary area.

To the west of MBC PAD01 is a localised floodplain or swale. Local cuttings into this terrace, associated with a boat ramp, indicate that soils here consist of deep fine alluvial silts and may contain archaeological deposits to considerable depths. The area of the terrace between the floodplain to the west and the steep river banks to the east is considered an area of PAD. Areas of localised disturbance associated with formation of the boat ramp, installation of concrete-based BBQ and eating facilities are not included in MBC PAD01

MBC Scarred Tree 1 #02-4-0079

MBC Scarred Tree 1 is a mature Bimble Box (*Eucalyptus populnea*) located in road reserve to the west of the Newell Highway. Its trunk is approximately 20m west of the western road marking of the Newell Highway. The tree was outside the boundaries of the survey area; however, it was highly visible and was therefore identified and recorded. The surrounds are level or slightly inclined landform with effectively zero soil visibility due to thick grass cover. The scar is not totally symmetrical, nevertheless it’s extremely regular and generally symmetrical outline matches the criteria for Aboriginal Scarred Trees (Long, 2005).

MBC Scarred Tree 2 #02-4-0080

MBC Scarred Tree 2 is a mature Bimble Box (*Eucalyptus populnea*) located to the east of the Newell Highway, immediately north of the intersection with an unnamed unsealed road. It is within 50 metres of Maynes Lagoon. The tree is outside of the proposal area; however, it had been provisionally recorded on a previous survey. Reinspection was desired to establish whether or not it was a scarred tree, and confirmation of its location was necessary to ensure it was not impacted by the proposed works. This tree was confirmed as an Aboriginal Scarred Tree.

MBC Scarred Tree 3 #02-4-0081

MBC Scarred Tree 3 is a mature Bimble Box (*Eucalyptus populnea*) located outside of and immediately to the west of the unsealed road which partially comprises the boundary of the survey area at the old Council pit, east of the Newell Highway. The tree is marginally within a preserved zone of woodland between the old Council pit and the Newell Highway. The dry face (dead tree trunk exposed through bark removal) has fallen from the tree and lies immediately in front of the tree. The
dry face was inspected, it did not display any features that would indicate that the tree was not culturally scarred. The scar is large and has generated one epicormic growth to its east.

**MBC Scarred Tree 4 #02-4-0082**

MBC Scarred Tree 4 is a mature Bimble Box (*Eucalyptus populnea*) located five meters west of the proposal area at the old Council pit, east of the Newell Highway. The tree is marginally within a preserved zone of woodland between the old Council pit and the Newell Highway. The highly symmetrical nature of the scar, and the fact that it extends around the natural curve of the tree indicate that the scar is likely to be from Aboriginal activity and not from lightning strike or road traffic accident. In consultation with TLALC elders and members and Gomeroi People it was determined that MBC Scarred Tree 4 is a culturally scarred tree.

**MBC Scarred Tree 5 #02-4-0084**

MBC Scarred Tree 5 is a mature Bimble Box (*Eucalyptus populnea*) located outside of the proposal area at the south-east corner of the Newell Highway and an unsealed private access road. The scar is small and was identified by TLALC members surveying the exposed ground within and surrounding the mapped survey area.

**MBC Scarred Tree 6 #02-4-0083**

MBC Scarred Tree 6 is a mature Bimble Box (*Eucalyptus populnea*) located outside the proposal area. MBC Scarred Tree 6 is located approximately 200m south of Maynes Lagoon. It is within an area to the west of the Newell Highway that Roads and Maritime requested be surveyed in addition to previously scheduled areas to the east of the Highway. The tree is located approximately 22m west of the western road marking of the Newell Highway. This scar is largely obscured by dense vegetation.

**The Rocks Site 1 #02-4-0024**

This site was poorly recorded in available site card data. Site card data identifies it as divided into two halves, north and south of the proposal area at the old Council Borrow Pit (Detail Map 15). This site was reidentified during ground survey around the northern perimeter of Survey Unit Four, at the old Council pit. This identified an extensive artefact scatter. The position of these artefacts relative to the proposal area could not be precisely determined in the field. A sample of artefacts located closest to the proposal area were therefore recorded and their positions logged with GPS. These artefacts have been confirmed as between seven and 10 metres outside of the proposal area and are part of the previously recorded artefact scatter 02-4-0024. Materials observed in surface artefacts at 02-4-0024 included silcrete, chert, quartz, quartzite and petrified wood. Artefacts ranged from large primary reduction flakes to smaller angular fragments.

To the south and east of the old Council borrow pit, visibility was very high due to graded track and exposed soils surrounding the old Council pit. No artefacts were identified during this survey and it is concluded that this site is not located within or immediately near to the proposal area in this location.
<table>
<thead>
<tr>
<th>Artefact Identity</th>
<th>AHIMS identity</th>
<th>Easting (GDA 94/56)</th>
<th>Northing (GDA 94/56)</th>
<th>Position relative to proposed build</th>
<th>In / Out of proposed build</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBC PAD01</td>
<td>02-4-0085</td>
<td>242607</td>
<td>6832098</td>
<td>40 m north</td>
<td>Out</td>
<td>Potential Archaeological Deposit – Boggabilla Boat Ramp</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>02-4-0086</td>
<td>240237</td>
<td>6828491</td>
<td>1 m to 2 m west</td>
<td>In</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>02-4-0087</td>
<td>233140</td>
<td>6815782</td>
<td>1 m to 2 m west</td>
<td>In</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>02-4-0088</td>
<td>239137</td>
<td>6827049</td>
<td>Within footprint</td>
<td>In</td>
<td>Single lithic artefact WITHIN PROPOSAL AREA</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>02-4-0079</td>
<td>237704</td>
<td>6825550</td>
<td>20 m west</td>
<td>Out</td>
<td>Bimble Box culturally scarred tree.</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>02-4-0080</td>
<td>238921</td>
<td>6826738</td>
<td>~50 m east</td>
<td>Out</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 3</td>
<td>02-4-0081</td>
<td>233351</td>
<td>6817630</td>
<td>10 m west</td>
<td>Out</td>
<td>Scarred Bimble Box, dead face of scar fallen to ground.</td>
</tr>
<tr>
<td>MBC Scarred Tree 4</td>
<td>02-4-0082</td>
<td>233362</td>
<td>6817469</td>
<td>5 m south west</td>
<td>Out</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 5</td>
<td>02-4-0084</td>
<td>233256</td>
<td>6816436</td>
<td>~20 m east</td>
<td>Out</td>
<td>Bimble Box Small cultural scar.</td>
</tr>
<tr>
<td>MBC Scarred Tree 6</td>
<td>02-4-0083</td>
<td>238756</td>
<td>6826673</td>
<td>~22 m west</td>
<td>Out</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>The Rocks Site 1</td>
<td>02-4-0024</td>
<td>Per mapping &amp; Figure 2</td>
<td>7 m to 10 m north</td>
<td>Out</td>
<td>The Rocks Site 1</td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Results of site survey
4.0 SIGNIFICANCE ASSESSMENT

4.1 Aboriginal Material Culture

There are three Aboriginal archaeological sites located within the proposal area. These are MBC Artefact 1 #02-4-0086, MBC Artefact 2 #02-4-0087 and MBC Artefact 3 #02-4-0088. These are isolated artefacts located either within the proposal footprint, or so close (1 m to 2 m from design) as to be effectively within the proposal footprint. All three artefacts were located within road gravels. They have most likely been transported within imported gravels to their current locations.

In addition to these three sites, there are eight Aboriginal sites that have been identified or re-identified in the immediate proximity of the proposal area:

- MBC PAD01 #02-4-0085
- MBC Scarred Tree 1 #02-4-0079
- MBC Scarred Tree 2 #02-4-0080
- MBC Scarred Tree 3 #02-4-0081
- MBC Scarred Tree 4 #02-4-0082
- MBC Scarred Tree 5 #02-4-0084
- MBC Scarred Tree 6 #02-4-0083
- The Rocks Site 1 #02-4-0024

MBC PAD01 #02-4-0085 is a PAD that is located 40 metres north of the proposal area.

Sites MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, and MBC Scarred Tree 6 #02-4-0083 are all located near to the proposal area.

The Rocks Site 1 #02-4-0024 is a large previously recorded artefact scatter that is located between seven and ten metres north of the proposal area.

The remainder of the proposal area is considered to have low archaeological potential. This is due to the level, nature of the landscape which is flood prone, and which is frequently located at more than one kilometre from water-sources. It is also due to the Newell Highway and reserves having been heavily disturbed by the construction and maintenance of roadway and associated drainage infrastructure.

4.2 Significance Assessment

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. OEH (2011) provides guidelines for heritage assessment with reference to the Burra Charter (Australia ICOMOS 2013) and the Heritage Office guidelines (2001). The assessment is made in relation to four values or criteria (Table 9). In relation to each of the criteria, the significance of the subject area should be ranked as high, moderate or low.

In addition to the four criteria, OEH requires consideration of the following:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state’s natural and cultural history?
• Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?

• Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?

• Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

It is important to note that heritage significance is a dynamic value.

### Table 9: Heritage significance criteria

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>The spiritual, traditional, historical or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them. Does the subject area have strong or special association with the Aboriginal community for social, cultural or spiritual reasons?</td>
</tr>
<tr>
<td>Historic</td>
<td>Historic value refers to the associations of a place with a historically important person, event, phase or activity in an Aboriginal community. Is the subject area important to the cultural or natural history of the local area and/or region and/or state?</td>
</tr>
<tr>
<td>Scientific</td>
<td>This refers to the importance of a landscape, area, place or object because of its rarity, representativeness and the extent to which it may contribute to further understanding and information. Information about scientific values will be gathered through any archaeological investigation undertaken. Does the subject area have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state?</td>
</tr>
<tr>
<td>Aesthetic</td>
<td>This refers to the sensory, scenic, architectural and creative aspects of the place. It is often linked with the social values. It may consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use. Is the subject area important in demonstrating aesthetic characteristics in the local area and/or region and/or state?</td>
</tr>
</tbody>
</table>

#### 4.2.1 Social Significance

OEH specifies that the social or cultural value of a place must be identified through consultation with Aboriginal people. The consultation process for the present project has not yet been completed, however the initial stages, along with the results of previous projects, have provided an indication of the social value of the proposal area.

No specific areas of cultural importance within the proposal area were identified by representatives of the registered Aboriginal stakeholders during the field survey or test excavation program, but it was made clear that the country and landscape as a whole is culturally significant to Aboriginal people. Scarred trees were noted as a dwindling number of important surviving indicators of past Aboriginal local lifeways, and as forming a connection through time to Aboriginal people of the past. This section will be updated following the AFG and review of this document by registered Aboriginal parties.
4.2.2 Historic Significance

The proposal area is not known to be associated with any people, events or activities of historical importance to the Aboriginal community. There have been relatively few archaeological subsurface investigations undertaken within the proposal area. This section will be updated following the AFG and review of this document by registered Aboriginal parties.

4.2.3 Scientific Significance

A summary of the archaeological significance values for each of the sites recorded within or near the proposal area is given in Table 10.

**Table 10: Summary of scientific significance**

<table>
<thead>
<tr>
<th>Site name</th>
<th>Research Potential</th>
<th>Scientific Value</th>
<th>Representative Value</th>
<th>Rarity Value</th>
<th>Overall significance assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBC PAD01 #02-4-0085</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate</td>
<td>Moderate-High*</td>
</tr>
<tr>
<td>MBC Artefact 1 #02-4-0086</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Artefact 2 #02-4-0087</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Artefact 3 #02-4-0088</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Scarred Tree 1 #02-4-0079</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>MBC Scarred Tree 2 #02-4-0080</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>MBC Scarred Tree 3 #02-4-0081</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>MBC Scarred Tree 4 #02-4-0082</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>MBC Scarred Tree 5 #02-4-0084</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>MBC Scarred Tree 6 #02-4-0083</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
</tr>
<tr>
<td>The Rocks Site 1 #02-4-0024</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
</tr>
</tbody>
</table>
The likely scientific significance of MBC PAD01 #02-4-0085 cannot be accurately determined without archaeological excavation.

4.2.4 Aesthetic Significance

The proposal area has been subject to substantial modification over the historical period through to the present. The present rural landscape contains few connections to the pre-contact Aboriginal past of the area.

The proposal area is considered to be of low aesthetic significance in terms of Aboriginal heritage. This section will be updated following the AFG and review of this document by registered Aboriginal parties.

4.3 Statement of Significance

The proposal area contains one Aboriginal site (isolated artefact MBC Artefact 3 #02-4-0088) which is assessed to have a low level of scientific value.

The proposal area is near to ten Aboriginal sites that have been assessed as having varying levels of scientific value:

MBC PAD01 #02-4-0085 is of moderate-high scientific value. It has the potential to contain sub-surface archaeological evidence of a nature rarely investigated in the region.

Isolated artefacts (MBC Artefact 1 & 2) are of low significance. They are unlikely to be of local origin, but nevertheless play a role as evidence of the lengthy Aboriginal history in the wider region.

Scarred Trees (MBC Scarred Trees 1 – 6) are of social and moderate to high scientific significance. These Aboriginal sites are considered to be of social significance to the contemporary Aboriginal community as part of an increasingly rare archaeological resource providing a tangible connection to the pre-contact Aboriginal people of the area.

The Rocks Site 1 #02-4-0024 is of high significance as it is a poorly documented deposit of large numbers of lithic artefacts produced from a wide range of materials. It has the potential to inform on local land-use over long periods of time and on the sourcing and possible exchange of stone materials over large distances. Detailed archaeological survey and possibly excavation of the Rocks Site 1 #02-4-0024 could produce rare and in-depth detail on the local Aboriginal past.

The remainder of the proposal area is considered to have little or no scientific or aesthetic value. The historical value of the proposal area is unknown. This section will be updated following the AFG and review of this document by registered Aboriginal parties.
5.0 AVOIDING AND MINIMISING HARM

5.1 Summary of Impacts to Archaeological Sites

As noted in Section 1.4.1, Roads and Maritime has refined and further developed a number of aspects of the proposal as documented in the REF that have resulted in a revised design and construction work zone boundary. The revised design showing an overall concept for the proposal has been developed and is illustrated in Figure 1 and also in detailed mapping (Figure 9 to Figure 32). The refined design has been developed to largely avoid impact to Aboriginal sites that have been identified near the proposal area. Isolated artefact sites located in the immediate proximity of the proposal area have been assessed as likely to be subject to direct impact from the proposed activity.

Table 11: Summary of impacts to Aboriginal sites

<table>
<thead>
<tr>
<th>Artefact Identity</th>
<th>AHIMS identity</th>
<th>Type of harm</th>
<th>Degree of harm</th>
<th>Consequence of harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBC PAD01</td>
<td>02-4-0085</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>02-4-0086</td>
<td>Direct</td>
<td>Total</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>02-4-0087</td>
<td>Direct</td>
<td>Total</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>02-4-0088</td>
<td>Direct</td>
<td>Total</td>
<td>Total loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 1*</td>
<td>02-4-0079</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Scarred Tree 2*</td>
<td>02-4-0080</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Scarred Tree 3*</td>
<td>02-4-0081</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Scarred Tree 4*</td>
<td>02-4-0082</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Scarred Tree 5*</td>
<td>02-4-0084</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>MBC Scarred Tree 6*</td>
<td>02-4-0083</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>The Rocks Site 1</td>
<td>02-4-0024</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

*The determination that no harm will occur to MBC Scarred Trees 1-6 is dependent upon the successful implementation of environmental safeguard AH-1 which requires an appropriate exclusion zone established by a qualified arborist around scarred trees 1, 2, 3, 4, 5 and 6 with a barrier to be installed around each exclusion zone while construction is being undertaken. If scarred tree harm is likely as a result of additional design refinements, revised measures will be required to guarantee their health and viability, or permit harm to them under an AHIP.
5.2 Consideration of Alternatives and Justification of Impacts

Impacts to Aboriginal cultural heritage values have been considered during the planning stage of the proposal and archaeological test excavation has further investigated the nature and extent of subsurface archaeology.

The proposed works are deemed necessary by Roads and Maritime to provide a long-term solution for associated safety upgrades to the Newell Highway.

This CHAR has confirmed that the proposed works will not impact on areas of high significance.

5.3 Ecologically Sustainable Development (ESD) Principles

In accordance with the Guide, Ecologically Sustainable Development (ESD) principles have been considered in the preparation of this CHAR, including options to avoid impacts to Aboriginal cultural heritage, assessment of unavoidable impacts, identification of mitigation and management measures, and taking account of Aboriginal community views.

The principles of ESD are detailed in the NSW Protection of the Environment Administration Act 1991. The ESD principles relevant to the assessment of the current proposal as it relates to Aboriginal cultural heritage are considered below.

5.3.1 The integration principle

Decision-making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations (the ‘integration principle’). The proposal would comply with the integration principle in regard to Aboriginal heritage. There are no areas of high significance located within the proposal area that will be impacted.

5.3.2 The precautionary principle

If there are threats of serious or irreversible environmental damage, lack of full scientific confidence should not be used as a reason for postponing measures to prevent environmental degradation (the ‘precautionary principle’).

Three recorded Aboriginal sites located within the proposal area would be directly impacted by the proposal. One of these sites, MBC Artefact 3 #02-4-0088 is located within the proposal area, while two sites MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087 are so close as to effectively be within the proposal area.

Eight recorded Aboriginal sites are outside the proposal area, however by their nature and due to the nature of proposed works, these sites may be subject to impacts resulting from roadway construction related activities, outside the proposed proposal area.

Roads and Maritime will take measures as listed below in Section 5.5, to prevent any harm to these sites, or to salvage these sites in a manner acceptable to Aboriginal Stakeholders.

5.3.3 The principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the ‘principle of intergenerational equity’).
equity'). Biological values have not been assessed in this report but have been considered and assessed in the proposal REF and Submissions Report.

5.3.4 Conservation of biodiversity

Cultural values of biodiversity are intertwined with the lives of Aboriginal people and their use of the landscape. Biological impacts of the proposal have been considered and assessed in separate technical report as part of the REF and Submissions Report.

5.3.5 Improved valuation, pricing and incentive mechanisms

Roads and Maritime are committed to cultural heritage protection as a key component of project development. The costs and time required to ensure these high standards of assessment and protection measures are maintained as a standard part of road infrastructure planning. Roads and Maritime strive to comprehensively assess impacts, avoid impacts (where feasible), work with the community, and implement mitigation and management measures which strike a balance between meeting the state’s infrastructure needs and protecting Aboriginal heritage values, for the betterment of all.

5.4 Management and Mitigation Measures

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved.

Where unavoidable impacts occur measures to mitigate and manage impacts are proposed. Mitigation measures primarily concern preserving the heritage values of sites beyond the physical existence of the site. The most common methods of this involve detailed recording of Aboriginal objects, archaeological test and salvage excavations, artefact analysis and, where appropriate, reburial of Aboriginal objects in a location determined by the registered Aboriginal stakeholders.

Mitigation measures vary depending on the assessment of archaeological significance of a particular Aboriginal site and are based on its research potential, rarity, representativeness and educational value. In general, the significance of a site would influence the choice of preferred conservation outcomes and appropriate mitigation measures, usually on the following basis:

- **Low archaeological significance**- Conservation where possible, but usually no mitigation required if impacts are unavoidable. Salvage if possible.
- **Moderate archaeological significance**- Conservation where possible. If conservation is not practicable, salvage excavations or similar mechanisms determined in consultation with the Aboriginal community may be necessary.
- **High archaeological significance**- Conservation as a priority. Only if all practicable alternatives have been exhausted would impacts be considered justified. Comprehensive salvage excavations may be necessary.

The proposal will unavoidably directly impact three sites of low archaeological significance. These are MBC Artefact 1 #02-4-0086, MBC Artefact 2 #02-4-0087 and MBC Artefact 3 #02-4-0088.

Six scarred trees rated as of moderate-high archaeological significance are located near to the proposal area, and may be subject to indirect impacts resulting from the proposal. These are MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081,
MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. Indirect impacts would be managed via the establishment of exclusion zones by a qualified arborist with a barrier installed around each exclusion zone while construction is being undertaken.

One site of moderate-high archaeological significance is located 40 m north of the proposal area. This is MBC PAD01 #02-4-0085.

One site of high archaeological significance (Site 1 #02-4-0024) is located near to (7 m to 10m) the proposal area and may be subject to indirect impacts resulting from the proposal. Impacts would be managed via an exclusion zone defined by a qualified archaeologist and a barrier to be erected around interface between the construction work zone and the site while construction is being undertaken. One previously recorded site, The Rocks Site 2, 02-4-0025 was previously thought to be near the proposal area, but has been determined not to be in the vicinity of the study area.

Given these findings, consideration of ESD principles, the views of the registered Aboriginal stakeholders, and the lack of practicable alternatives to avoid impacts, the recommended mitigation and management measures are presented below.

5.5 Proposed Management Policy for Aboriginal Sites

5.5.1 AHIP

An area based AHIP should be obtained for the proposal area to permit salvage collection of identified isolated artefacts, MBC Artefact 1 #02-4-0086, MBC Artefact 2 #02-4-0087 and MBC Artefact 3 #02-4-0088. and to allow subsequent impact to their locations.

5.5.2 Protection

- The six scarred trees identified in this study (MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083.) should be assessed by an arborist or other suitably qualified specialist, to determine the size of buffer required to protect these trees, their canopies and root-balls from impact by the proposed activities. Appropriately robust barriers must be placed between proposed works and the buffer zone advised for each tree. Where it is identified by the arborist that there is likely to be impact to any of the identified scarred trees from the proposal, an addendum CHAR and revised consultation with stakeholders, including a second AFG, would be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP application where this impact is identified subsequent to issuance by OEH of the first AHIP.

- Although assessed as not to be impacted in the course of works, MBC PAD01 and The Rocks Site 1 should be clearly marked with signage as a 'no-go / no harm zone' for construction vehicles and plant.

5.5.3 Construction Environment Management Plan

A CEMP and accompanying unexpected finds procedure will provide a method to manage potential heritage constraints and unexpected finds during construction works. Aspects of site area protection that should be included in the CEMP include:
• Establishing no-harm areas where appropriate. Depending on the nature and timing of works in the vicinity of identified Aboriginal sites that will not be impacted by the proposed works, it may be appropriate to establish visual markers around no-harm areas to avoid inadvertent impacts. This would include signage that clearly denotes the area as a “No Go Zone” Environmentally Sensitive area.

• Nature of the visual markers around no-harm areas. The CEMP should document what type of visual marker will be put in place, such as temporary fencing, high visibility tape, and temporary signage.

• Provide clear guidance to all site workers on access restrictions to no-harm areas through site inductions, tool box talks and daily heritage discussions.

• Unexpected finds procedure in accordance with the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.

5.5.4 Discovery of human remains

If suspected human skeletal remains are uncovered at any time throughout undertaking the proposed works, procedures outlined in the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.

5.5.5 Changes to the proposed works

This CHAR is based upon the most recent information made available to Artefact Heritage as of the date of preparation of this report. Any changes made to the proposal should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups. Any changes that may impact on Aboriginal sites not assessed during the current study may warrant further investigation and result in changes to the recommended management and mitigation measures.

5.5.6 Ongoing consultation with Aboriginal Stakeholders

Consultation with registered Aboriginal stakeholders would continue throughout the life of the project, as necessary. Ongoing consultation with registered Aboriginal stakeholders will take place throughout determination of the REF, any salvage excavations, care and control of retrieved artefacts and in the event of any unexpected Aboriginal objects being identified during works.

5.5.7 Management of Aboriginal objects

Further consultation with registered Aboriginal stakeholders will take place regarding the appropriate strategy for future long-term management of the retrieved artefact assemblage from test excavation and salvaged artefacts for the final version of this report.

Suitable long-term management of the retrieved artefact assemblage may include reburial at one location within the proposal area. This section will be updated following the AFG and review of this document by registered Aboriginal parties.
6.0 RECOMMENDATIONS

The following recommendations are based on consideration of:

- Legislative, policy and procedural requirements for the assessment of Aboriginal cultural heritage
- The recommendations of the ASR
- The findings of the test excavation
- ESD principles
- The views and information provided by registered Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- There are three recorded Aboriginal sites located within the proposal area which would be directly impacted by the proposal. One of these sites, MBC Artefact 3 #02-4-0088 is located within the proposal area, while two sites MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087 are so close as to effectively be within the proposal area.
- There are eight Aboriginal sites including one PAD located near to the proposal area. These comprise:
  - One Potential Archaeological Deposit (PAD) – MBC PAD01 #02-4-0085, at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development
  - Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees; MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. These are outside, but close to the current planned development
  - One previously recorded site, The Rocks Site 1 #02-4-0024, is an artefact scatter near the proposal area in the ancillary area at the old Council borrow pit
  - One previously recorded site, The Rocks Site 2, 02-4-0025 was previously thought to be near the proposal area, but has been determined not to be in the vicinity of the study area.

It is therefore recommended that:

- In areas surveyed for this study where no Aboriginal heritage values have been identified, the proposed activity may commence without further formal archaeological assessment. The proposed activity must adhere to the CEMP and accompanying unexpected finds policy as outlined below.
- An AHIP will be secured for known impacts to Aboriginal heritage in the areas surveyed for this study. The AHIP will be secured to permit salvage of the three isolated artefact sites (MBC Artefact 1 #02-4-0086, MBC Artefact 2 02-4-0087, MBC Artefact 3 02-4-0088), and to permit any subsequent impacts to their locations. Connected with this, it is recommended Roads and...
Maritime arrange, in accordance with the recommendations of registered Aboriginal stakeholders and OEH guidelines:

- Community collection of these artefacts
- Facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.

- Roads and Maritime arrange for inspection of the locations of the six scarred trees identified in this study (MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083) by an arborist or other suitably qualified specialist, to determine the size of buffer required to protect these trees, their canopies and root-balls from impact by the proposed activities. Appropriately robust barriers must be placed between proposed works and the buffer zone advised for each tree while construction is being undertaken. Where additional design refinements are likely to impact to any of the identified scarred trees from the proposal, an addendum CHAR and revised consultation with stakeholders, including a second AFG, would be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP application where this impact is identified subsequent to issuance by OEH of the first AHIP.

- Although unlikely to be impacted in the course of works, an exclusion zone will be defined by a qualified archaeologist and a barrier will be erected around interface between the construction work zone and MBC PAD01 and The Rocks Site 1 #02-4-0024 while construction is being undertaken.

- A heritage induction will be provided to workers before construction begins. It will inform them of exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.

- A CEMP and accompanying unexpected finds procedure will provide a method to manage potential heritage constraints and unexpected finds during construction works. Aspects of site and cultural area protection that should be included in the CEMP include:
  - Establishing no-harm areas where appropriate. Depending on the nature and timing of works in the vicinity of identified Aboriginal sites or cultural areas that will not be impacted by the proposed works, it may be appropriate to establish visual markers around no-harm areas with appropriate signage to avoid inadvertent impacts.
  - Nature of the visual markers around no-harm areas. The CEMP should document what type of visual marker will be put in place, such as temporary fencing, high visibility tape, and temporary signage.
  - Provide clear guidance to all site workers on access restrictions to no-harm areas including site inductions and tool box talks.
  - Unexpected finds procedure in accordance with the Roads and Maritime *Unexpected Heritage Items Procedure 2015* would be followed.
• If any suspected human remains are located during any stage of the proposed works, work should stop immediately and the procedures outlined in the Roads and Maritime *Unexpected Heritage Items Procedure 2015* would be followed.

• Should any changes be made to the proposed works that would involve additional impacts to Aboriginal heritage or areas outside of the proposal area, these changes should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups and further investigation may be necessary.

• The final version of this CHAR and accompanying documentation should be forwarded to registered Aboriginal stakeholders and OEH with an AHIP application.
7.0 REFERENCES


NSW Geology Plus. (2016). *NSW Geology Plus*. Retrieved from https://api.tiles.mapbox.com/v4/tybion.a0n6d2t9/page.html?access_token=pk.eyJjIjoidHlia9uIiwicCI6IjQwNzA3Nzg4OTIiLCJpZCI6c2V0dCV1c2V0dCIsIm5iIjoiMTY4NjUyODU1MDMzNjczODc2OTYyZjQyOGNjNTQ4ZjZlNjEwMmRlYmY3YmY3NTU3Y2IiLCJzdF9pIjoxfQ..X8c8fyJg11-BDWz3KcQOBw#11/-28.7689/150.3191


8.0 APPENDICES
## APPENDIX A. RMS STAKEHOLDER CALL LOG

### Contact Persons / Stakeholder Call Log

<table>
<thead>
<tr>
<th>Person</th>
<th>Body</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glynis</td>
<td>Act CEO Toomelah LALC</td>
<td><a href="mailto:Toomelahlandcouncil@gmail.com">Toomelahlandcouncil@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office: 07 4676 2348</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mob: 0422145418</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fax: 07 4676 2555</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Jack back up number) Mob: 0403554421</td>
</tr>
<tr>
<td>Frank Russo</td>
<td>NTSCorp Senior Solicitor</td>
<td><a href="mailto:frusso@ntscorp.com.au">frusso@ntscorp.com.au</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph: 9310 3188</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fax: 61 2 9310 4177</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mob: 0448 386 848</td>
</tr>
<tr>
<td>Phil Duncan</td>
<td>Gomeroi NT Temp Chair Person indorsed by NTSCorp</td>
<td><a href="mailto:ngnulu@optusnet.com.au">ngnulu@optusnet.com.au</a></td>
</tr>
<tr>
<td>Barry Jarrett</td>
<td></td>
<td>Mob: 0452411180</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office Ph: 9689 4435</td>
</tr>
<tr>
<td>Jeff Charlton</td>
<td>RMS</td>
<td>Ph: 02 6861 1658</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mob: 0428463258</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>From</th>
<th>To</th>
<th>Phone/ Email</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/09/16</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left Message to ring back</td>
</tr>
<tr>
<td>08/09/16</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone/Email</td>
<td>Left Message to ring back Email to touch base regarding inspection</td>
</tr>
<tr>
<td>12/09/16</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left Message to ring back</td>
</tr>
<tr>
<td>12/09/16</td>
<td>RMS</td>
<td>NTSCorp Frank Russo</td>
<td>Email</td>
<td>Contact the most appropriate person for the Gomeroi People NTC</td>
</tr>
<tr>
<td>13/09/16</td>
<td>RMS</td>
<td>NTSCorp Frank Russo</td>
<td>Phone</td>
<td>Requesting contacts for the Gomeroi People NT</td>
</tr>
<tr>
<td>13/09/16</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Email</td>
<td>Sent new list of NT applicants but not the contact person</td>
</tr>
<tr>
<td>13/09/16</td>
<td>RMS</td>
<td>NTSCorp Frank Russo</td>
<td>Email</td>
<td>Request NT contact numbers for applicants</td>
</tr>
<tr>
<td>Date</td>
<td>From</td>
<td>To</td>
<td>Phone/ Email</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
<td>--------------</td>
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</tr>
<tr>
<td>13/09/16</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Email</td>
<td>Sent contact numbers for all applicants not contact person</td>
</tr>
<tr>
<td>13/09/16</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>To send information of the project and availability of site officers</td>
</tr>
<tr>
<td>14/09/16</td>
<td>RMS</td>
<td>Jason Wilson</td>
<td>Phone</td>
<td>No answer left message</td>
</tr>
<tr>
<td>14/09/16</td>
<td>RMS</td>
<td>Marcus Walters</td>
<td>Phone</td>
<td>No answer left message</td>
</tr>
<tr>
<td>14/09/16</td>
<td>RMS</td>
<td>Phil Duncan</td>
<td>Phone</td>
<td>No answer left message</td>
</tr>
<tr>
<td>14/09/16</td>
<td>RMS</td>
<td>Donald Craigie</td>
<td>Phone</td>
<td>Discuss the contact person will get back to me tomorrow</td>
</tr>
<tr>
<td>15/09/16</td>
<td>RMS</td>
<td>NTSCorp Frank Russo</td>
<td>Phone</td>
<td>Discuss the contacts unable to provide chair person as yet</td>
</tr>
<tr>
<td>15/09/16</td>
<td>RMS</td>
<td>Donald Craigie</td>
<td>Phone</td>
<td>To contact NTSCorp to discuss my requests</td>
</tr>
<tr>
<td>15/09/16</td>
<td>RMS</td>
<td>Phil Duncan</td>
<td>Phone</td>
<td>Phil said he is the contact person still need ok from NTSCorp</td>
</tr>
<tr>
<td>22/09/16</td>
<td>RMS</td>
<td>NTSCorp Frank Russo</td>
<td>Phone</td>
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</tr>
<tr>
<td>22/09/16</td>
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<td>RMS</td>
<td>Email</td>
<td>Response noting the newly authorised applicant group. Still need contact person</td>
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<tr>
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<td>Phil Duncan</td>
<td>Phone</td>
<td>Left Message call back</td>
</tr>
<tr>
<td>22/09/16</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Phone</td>
<td>Follow up on contact person list</td>
</tr>
<tr>
<td>26/09/16</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left Message to ring back</td>
</tr>
<tr>
<td>Date</td>
<td>From</td>
<td>To</td>
<td>Phone/ Email</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>------------------</td>
<td>--------------</td>
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</tr>
<tr>
<td>28/09/2016</td>
<td>RMS</td>
<td>Phil Duncan Gomeroi NT</td>
<td>Phone</td>
<td>Phil said he is the contact person still and will arrange inspection at this stage no insurance or work cover still in transition from previous applicants</td>
</tr>
<tr>
<td>29/09/2016</td>
<td>RMS</td>
<td>Toomeelah LALC</td>
<td>Phone</td>
<td>Left Message to ring back</td>
</tr>
<tr>
<td>29/09/2016</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Phone</td>
<td>To send official letter for contact person</td>
</tr>
<tr>
<td>29/09/2016</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Email</td>
<td>Official letter for interim contact person Phil Duncan</td>
</tr>
<tr>
<td></td>
<td>Stephen Talbot</td>
<td>RMS</td>
<td>Phone</td>
<td>Interest in site inspection will call Stephen back on Tuesday as I am on leave</td>
</tr>
<tr>
<td>11/10/2016</td>
<td>RMS</td>
<td>Phil Duncan Gomeroi NT</td>
<td>Mob</td>
<td>Will talk to Stephen regarding area and who to do inspection</td>
</tr>
<tr>
<td>11/10/2016</td>
<td>RMS</td>
<td>Phil Duncan Gomeroi NT</td>
<td>Phone</td>
<td>Left Message call back</td>
</tr>
<tr>
<td>11/10/2016</td>
<td>RMS</td>
<td>Toomeelah LALC</td>
<td>Phone/ Email</td>
<td>Left Message to ring back</td>
</tr>
<tr>
<td>12/10/2016</td>
<td>RMS</td>
<td>Phil Duncan Gomeroi NT &amp; Toomeelah LALC Reps</td>
<td>Phone</td>
<td>Phil Advised the applicant’s ring, to redirect them directly to him as their not entitled to site work? Arrange for site officers to send final Letters of Engagements/Dates to be set</td>
</tr>
<tr>
<td>13/10/2016</td>
<td>RMS</td>
<td>Josh Symons ARTEFACT</td>
<td>Phone</td>
<td>Request dates for inspection</td>
</tr>
<tr>
<td>13/10/2016</td>
<td>RMS</td>
<td>Toomeelah LALC</td>
<td>Phone/Email</td>
<td>Letters of Engagements sent/Dates to follow ( all good )</td>
</tr>
<tr>
<td>13/10/2016</td>
<td>RMS</td>
<td>Barry Jarrett</td>
<td>Phone</td>
<td>Project up date and to call Carl for more information</td>
</tr>
<tr>
<td>Date</td>
<td>From</td>
<td>To</td>
<td>Phone/ Email</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>------------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>13/10/2016</td>
<td>RMS</td>
<td>Toomelah LALC Rep (Carl)</td>
<td>Phone</td>
<td>Engaged ring back. Left mob with school to call me back</td>
</tr>
<tr>
<td>13/10/2016</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Email</td>
<td>Advising that he has spoken to Phil Duncan and there may be a new contact person for the area, will know as early as 14/10/2016 will send an email asap</td>
</tr>
<tr>
<td>19/10/2016</td>
<td>NTSCorp Frank Russo</td>
<td>RMS</td>
<td>Email</td>
<td>Applicant for the Gomeroi People native title determination application is through Barry Jarrett.</td>
</tr>
<tr>
<td>20/10/2016</td>
<td>RMS</td>
<td>Barry Jarrett</td>
<td>Phone</td>
<td>Project up date and will get Carl to ring me</td>
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<tr>
<td>21/10/2016</td>
<td>Carl Mc Grady</td>
<td>RMS</td>
<td>Phone</td>
<td>About site officers were cut off due to coverage I will ring back on Monday</td>
</tr>
<tr>
<td>24/10/2016</td>
<td>RMS</td>
<td>Carl Mc Grady</td>
<td>Phone</td>
<td>About site officers were cut off due to coverage ring back on Monday on school number left mob for Carl to ring me back</td>
</tr>
<tr>
<td>24/10/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left message to call back</td>
</tr>
<tr>
<td>25/10/2016</td>
<td>RMS</td>
<td>Carl Mc Grady</td>
<td>Phone</td>
<td>Left message to call back</td>
</tr>
<tr>
<td>25/10/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left message to call back</td>
</tr>
<tr>
<td>26/11/2016</td>
<td>RMS</td>
<td>Project Manager</td>
<td>Email</td>
<td>Update on meeting</td>
</tr>
<tr>
<td>26/10/2016</td>
<td>RMS</td>
<td>Artefact</td>
<td>Phone</td>
<td>Date for Inspection will confirm as soon as possible</td>
</tr>
<tr>
<td>27/10/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Agreed to the inspection 3 site officers each date to be conformed</td>
</tr>
<tr>
<td>02/11/2016</td>
<td>RMS</td>
<td>Artefact</td>
<td>Phone</td>
<td>Date changed to the 28th of November</td>
</tr>
<tr>
<td>Date</td>
<td>From</td>
<td>To</td>
<td>Phone/ Email</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
<td>---------------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>02/11/2016</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone/Email</td>
<td>Date changed to the 28th of November No issues preferred the extra time to engage the right site officers</td>
</tr>
<tr>
<td>03/11/2016</td>
<td>RMS</td>
<td>Artefact</td>
<td>Email</td>
<td>Date for Inspection will confirmed 28th of November</td>
</tr>
<tr>
<td>08/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Email</td>
<td>Date for Inspection will confirmed 28th of November</td>
</tr>
<tr>
<td>12/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Email Text</td>
<td>Left message to call back (site inspectors)</td>
</tr>
<tr>
<td>14/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left message to call back (site inspectors)</td>
</tr>
<tr>
<td>14/11/2016</td>
<td>RMS Carl Mc Grady</td>
<td>07 46762223 0403344405</td>
<td>Phone</td>
<td>Left message to call back (site inspectors)</td>
</tr>
<tr>
<td>17/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left message to call back (site inspectors)</td>
</tr>
<tr>
<td>18/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Email</td>
<td>site inspectors and paperwork</td>
</tr>
<tr>
<td>21/11/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left message to call back (site inspectors)</td>
</tr>
<tr>
<td>02/12/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Email</td>
<td>site inspectors and paperwork time sheets</td>
</tr>
<tr>
<td>13/12/2016</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone/Email</td>
<td>Signed Letters of Engagements</td>
</tr>
<tr>
<td>19/12/2016</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone/Email</td>
<td>Time sheets &amp; current copy Certificate Of Currency</td>
</tr>
<tr>
<td>19/12/2016</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone/Email</td>
<td>Dates for the new inspection 5 to7 km on western side in Jan 2017</td>
</tr>
<tr>
<td>18/01/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Email</td>
<td>Contractors statement to be completed requested by project manager</td>
</tr>
<tr>
<td>25/01/2017</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Requesting signed copy of the Contractors statement</td>
</tr>
<tr>
<td>Date</td>
<td>From</td>
<td>To</td>
<td>Phone/ Email</td>
<td>Comments</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>-----------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>02/02/2016</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone/Email</td>
<td>Left message regarding Statement</td>
</tr>
<tr>
<td>08/02/2017</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Dates for the new inspection 5 to 7 km on western side in Jan 2017</td>
</tr>
<tr>
<td>10/02/2017</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone</td>
<td>Missed call I will ring back on Monday</td>
</tr>
<tr>
<td>12/02/2017</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Left Message Stage two walk over</td>
</tr>
<tr>
<td>13/02/2017</td>
<td>RMS</td>
<td>Toomelah LALC</td>
<td>Phone</td>
<td>Arrange Site officers request Report from 1st walk over (still going over Artefacts report)</td>
</tr>
<tr>
<td>02/03/2017</td>
<td>Toomelah LALC</td>
<td>RMS</td>
<td>Phone</td>
<td>Advice change of CEO, reports to be looked at, will contact new CEO next week Carl McGrady</td>
</tr>
</tbody>
</table>
APPENDIX B. STAGE 1 / PRELIMINARY SURVEY
HW17 Mungle Back Creek to Boggabilla heavy duty pavement project

PACHCI Stage 1 Aboriginal Heritage Assessment

DRAFT

Report to Arcadis

August 2016
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1.0 INTRODUCTION

1.1 Background

Roads and Maritime Services (Roads and Maritime) proposes to carry out heavy duty pavement upgrades to achieve a 40 year life and widen the formation along 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla in the Moree Plains local government area. On behalf of Roads and Maritime, Arcadis is preparing a Review of Environmental Factors (REF) for the proposed activity. Arcadis has engaged Artefact Heritage to prepare this report, to identify Aboriginal heritage constraints.

1.2 Study area

The study area consists of the Newell Highway from the intersection with North Star Road, Boggabilla to the intersection with McCosker Street, Boggabilla, including additional land surrounding intersections within the study area and the parcels of land on either side of the road (Figure 1). The study area is located in the Moree Plains Local Government Area (LGA) and runs through the parishes of Boggabilla, Mayne, Cook, Wonga, Coppymurrumbil and Coolanga.

The study area is within the Toomelah Local Aboriginal Land Council (LALC) boundaries.

The study area incorporates the Newell Highway road reserve between chainages 87,400 to 114,900, as well construction ancillary facilities locations, boreholes and pump stations. The study area is defined by the 80 per cent concept design.

1.3 Legislative context

In New South Wales, Aboriginal objects and declared Aboriginal Places are protected by the National Parks and Wildlife Act 1974, which is administered by the Office of Environment and Heritage (OEH). If a proposed activity is likely to result in harm to an Aboriginal object or declared Aboriginal Place, it is necessary to apply for an Aboriginal Heritage Impact Permit (AHIP) in accordance with Section 90 of the National Parks and Wildlife Act 1974.

OEH has issued the Due diligence code of practice for the protection of Aboriginal objects in New South Wales (DECCW 2010). The Code of practice is intended to help individuals and organisations to exercise due diligence when carrying out activities that may harm Aboriginal objects and to determine whether they should apply for an AHIP.

In addition, Roads and Maritime has internal guidelines; the Procedure for Aboriginal cultural heritage consultation and investigation, referred to as the PACHCI (Roads and Maritime 2011). Stage 1 of the PACHCI consists of a desktop risk assessment, and is intended to determine whether a Roads and Maritime project is likely to harm Aboriginal cultural heritage, and whether further assessment or investigation is required.

The present report has been prepared in accordance with the Stage 1 of the PACHCI and has been prepared generally in accordance with the Due diligence code of practice for the protection of Aboriginal objects in New South Wales (DECCW 2010).
1.4 Authorship and acknowledgments

This report was completed by Fenella Atkinson with assistance from Alyce Haast and mapping undertaken by Duncan Jones. The report was reviewed by Josh Symons. The assistance of the following people is gratefully acknowledged:

- Jeffrey Charlton and Andrew Whitton, Roads and Maritime
- Javier Valderrama, Arcadis.
HW17 Mungle Back Creek to Boggabilla heavy duty pavement project
PACHCI Stage 1 Aboriginal Heritage Assessment

Figure 1: Location of the study area (outlined in red).
2.0 BACKGROUND

2.1 Environmental context

The study area is located within two distinct bioregions. The northern portion of the study area is within the Northern Alluvial Fans Castlereagh-Barwon Province of the Darling Riverine Plains (Heritage Concepts 2009: 21). The Darling-Riverine Plains consist of the Darling and Barwon Rivers catchments, and the landscape consists largely of drainage channels and extensive floodplains. Soils within this subregion are dominated by the grey and brown clays on the plains and brown loamy sands on the rises of former levees and channels.

The southern part of the study area is within the Northern Outwash Province of the Brigalow Belt South Bioregion (Heritage Concepts 2009: 21). This Province consists of tertiary and quaternary alluvial fans and the topography is characterised by sloping plains. Soils within the subregion are dominated by red loams and heavy brown clays.

The geology is characterised by quaternary sediments up to a depth of 20 metres (Heritage Concepts 2009: 21). Typically this comprises of a soft alluvium to a depth of 3-4 metres underlain by compacted alluvial clays and gravels. The soils are predominantly grey, brown and black cracking clays, which have developed from basalt and basaltic alluvium (Heritage Concepts 2009: 20, 25). These finely structured self-mulching soils are known as ‘black soils’ (Bonhomme 1987: 5). The archaeological potential of these soils are impacted by their shrink swell properties which rotates surface material as the sediment expands and contracts with moisture. Artefacts may fall down cracks in the soil profile when the soil is dry, and soil heaving when wet will disturb archaeological context (Heritage Concepts 2009: 29).

Watercourses within the region form part of the Upper Darling River System. In addition, ephemeral lakes, swamps and claypans occur throughout the region, associated with broad shallow watercourses (Bonhomme 1987: 4). Palaeochannels are also present, and may flow during prolonged rainy periods (Bonhomme 1987: 4). Seasonal and semipermanent wetlands are present on the major tributaries, including the Boobera Lagoon wetlands associated with the Macintyre River west of Boggabilla (Heritage Concepts 2009: 20).

Rainfall varies significantly, with prolonged periods of both drought and flooding, both of which are common. The larger watercourses, such as the Gwydir and Macintyre Rivers, are subject to extensive flooding (Heritage Concepts 2009: 28). In times of droughts many of the rivers are reduced to waterholes with only larger watercourses such as Whalan Creek continuing to flow.

The Newell Highway crosses several major watercourses within the study area, the most significant of which is Whalan Creek. Gravels are found in the lagoons along Whalan Creek, where buried point bar sediments of the prior streams are exposed (Bonhomme 1987: 5). There is evidence these gravels were used as sources of stone for flaking (Bonhomme 1987: 6). The topographic map indicates the northern part of the study area passes through a large area of swamp or floodprone land, between Morella Watercourse in the north and Whalan Creek in the south.

The Moree Plains are flat alluvial plains associated with the Gwyder and Macintyre River systems. The study area is within the Macintyre valley. In general, the landforms contain three major formations:

- River channels, levees and lower floodplains with riparian woodland vegetation
- Upper floodplains with grassland
- Wooded low rises with some higher gently undulating areas (Heritage Concepts 2009: 20).
There are also smaller local landforms in places. Prior stream levees form belts of slightly elevated undulating land, characterised by uppermost deposits of a lighter sandier texture than the surrounding floodplain (Bonhomme 1987: 5).

The vegetation of the Moree Plains would have consisted of open riverine woodland and grassland before European settlement (Heritage Concepts 2009: 26). Thirteen woodlands communities, two wetland communities and two grassland communities have been identified in the general region.

**Figure 2:** Location of major watercourses within and next to the study area (Source: SixMaps)
2.2 Historical land-use

John Oxley was the first European explorer in the Moree Plains region to conduct an expedition along the Macquarie River 1818 (Heritage Concepts 2009). This expedition was later followed by Surveyor-General Mitchell’s exploration of the northern coast hinterland in the 1830s, which opened up the region for pastoral settlement, predominately squatters. The town of Moree was gazetted in 1844 and sales of land in the region (beyond the informal possession of land by squatters) first occurred in 1862 (Heritage Concepts 2009).

Land in the Moree and Boggabilla region was first exploited for pastoral and agricultural properties in the late nineteenth century. Artesian wells in Boggabilla were drilled in the 1890s to provide water for cattle that were passing through as the town became a settlement on a new travelling stock route between Moree and the Queensland border. Boggabilla grew to service the drovers and cattle trade in the early twentieth century (Somerville 2013).

The primary travelling stock route was located to the west of the study area, although the route that became the Newell Highway from 1941 was in part used for traversing stock (Figure 3). The section of the Newell Highway within the study area was developed after the 1970s when the road was bitumenised. The level, swampy and well-watered study area can be prone to flooding, and in-fill was imported to build up the road. Much of the road has been laid on large quantities of imported road base, after extensive compression of the unsealed gravel surface in the road corridor (Ozroads 2005).

Figure 3 1900 map of NSW showing Pastures Protection Districts & travelling stock routes (red) with distances. Study area is highlighted in yellow and portion of road associated with a stock route is outlined in red (Source: National Library of Australia).
3.0 ARCHAEOLOGICAL CONTEXT

The following section outlines the results of previous archaeological investigations in the locality. It should be noted archaeological evidence forms only one part of the heritage of the local Aboriginal people. The Boggabilla area has a rich and diverse Aboriginal heritage, exemplified in a number of known intangible and historical Aboriginal places, including the following:

- Boobera Lagoon, the residence of the garru, or rainbow serpent, which travelled there from a lagoon near Yetman (Bonhomme 1987: 3, 15)
- Bora ring and carved trees at Kunopia (Bonhomme 1987: 3)
- Euraba Mission, on Whalan Creek, which was occupied from 1912 until 1927 (Bonhomme 1987: 3, 15)
- Old Toomelah Mission and Cemetery, on Willimill Station (Bonhomme 1987: 3).

3.1 Previous archaeological investigations

A number of previous archaeological studies have been undertaken in the local area, and the available reports are summarised below.

**Boggabilla Common (Dennison 1985)**

A survey of Boggabilla Common was undertaken as part of a training program for the Toomelah Local Aboriginal Land Council, in conjunction with Tranby College. The survey began at the corner of South Street and the Bruxner Highway, and extended south along the western side of the Highway for a distance of about 1.5km.

The survey resulted in the identification of 25 scarred trees, with a total of 28 scars. Twelve of the scars were interpreted as resulting from the manufacture of canoes, eight from shields, three from coolamons, and five were unidentified in the report. Maximum dimensions of some of the scars are provided below. These are recorded in millimetres, but review of the photographs suggests the units are likely to be centimetres:

- Canoe 140x30, 215x60, 250x75
- Shield 160x50, 120x30, 150x40, 90x30, 150x30, 150x40
- Coolamon 110x15, 44x20.

The survey also resulted in the identification of a hammer stone, and another stone artefact at the base of one of the scarred trees. Campsites were also noted in the general area, but were not recorded as they were not within the study area.

**S87 Seismic Program Area (Bonhomme 1987)**

This investigation covered an area south of Bruxner Road, about 23km to the west of the present study area and involved targeted survey along proposed seismic lines. It was found artefacts occurred as continuous scatters around the lagoons and as isolated sites along the creek. Most of the sites recorded were small, consisting of fewer than 10 artefacts. However, sites consisting of hundreds of artefacts were identified in places along the creek and around the lagoons.

It was suggested the focus of activities in these areas was the rich food resources and also the exposure of high quality gravels suitable for flaking. Bonhomme noted there was evidence of the use of gravels in Whalan Creek as sources of stone for flaking. And the presence of grindstone fragments
near watercourses, as a result of grinding vegetable foods. Bonhomme noted watercourses were probably the main lines of communication across the plains.

Consultation was undertaken with representatives of the North West Regional Aboriginal Land Council, Toomelah Local Aboriginal Land Council and Moree Local Aboriginal Land Council. These representatives informed the archaeologist of the presence of known archaeological sites along Whalan Creek, and Mosquito Creek.

It was noted the most archaeologically sensitive areas will be creek lines, lagoons, and prior stream levees. The management recommendations indicated areas within 100 metres of watercourses should be considered to be archaeologically sensitive. However, open sites were likely to be covered by alluvial deposit, as the region is largely floodplain. As a result, these types of sites are likely to be found only in areas that have been disturbed or eroded or in areas which are not regularly flooded.

The report included a list of site types that may be present within the region:

- **Open campsites.** Usually recorded on eroded areas of floodplain and on areas not frequently flooded.
- **Bora rings.** None survive today, but carved trees may remain to mark the presence of a ceremonial ground.
- **Burials.** Including Aboriginal burials associated with contact sites, including the Old Toomelah Mission cemetery, and older burials, which could be expected to occur in sand along creeks and watercourses and prior stream levees.
- **Scarred trees.**
- **Carved trees.** Most have been destroyed or removed to museums or private collections, and it is not expected any more are present.
- **Natural mythological site.** Boobera Lagoon.
- **Contact sites.** Euraba Mission site, Old Toomelah Mission and Cemetery.
- **Waterhole / well.** Two waterholes have been identified on Whalan Creek, and were tentatively identified as Aboriginal wells. Bonhomme suggests digging wells near dry watercourses may have been part of the water procurement strategy in the otherwise waterless plain.

### Brigalow Belt South Bioregion (Stage 2) (NPWS 2002)

A broad Aboriginal cultural heritage assessment of the Brigalow Belt South Bioregion, which includes the southern part of the present study area, was undertaken to inform broad-based land use planning and allocation issues. The approach taken was intended to identify patterns between landform and site distribution. The association between site location and water that is found more generally across NSW was confirmed in the study area. However, the distance from water varied depending on the nature of the watercourse – the stream order appeared to be relevant, as did the type.

The project also included a process of oral history recording among the local Aboriginal community, which touched on many themes of relevance to the study area. With regard to heritage specifically, the following points were made:

---

This section includes community members’ views on the management of physical and documentary heritage including the importance of Aboriginal involvement and control of the management process. There are also expressions of concern about...
the destruction that has occurred historically, and continues to occur, of cultural heritage sites and items. The need to preserve the physical landscapes, particularly rivers and forests, as the necessary location for the transmission of cultural knowledge is highlighted.

Moree Plains Local Government Area (Heritage Concepts 2009)

An Aboriginal heritage study was undertaken as part of the review of the Moree Plains Shire Local Environmental Plan. The report contained the following assessment of the archaeological resource of the area, with regard to environmental characteristics (29-30):

To sum up, flat flood plain areas are likely to quickly cover over any archaeological materials, which are subsequently only exposed through erosion of the soil, whether through sheet wash associated with flooding, stream bank destabilisation or wind erosion. The former two types of erosion are also more likely to remove artefacts depending on the strength of the flood waters.

Areas not frequently inundated are more likely to retain surface artefacts as they are not carried away by flood waters or covered over with flood deposits. Erosion on these high points in the landscape is more likely to create lag deposits owing to the flat topography. Conversely, sites located on the shallow soils of the higher slopes are more likely to be translocated downhill through colluvial and/or fluvial erosive events. Sites are also expected along the prior stream formations; however, sand quarrying of these areas has been extensive. Lastly, a general under-representation of surface archaeological remains on the alluvial deposits is expected owing to the intensive forms of agriculture occurring throughout the Moree district.

It was suggested archaeological site patterning could be expected to be different for the two biophysiographic regions within the LGA; the Northern Outwash province of the Brigalow Belt South and the Castlereagh Barwon province of the Darling Riverine Plains. Proximity to water has been found to be a significant factor affecting site location. However evidence suggests sites in the western sector of the LGA, more subject to flooding, tend to be located away from the flood zones of rivers and streams, and situated on slightly higher, well drained areas.

Moree Solar Farm (New South Wales Archaeology 2010)

This assessment covered an area of 120 hectares to the southeast of Moree, about 80 kilometres south of the study area. The investigation did not result in the identification of any Aboriginal objects, and it was considered that any undetected or subsurface artefacts would be disturbed and present in very low densities.

3.2 Aboriginal Heritage Information Management System (AHIMS) Search

The location of Aboriginal sites is considered culturally sensitive information. It is advised that the information in this section, including the AHIMS data appearing on the heritage map for the proposal, be removed from this report if it is to enter the public domain.

OEH maintains the AHIMS, a database of registered sites in NSW. A search of the AHIMS database was undertaken on 8 January 2016, with the following details:
A total of 27 sites were found in the search area, with one site listed within the study area. The spatial extent of this site is not listed in the AHIMS system. In addition, the precise location listed on the AHIMS register may be inaccurate. The site is listed in Table 1 below.

### Table 1: AHIMS listed site located in the study area

<table>
<thead>
<tr>
<th>AHIMS Number</th>
<th>Site Name</th>
<th>Site Type</th>
<th>Location within study area</th>
<th>Chainage (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-4-0041</td>
<td>BBS Toomelah LALC Mungle Ck 3</td>
<td>Artefact Site</td>
<td>Ancillary area, north of North Star road rest area</td>
<td>86,400</td>
</tr>
</tbody>
</table>

The recorded locations place the scarred trees on the north side of the Creek, and the artefact scatter on the south.

### Table 2: Frequency of site features from AHIMS data.

<table>
<thead>
<tr>
<th>Site feature</th>
<th>Number</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified tree (carved or scarred)</td>
<td>21</td>
<td>75</td>
</tr>
<tr>
<td>Artefact</td>
<td>7</td>
<td>25</td>
</tr>
</tbody>
</table>

Four groups of registered sites are located in proximity to the study area, outlined below, from south to north.

**Mungle Back Creek**

- **AHIMS No. 02-4-0039** (Mungle Creek Scarred Tree 1). Bimble box, one scar (137x26cm)
- **AHIMS No. 02-4-0040** (Mungle Creek Scarred Tree 2). Bimble box, one scar (123x30cm)
- **AHIMS No. 02-4-0041** (Mungle Creek 3). Surface scatter comprising over 200 artefacts, consisting largely of silcrete and quartz but also including quartzite, chert, chalcedony, tuff and silicified sandstone. Much of the site was covered with sediment from flooding, but there were areas of wash-out with high visibility
- **AHIMS No. 02-4-0048** (Mungle Creek Scarred Tree 5). Bimble box (dead), one scar (115x20cm)
- **AHIMS No. 02-4-0056** (Mungle Creek Scarred Tree 4). Bimble box (dead), one scar (79x32cm).

These five sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study (see Section 3.1). The complex is located on either side of Mungle Back Creek, next to the southern end of the study area, to the east of the Highway. The recorded locations place the scarred trees on the north side of the Creek, and the artefact scatter on the south.
Mungle Creek Tributary

- AHIMS No. 02-4-0049 (Whalan Creek 15). Artefact scatter on a gentle slope, comprising 20-50 artefacts over an area of 170x80m. The raw material was predominantly silcrete
- AHIMS No. 02-4-0050 (Whalan Creek Scarred Tree 16). Bimble box with one scar.

These two sites were recorded during fieldwork undertaken for the Brigalow Belt South Bioregion study (see Section 3.1). They are located on the east side of the Highway, next to a first-order tributary of Mungle Creek. This was described as an ephemeral tributary or drainage depression, at the time of the recording.

The Rocks

- AHIMS No. 02-4-0023 (The Rocks Site 1). Site card not available.
- AHIMS No. 02-4-0024 (The Rocks Scarred Tree 1). Bimble box (alive) with one scar of coolamon shape (100x11cm).
- AHIMS No. 02-4-0025 (The Rocks Site 2). Stone artefact scatter, consisting of at least 46 artefacts of silcrete, chert, quartz and petrified wood, located on the highest part of the ridge. The site was deflating in parts, with areas destroyed by the gravel pit and a service trench for an optic fibre line. The site extends west of the optic fibre line towards the Highway.
- AHIMS No. 02-4-0026 (The Rocks Scarred Tree 2). Probable bimble box (dead), with one scar of canoe shape (240x800cm).
- AHIMS No. 02-4-0027 (The Rocks Scarred Tree 3). Probable bimble box (dead, fallen), with one scar of shield shape (140x15cm).

Three scarred trees and two artefact scatters were identified during a survey undertaken before proposed extension of a gravel pit located to the east of the study area, just south of the intersection with the Dolgelly-Boggabilla Road (Figure 4).

The location of one of the sites (AHIMS No. 02-4-0024) is erroneously recorded in AHIMS, about 700m to the north of the actual location. The associated report is not available through AHIMS.

However, it appears the two surface scatters (AHIMS Nos. 02-4-0023 and 02-4-0025) are likely to originally have been one site, partly destroyed by the historical use of the gravel pit.

Individual artefact locations given for AHIMS No. 02-4-0025 include objects within the study area.

Whalan Creek

- AHIMS No. 02-4-0055 (Whalan Creek 1). Artefact scatter consisting of over 10,000 artefacts across an area of 2km x 100m. Dominant raw materials are silcrete and quartzite, with petrified wood, chert, chalcedony, tuff and quartz also present. Artefacts are visible on tracks and in erosion scars.
- AHIMS No. 02-4-0057 (Whalan Creek Scarred Tree 2). Bimble box (dead) with one scar (120x85cm).
- AHIMS No. 02-4-0058 (Whalan Creek Scarred Tree 3). Bimble box with two scars (120x30cm and 68x10cm).
• AHIMS No. 02-4-0059 (Whalan Creek Scarred Tree 4). Bimble box with one scar (56x29cm).
• AHIMS No. 02-4-0060 (Whalan Creek Scarred Tree 5). Bimble box (dead) with one scar (102x6cm).
• AHIMS No. 02-4-0061 (Whalan Creek Scarred Tree 6). Bimble box with one scar (148x30cm).

These six sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study (see Section 3.1).

The recorded locations are on the west side of the Highway; the artefact scatter and four of the trees are located on the south side of Whalan Creek, and the fifth tree is on the north side of the Creek.

Figure 4: Sketch of sites recorded at The Rocks (AHIMS No. 02-4-0024 site card).
Figure 5: AHIMS registered sites near and in the study area
4.0 SITE INSPECTION

A site inspection was undertaken by Fenella Atkinson (Artefact) and Jeffrey Charlton (Roads and Maritime) on 8 March 2016. This inspection targeted likely areas of archaeological potential, however a comprehensive site survey of the entire road corridor was not conducted, in accordance with PACHCI Stage 1 requirements.

The study area covered by the site inspection consists of a stretch of the Newell Highway, about 28 kilometres in length, starting in the north just to the south of Boggabilla, and ending in the south just south of the Mungle Back Creek crossing. In general, the study area covered by the site inspection is 80 metres in width, extending across the existing road reserve, which is variable in width but generally about 55-60 metres. The study area is wider at intersections, and also in the proposed locations of ancillary work. The site inspection was restricted to the road reserve.

Construction ancillary facility areas were added to the project footprint after the 8 March 2016 survey, and these were not inspected.

The landscape traversed by the study area is a level plain, much of which is under cultivation. This land use has involved clearing most of the native trees and shrubs (Figure 9). However, there are sparse trees within the road reserve; and areas of remnant bush, particularly in the vicinity of watercourses and within and next to the southern part of the study area. The study area crosses a number of watercourses, from south to north:

- Mungle Back Creek
- Wallaby Creek
- Three unnamed tributaries of Mungle Creek
- Whalan Creek at junction with Mobbindry Creek
- Maynes Lagoon
- Morella Watercourse and an unnamed tributary of the Morella Watercourse

In general, the watercourses flow to the west or south-west, to join Mungle Creek then Whalan Creek, which runs to the Barwon River.

The Newell Highway is a two-lane road surfaced with asphalt, with narrow gravel shoulders (Figures 7 & 8). There are no formed kerbs, gutters or drains alongside the road. Concrete bridges or culverts carry the road across the watercourses (Figure 9).

In general, ground surface visibility was poor, due to the surface of the current road, and dense grass in the road reserve. In places, an unsurfaced access track runs parallel to the Newell Highway.

In one location, approximately 150m to the east of chainage 109,300 the track had been recently regraded, exposing the subsoil (Figure 10). No artefacts were observed in this location. There were additional areas of higher ground visibility next to watercourses and around the bases of trees.

A number of scarred trees and stone artefacts were identified within and in close proximity to the study area. These are listed in Table 3 and Table 4, and discussed below from south to north.

AHIMS No. 02-4-0041 (Mungle Creek 3)

Artefacts 1 and 2 were a silcrete core and distal end of a flake respectively (Figure 11). These were located in proximity to the previously recorded site AHIMS No. 02-4-0041 (Mungle Creek 3) and are
considered to belong to that site. This is an artefact scatter located on the gently sloping terrace to the south of Mungle Back Creek. The original recording noted over 200 artefacts over an area of about 200 x 60m.

No artefacts from this site were identified within the study area. However, the associated landform extends within the study area, and part of the site is therefore likely also to be included within the study area. Four scarred trees were recorded in association with the artefact scatter, but were not re-located during the survey; AHIMS Nos. 02-2-0039, 02-2-0040, 02-4-0048, and 02-4-0056. It is possible the locations recorded in AHIMS are inaccurate.

**Newell Hwy Scarred Tree 1**

This is a stump of a tree with a partial scar, the top having been removed (Figure 12). It is located in proximity to AHIMS No. 02-4-0049 (Whalan Creek 15), a surface artefact scatter; and AHIMS No. 02-4-0050 (Whalan Ck ST 16), a scarred tree. It is unlikely to be the same item as AHIMS No. 02-4-0050, as the previously recorded site was a living tree, and the sketch of the scar is substantially different. The site is located about 400m to the south of a tributary of Mungle Creek.

**The Rocks**

Two scarred trees were recorded in the general location of the previously recorded site complex referred to as The Rocks; Newell Hwy Scarred Tree 2 and Newell Hwy Scarred Tree 3 (Figure 13). The first of these appears to be mapped in the sketch map included in the site cards (see Figure 4). However, neither of the two appears to have been recorded individually on site cards. The locations of a number of the previously recorded elements of The Rocks complex, as recorded in AHIMS, were targeted but the relevant features were not re-located. It is likely the recorded locations are inaccurate.

**Whalan Creek and Mobbindry Creek**

A number of sites have previously been recorded in proximity to Whalan Creek, to the west of the junction with Mobbindry Creek. The survey resulted in the identification of four scarred trees and three artefacts, none of which appear to have been recorded previously as individual elements of this complex of sites. One of these trees (4) was located on the western side of the Highway. The scar was irregular in shape, and an axe mark was apparent in the centre. It is dissimilar to the other scars recorded along the study area, and it is considered unlikely to represent a scar of traditional Aboriginal cultural origin.

The remaining three scarred trees and three surface artefacts have been recorded as a single site; Newell Hwy Group 1. The six items are located in close proximity to each other, 30 – 90m to the south of Mobbindry Creek, on a terrace to the east of the Highway. They are likely to represent an extension to the complex of sites that has previously been identified along Whalan Creek to the west of the Highway. Again, the results of the survey in this location indicate there may be some inaccuracy in the site locations as recorded in AHIMS.

**Newell Hwy Scarred Tree 8**

A scarred tree that does not appear to have been recorded previously. Located within the road reserve, on the western side of the Highway.

**Maynes Lagoon**

Two scarred trees, located just south of Maynes Lagoon, to the east of the Highway.
### Table 3: Artefacts identified during the survey. Site locations illustrated in Figure 16

<table>
<thead>
<tr>
<th>No.</th>
<th>AHIMS No.</th>
<th>Chainage (approx.)</th>
<th>Name</th>
<th>Easting</th>
<th>Northing</th>
<th>Description</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>02-4-0041</td>
<td>86,600</td>
<td>Mungle Creek 3</td>
<td>229526</td>
<td>6806853</td>
<td>Silcrete core 64x34x32mm</td>
<td>6481</td>
</tr>
<tr>
<td>2</td>
<td>02-4-0041</td>
<td>86,600</td>
<td>Mungle Creek 3</td>
<td>229555</td>
<td>6806915</td>
<td>Silcrete flake, distal end 18x9x4mm</td>
<td>6477</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233400</td>
<td>6818354</td>
<td>Quartzite flake 21x10x3mm</td>
<td>6445</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233399</td>
<td>6818388</td>
<td>Chalcedony flake 19x30x12mm</td>
<td>6429</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233438</td>
<td>6818394</td>
<td>Silcrete flaked piece 22x19x6 mm Mid-slope</td>
<td>6419</td>
</tr>
</tbody>
</table>

### Table 4: Scarred trees identified during the survey. Site locations illustrated in Figure 17

<table>
<thead>
<tr>
<th>No.</th>
<th>Chainage (approx.)</th>
<th>Name</th>
<th>Easting</th>
<th>Northing</th>
<th>Description</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>92,400</td>
<td>Newell Hwy Scarred Tree 1</td>
<td>231944</td>
<td>6812093</td>
<td>Stump only – top of scar removed 27x70cm 40cm from ground</td>
<td>6466</td>
</tr>
<tr>
<td>2</td>
<td>98,000</td>
<td>Newell Hwy Scarred Tree 2</td>
<td>233362</td>
<td>6817469</td>
<td>33x104cm 148cm from ground</td>
<td>6457-6462</td>
</tr>
<tr>
<td>3</td>
<td>98,200</td>
<td>Newell Hwy Scarred Tree 3</td>
<td>233349</td>
<td>6817631</td>
<td>Rotted out 210x18cm</td>
<td>6451</td>
</tr>
<tr>
<td>4</td>
<td>98,800</td>
<td></td>
<td>233202</td>
<td>6818283</td>
<td>Irregularly shaped scar, with modern axe mark in centre. Probably not an Aboriginal scarred tree</td>
<td>6402</td>
</tr>
<tr>
<td>5</td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233393</td>
<td>6818391</td>
<td>Possibly natural scar</td>
<td>6427</td>
</tr>
<tr>
<td>6</td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233399</td>
<td>6818388</td>
<td>33x175cm</td>
<td>6429</td>
</tr>
<tr>
<td>7</td>
<td>99,000</td>
<td>Newell Hwy Group 1</td>
<td>233402</td>
<td>6818384</td>
<td>19x143cm 75cm from ground</td>
<td>6433</td>
</tr>
<tr>
<td>8</td>
<td>107,700</td>
<td>Newell Hwy Scarred Tree 8</td>
<td>237709</td>
<td>6825550</td>
<td>72x19cm</td>
<td>6389</td>
</tr>
<tr>
<td>9</td>
<td>109,400</td>
<td>Newell Hwy Scarred Tree 9</td>
<td>238918</td>
<td>6826738</td>
<td>Possible Extends to ground</td>
<td>6378-2379</td>
</tr>
<tr>
<td>10</td>
<td>109,400</td>
<td>Newell Hwy Scarred Tree 10</td>
<td>238945</td>
<td>6826748</td>
<td>163x58 Extends to ground</td>
<td>6380-6383</td>
</tr>
</tbody>
</table>
Figure 6: View of the northern part of the study area.

Figure 7: Newell Highway

Figure 8: Road shoulder.

Figure 9: Bridge at Maynes Lagoon.

Figure 10: Regraded access track.

Figure 11: Artefact 1, part of AHIMS No. 02-4-0041.
Figure 12: Newell Hwy Scarred Tree 1.

Figure 13: Newell Hwy Scarred Tree 3.

Figure 14: Artefact 4, part of Newell Hwy Group 1.

Figure 15: Newell Hwy Scarred Tree 8, part of Newell Hwy Group 1.
Figure 16: Location of artefact sites identified during site inspection
Figure 17: Location of Aboriginal scarred trees identified during site inspection
5.0 DISCUSSION

5.1 Assessment of archaeological potential

The site inspection targeted areas of likely archaeological potential within the study area in accordance with Stage 1 requirements. A full coverage survey would be required during Stage 2 PACHCI investigations. A preliminary assessment of archaeological potential to inform a further PACHCI Stage 2 investigation has been presented below.

The study area traverses a region that is particularly rich in archaeological evidence of past Aboriginal occupation. In particular, Whalan Creek and the land to the south appear to have been a focus of occupation. Four groups of Aboriginal archaeological sites have been identified along the length of the study area, in the vicinity of; Mungle Back Creek, an unnamed tributary of Mungle Creek, a former gravel pit (The Rocks), and Whalan and Mobbindry Creeks. These groups had been recorded as part of earlier projects, but the survey resulted in the identification of additional elements. It also appears some of the site locations recorded in AHIMS may not be accurate.

The results suggest the following:

- In the vicinity of Whalan Creek and to the south, there is a high potential for the presence of Aboriginal archaeological sites within the study area. These sites are likely to consist of scarred trees, surface artefacts and subsurface archaeological deposits. They are likely to be located in proximity to water, however the exact distance is not known. OEH specifies, in general, Aboriginal objects are likely to be located on land within 200m of water. However, the background research suggests this distance may be greater on the Moree Plains, as occupation (and the remains of occupation) would be located out of the reach of floodwaters.
- The site inspection completed did not identify scarred trees in proximity to water. There is potential for scarred trees to be present wherever old-growth trees remain standing.
- To the north of Whalan Creek, the archaeological potential is lower. This area appears to be swampy in nature and would therefore be less suited to long-term and/or repeated occupation. In addition, less vegetation remains in this location, and the potential for the presence of scarred trees is therefore lower.
- In general, the footprint of the Newell Highway road formation has low archaeological potential. These areas have been subject to previous ground disturbance for the construction of the highway. However, areas of archaeological potential may remain between the road formation and the road reserve boundary, that has been subject to lower levels of disturbance; and on land close to watercourses, where a deep soil profile may be present.
- There are places of intangible and historical Aboriginal heritage significance in the local region. Identification of any such sites that may be affected by the proposed work would require consultation with the local Aboriginal community.

5.2 Proposed activity

The proposal would involve upgrade to heavy duty pavement of about 28km of the Newell Highway an increased road width, new overtaking lanes, road intersection upgrades and private property
access improvements, installation of new road furniture, drainage upgrades and the provision of new water supply infrastructure to facilitate the construction and maintenance of the project.

In general, the footprint of the project as presented in the 80% concept design would cover the existing highway road surface and shoulder and land along the eastern side within the Newell Highway road reserve boundary. Construction ancillary facilities would also be required, including a construction compound, stockpile sites, groundwater boreholes, and a pump station at the McIntyre River.

It is noted the 80% concept design avoids those locations where Aboriginal archaeological sites were recorded during the survey, and the locations of previously identified sites as recorded in AHIMS (Figure 18).

5.3 Due diligence process

The results of the due diligence process are outlined in Table 5 below. In brief, the results indicate Aboriginal objects are likely to be present within the study area. The concept design as completed to date has avoided impact to the locations of recorded sites. However it is unlikely this will be sufficient to ensure no harm to Aboriginal objects occurs, for two main reasons:

- Issues have been identified with the accuracy of the recorded locations of previously identified sites.
- It is unlikely all Aboriginal sites within the study area have been identified and recorded, and the results of the research indicate a high potential that additional sites are present.

Table 5: Results of the due diligence process.

<table>
<thead>
<tr>
<th></th>
<th>Will the activity disturb the ground surface or any culturally modified trees?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The activity will disturb the ground surface. The design of the proposed activity avoids the locations of identified culturally modified trees. Additional culturally modified trees may be identified and recorded during Stage 2 PACHCI investigations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>The AHIMS database shows one listed site located within the study area. This site is the BBS Toomelah LALC Mungle Ck 3 site (AHIMS no. 02-4-0041). The AHIMS database contains records of a number of sites that have previously been identified in close proximity to the southern part of the study area (as far north as Whalan Creek).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Are there any other sources of information of which a person is already aware?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2b</td>
<td>No previous reports were found that addressed the study area specifically.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Are there any landscape features that are likely to indicate the presence of Aboriginal objects?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2c</td>
<td>The OEH guidelines indicate Aboriginal objects are likely to be present within 200m of water. This landscape feature is present within the study area, as the Newell Highway crosses a number of watercourses: Mungle Back Creek &amp; two unnamed tributaries Wallaby Creek Unnamed tributary of Mungle Creek Unnamed tributary of Mungle Creek Unnamed tributary of Mungle Creek</td>
</tr>
</tbody>
</table>
- Mobbindry Creek
- Whalan Creek
- Maynes Lagoon
- Morella Watercourse

There are additional watercourses that do not enter the study area, but are within 200m. In addition, to the north of Whalan Creek, the study area passes through land that is, at least at times, flood prone and swampy.

3. **Can harm to Aboriginal objects listed on AHIMS or identified by other source of information and/or can the carrying out of the activity at the relevant landscape features be avoided?**

The concept design for the proposed activity has been undertaken with the intention to avoid impact to all recorded Aboriginal site locations. However, it is unlikely all Aboriginal sites within the study area have been identified.

Some modifications to the design of the proposed activity are possible. However, as the activity consists of upgrading an existing highway, it is not possible to make substantial amendments to the location of the proposed work.

4. **Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?**

The results of the investigation confirmed Aboriginal sites, comprising scarred trees and surface artefacts, are present in the vicinity of the study area, and in some cases within the study area. In addition, it is likely that additional, unrecorded sites are present. These are likely to consist of:
- Scarred trees.
- Surface artefacts.
- Subsurface archaeological deposits.

Places with intangible and historical Aboriginal heritage values may also be present in the locality.

5.4 **Recommendations**

The following recommendations about Aboriginal heritage are based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974* as amended.
- The requirements of the PACHCI.
- The results of the background research, site survey and assessment.
- The likely impact of the proposed development.

The following recommendation is made:

- An Aboriginal archaeological survey should be undertaken and a report prepared, in accordance with Stage 2 of the PACHCI and the *Code of practice for archaeological investigation of Aboriginal objects in New South Wales* (DECCW 2010).
Figure 18: 80% concept design in relation to the main groups of sites identified along the study area.
6.0 REFERENCES


Darling Riverine Plains Subregion


Egis 2002, Bypass of the Moree Town Centre, Environmental Impact Statement, Report to NSW Roads and Traffic Authority


APPENDIX C: CONSULTATION DOCUMENTATION FOR AFG
APPENDIX D: PACHCI STAGE 2 ASR
HW17 Mungle Back Creek to Boggabilla heavy duty pavement project

Aboriginal Archaeological Survey Report (PACHCI Stage 2)

Report to Roads and Maritime Services

Artefact item 151204

February 2017
EXECUTIVE SUMMARY

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are to:

- Provide a heavy duty pavement
- Widen the existing highway or construct a new two lane highway adjacent to the existing highway
- Provide dedicated overtaking lanes
- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity when feasible and reasonable
- Provide water supply infrastructure to help build and maintain the proposal.

Artefact Heritage has been engaged by Arcadis to conduct an Aboriginal archaeological survey and assessment of the proposed design areas in accordance with Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) guidelines. This heritage assessment forms part of the Review of Environmental Factors (REF) being prepared for Roads and Maritime in accordance with the requirements of Part 5 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

The aim of this report is to identify whether any Aboriginal objects or areas of archaeological potential would be impacted by the proposal, whether an Aboriginal Heritage Impact Permit (AHIP) would be required from the Office of Environment and Heritage (OEH), and to recommend if any further assessment and/or management or mitigation measures are required.

The local area is characterised by level floodplains of deep alluvial or colluvial deposits. These are incised by ephemeral drainage lines and several larger waterways. Previous studies have identified scarred trees as the most numerous Aboriginal site in the area. The second most frequent Aboriginal site type is stone artefact scatters which range from individual artefacts to sites with estimated hundreds of artefacts.

As part of the Roads and Maritime Stage 2 PACHCI procedure, a pedestrian survey of the proposal area was undertaken in conjunction with Elders and representatives of the Toomelah Local Aboriginal Land Council (LALC) and Gomeroi People. This survey found that the proposal area is largely disturbed due to the presence of existing roadway and road shoulders. This survey identified the following Aboriginal heritage items:

- One Potential Archaeological Deposit (PAD) – MBC PAD01 at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development.
- Three isolated Aboriginal stone artefacts in three different locations all located about one meter from the tarmac of the Newell Highway.
- Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees. One of these, MBC Scarred Tree 4, is within five meters of the proposal area.
One Aboriginal stone artefact scatter has been identified as part of the recorded AHIMS site 02-4-0024. This is about 7 meters north of the proposal area.

Recommendations

The following recommendations are based on consideration of:

- Legislative, policy and procedural requirements for the assessment of Aboriginal cultural heritage
- The recommendations of the ASR
- ESD principles
- The views and information provided by registered Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- There are three recorded Aboriginal sites located within the proposal area which would be directly impacted by the proposal. One of these sites, MBC Artefact 3 # 02-4-0088 is located within the proposal area, while two sites MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087 are so close as to effectively be within the proposal area.
- There are eight Aboriginal sites including one PAD located near to the proposal area. These comprise:
  - One Potential Archaeological Deposit (PAD) – MBC PAD01 #02-4-0085. at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development
  - Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees; MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. These are outside, but close to the current planned development
  - One previously recorded site, The Rocks Site 1 #02-4-0024, is an artefact scatter near the proposal area in the ancillary area at the old Council borrow pit. One previously recorded site, The Rocks Site 2, 02-4-0025 was previously thought to be near the proposal area, but has been determined not to be in the vicinity of the study area.

It is therefore recommended that:

- In areas surveyed for this study where no Aboriginal heritage values have been identified, the proposed activity may commence without further formal archaeological assessment. The proposed activity must adhere to the CEMP and accompanying unexpected finds policy as outlined below.
- An AHIP will be secured for known impacts to Aboriginal heritage in the areas surveyed for this study. The AHIP will be secured to permit salvage of the three isolated artefact sites (MBC Artefact 1 # 02-4-0086, MBC Artefact 2 #02-4-0087, MBC Artefact 3 #02-4-0088), and to permit any subsequent impacts to their locations. Connected with this, it is recommended Roads and
Maritime arrange, in accordance with the recommendations of registered Aboriginal stakeholders and OEH guidelines:

- Community collection of these artefacts
- Facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.

Roads and Maritime arrange for inspection of the locations of the six scarred trees identified in this study (MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083) by an arborist or other suitably qualified specialist, to determine the size of buffer required to protect these trees, their canopies and root-balls from impact by the proposed activities. Appropriately robust barriers must be placed between proposed works and the buffer zone advised for each tree while construction is being undertaken. Where additional design refinements are likely to impact to any of the identified scarred trees from the proposal, an addendum CHAR and revised consultation with stakeholders, including a second AFG, would be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP application where this impact is identified subsequent to issuance by OEH of the first AHIP.

Although unlikely to be impacted in the course of works, an exclusion zone will be defined by a qualified archaeologist and a barrier will be erected around interface between the construction work zone and MBC PAD01 and The Rocks Site 1 #02-4-0024 while construction is being undertaken.

A heritage induction will be provided to workers before construction begins. It will inform them of exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.

A CEMP and accompanying unexpected finds procedure will provide a method to manage potential heritage constraints and unexpected finds during construction works. Aspects of site and cultural area protection that should be included in the CEMP include:

- Establishing no-harm areas where appropriate. Depending on the nature and timing of works in the vicinity of identified Aboriginal sites or cultural areas that will not be impacted by the proposed works, it may be appropriate to establish visual markers around no-harm areas with appropriate signage to avoid inadvertent impacts.

- Nature of the visual markers around no-harm areas. The CEMP should document what type of visual marker will be put in place, such as temporary fencing, high visibility tape, and temporary signage.

- Provide clear guidance to all site workers on access restrictions to no-harm areas including site inductions and tool box talks.

- Unexpected finds procedure in accordance with the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.
• If any suspected human remains are located during any stage of the proposed works, work should stop immediately and the procedures outlined in the Roads and Maritime *Unexpected Heritage Items Procedure 2015* would be followed.

• Should any changes be made to the proposed works that would involve additional impacts to Aboriginal heritage or areas outside of the proposal area, these changes should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups and further investigation may be necessary.
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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are to:

- Provide a heavy duty pavement
- Widen the existing highway or construct a new two lane highway adjacent to the existing highway
- Provide dedicated overtaking lanes
- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity when feasible and reasonable
- Provide water supply infrastructure to help build and maintain the proposal.

Artefact Heritage has been engaged by Roads and Maritime to conduct an Aboriginal archaeological survey and assessment of the proposed design areas in accordance with Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage and Consultation Investigation (PACHCI) guidelines. This heritage assessment forms part of the Review of Environmental Factors (REF) being prepared for Roads and Maritime in accordance with the requirements of Part 5 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

The aim of this report is to identify whether any Aboriginal objects or areas of archaeological potential would be impacted by the proposal, whether an Aboriginal Heritage Impact Permit (AHIP) would be required from the Office of Environment and Heritage (OEH), and to recommend if any further assessment and/or management or mitigation measures are required.

The proposal area is located within lands of the Goomeroi / Kamilaroi People (Heritage Concepts, 2009). The Goomeroi / Kamilaroi are one of the largest Aboriginal nations in Australia and their affairs are often run by local representative groups. The Toomelah Local Aboriginal Lands Council and the Gomeroi People were the primary sources of Aboriginal consultation during this reporting.

1.2 Proposal area

The proposal area comprises approximately 28 kilometres of Newell Highway road corridor, proposed sites for ancillary areas and the Boggabilla boat ramp site. The proposal area extends between Roads and Maritime chainages 87,400 to 114,900. For the purposes of this report, the proposal area is defined as the extent of the area required for construction and operation of the proposal. This includes provision of new pavement, road widening or new roadway, overtaking lanes, road intersection improvements, improvements to private property access, road signage, delineation and roadside furniture, drainage upgrades, water supply infrastructure, construction work zones, erosion and sediment controls, stockpile areas and ancillary facilities as shown in Figure 1. A variable buffer of between 10 – 30 metres was surveyed around the proposal area where practicable.
Figure 1: Location of the proposal area
The linear extents of the proposal area are: (see Figure 1):

- An area of approximately 500 metres in length at the eastern end of South Street, Boggabilla, Roads and Maritime proposed to construct a turnaround area and water pumping facility at this location
- Approximately 28 kilometres along the Newell Highway from Boggabilla to Mungle Back Creek.

The non-linear extents of the proposal area are: (see Figure 1):

- Ancillary Facility 1 is a polygon measuring 380 m$^2$ to the east of the Newell Highway adjacent to Boggabilla Cemetery.
- Ancillary Facility 2 is a polygon measuring 4.4 hectares at former Council borrow site east of the Newell Highway below Dolgelly-Boggabilla Road.
- Ancillary Facility 3 is a polygon measuring 300m$^2$ at the north-east corner of the intersection of North Star Road and the Newell Highway.

1.3 The Proposal

The main features of the proposal are:

- Provide heavy duty pavement
- Widen the road
- Provide dedicated overtaking lanes
- Upgrade intersections
- Improve access to private property
- Provide road delineation, sign posting and roadside furniture
- Upgrade drainage to improve the Newell Highway flood immunity to a 20-year average recurrence interval when feasible and reasonable
- Provide water supply infrastructure to facilitate the construction and maintenance of the proposal.

1.4 Report Structure

The purpose of this report is to document the results of an investigation of Aboriginal heritage in accordance with Stage 2 of the Roads and Maritime PACHCI. The report will be included with the REF being prepared for the proposal as Appendix E Aboriginal heritage technical paper. As such, the structure of this report includes:

- **Section 2 – Statutory requirements**: outlines relevant legislation for this assessment
- **Section 3 – Proposal area context**: provides a succinct overview of the environmental and archaeological context of the proposal area
- **Section 4 – Survey methodology**: methodology for the archaeological survey
- **Section 5 – Survey results**: describes the site survey conducted for this assessment
• Section 6 – Analysis and discussion: provides a discussion of the results of the site survey
• Section 7 – Significance assessment: provides an assessment of archaeological significance
• Section 8 – Impact assessment: assesses potential impacts to identified Aboriginal sites
• Section 9 – Management and mitigation measures: outlines relevant management and mitigation measures for the proposal
• Section 10 – Recommendations

1.5 Limitations and Constraints

The scope of this assessment and associated field survey are based on information supplied by the proponent.

1.6 Report Authorship and Acknowledgements

This report was prepared by Michael Lever (Senior Heritage Consultant), with contributions by Alyce Haast and Stephanie Moore (Heritage Consultants). Management input and review was provided by Josh Symons (Principal) and Dr Sandra Wallace (Managing Director).

Artefact acknowledge the support and direction provided by the following people during preparation of this report:

• Steven Brailsford (Roads and Maritime)
• Jeff Charlton (Roads and Maritime)
• Javier Valderrama (Arcadis)
• Stuart Cameron (Arcadis)

1.7 Aboriginal Community Involvement

Particular thanks are due to Uncle Reg Haines and Aunty Judy Duncan who participated in the entire survey and provided valuable information and insights. Their commitment, enthusiasm and presence served to guide the large number of Toomelah Local Aboriginal Land Council (TLALC) and Gomeroi People trainees who rotated through participation in the survey. Glynis McGrady of the TLALC provided invaluable organisational and logistics support.
2.0 STATUTORY REQUIREMENTS


The NPW Act, administered by the OEH provides statutory protection for all Aboriginal objects and places (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 86 of the Act.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only AHIP available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.

As part of the administration of Part 6 of the Act, OEH regulatory guidelines on Aboriginal consultation are in place, which are outlined in the Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010). Guidelines are also in place for the processes of due diligence as outlined in the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (2010) in accordance with the 2010 amendment to the Act. There are no gazetted Aboriginal Places within the study. All Aboriginal objects, whether recorded or not are protected under the Act.

2.2 Native Title Act (1994)

The NSW Native Title Act 1994 was introduced to work in conjunction with the Commonwealth Native Title Act 1993. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act. A search of the National Native Tribunal applications register was undertaken for this assessment. The entirety of the proposal area of this report is located within lands subject to the Registered Native Title Claim NC2011/006 by the Gomeroi People, filed on 20/12/2011 (Gomeroi People NC2011/006, 2012). However, the terms of this claim (par. 3) stipulate that any public works commenced before 23 December 1996 are excluded from Native Title Claim NC2011/006. The proposed works may therefore be excluded from the Gomeroi People Native Title Claim NC2011/006.

2.3 Aboriginal heritage investigation guidelines

The current investigation adheres to Stage 2 of the Roads and Maritime PACHCI and the OEH Code of practice. Stage 2 of the PACHCI involves the identification of Aboriginal sites and areas of archaeological potential within a particular proposal area. The investigation involves an archaeological survey conducted with representatives of the Toomelah Local Aboriginal Land Council and Gomeroi People. Where it is identified in the PACHCI Stage 2 investigation that Aboriginal sites or areas of archaeological potential will be impacted, Roads and Maritime commences Stage 3 of the PACHCI. Stage 3 includes comprehensive Aboriginal stakeholder consultation, archaeological test excavation (where required), an Aboriginal Focus Group (AFG) meeting, and preparation of an Aboriginal Cultural Heritage Assessment Report (CHAR) to support an AHIP application or SSI approvals. Stage 4 of the PACHCI involves any mitigation measures required following approvals, such as archaeological salvage excavation or surface collection prior to impacts.
3.0 PROPOSAL AREA CONTEXT

3.1 Aboriginal Archaeological and Ethnohistorical Context

3.1.1 Aboriginal Ethnohistorical Context

The Aboriginal group is located within lands of the Goomeroi / Kamilaroi People (Heritage Concepts, 2009).

The alignment of traditional Aboriginal groupings in the wider region of the proposal area have been subject to some debate (Heritage Concepts, 2009, p. 32). It is generally understood that the speakers of the Kamilaroi language group extended over an extremely large area of northern NSW.

Many Aboriginal tribal boundaries in Australia have been determined from linguistic evidence. They are therefore only approximations. Simply identifying a named group of Aboriginal people who were once observed to inhabit an area may not provide much real insight to concepts or practices of land use at the time. Social interaction, tribal boundaries and linguistic evidence may not always correlate. Further, a western understanding of the nature of borders and boundaries appears incompatible with Aboriginal behaviours described by authors including W. Stanner (1905-1981). Stanner is probably the single most influential Australian anthropologist of the twentieth century.

Stanner provided an analytic framework for understanding Aboriginal concepts of place and belonging, and practices of land use (Stanner, 1965). Stanner proposed that an integrated and nested scheme of spatial meanings best represented Aboriginal attachments to place and social organisation. These were: Estate, Range, Domain and Regime.

The estate comprised core lands associated with an immediate patrilineal family group.

The range generally included the estate, but also included wider ranging hunting and foraging areas.

Domain was constituted of the combined estate and range.

Regime describes the location of an Aboriginal group with respect to an over-arching land pattern or environment, (which may correlate to divisions in language group). Thus, Aboriginal groups may be depicted, or depict themselves, as River People, Dryland People, or Saltwater People to name a few examples.

Stanner noted that different elements of life and values were differently represented in these spatial concepts:

Range was more important than estate from the aspect of survival. Estate was probably more important from the aspect in which social life expressed through institutions and culture the triumph over the problems of survival (Stanner, 1965, p. 3) British colonisation had a profound and devastating effect on the Aboriginal population of New South Wales. In the early days of the colony Aboriginal people were disenfranchised from their land as the British claimed areas for settlement and agriculture. The process of colonisation saw the appropriation of resources such as pasture, timber, fishing grounds and water sources, often at the expense of the local Aboriginal people.

A large part of the destruction of Aboriginal culture may not have occurred through war with the British, or through British decimation of Aboriginal groups, but instead through disease and forced removal from traditional lands. The small pox epidemic of 1789 had a profound effect on the population of New South Wales, and would have impacted disastrously on Aboriginal groups (Karskens, 2010).
Historically, Aboriginal people have often been depicted as largely nomadic and predominantly living in ephemeral huts or shelters. In the past decade research, has indicated that these descriptions may be both inaccurate and written to serve a colonialist imperative. Through depicting Aboriginal people as transient and without established settlements or villages, authors may have sought to enhance notions of European ownership of Australia, and to diminish Aboriginal territorial claims. Recent re-examination of works by first white explorers such as Mitchell, and also recent archaeological investigations support the proposal that at first encounter with Europeans, many Australian Aboriginal groups lived in what explorers described as ‘villages’ of relatively robust huts (Pascoe, 2014; Memmott, 2007; McDonald, J -The Australian, 2016; Government, 2016).

Material culture

A summary list of Aboriginal implements observed in use by early European explorers of the Moree Plains has been compiled by Balme (Balme, 1986). The list is reproduced in the Moree Aboriginal Heritage Study (Heritage Concepts, 2009, p. 34).

This list is illustrative of both items that Aboriginal people would once have used, and the types of items that European male explorers deemed worth recording. It includes no grindstones or other items generally associated with women’s practices. Neither does it include Aboriginal flaked stone artefacts.

Balme’s list comprises:

- Bark containers or coolamon - for holding water, gathering berries and other substances
- Boomerangs and throwing sticks – short wooden tools for hunting.
- Cloaks - made of kangaroo skin.
- Clubs or nulla nulla – designed for hand to hand combat
- Hatchets – of hafted stone, for bark removal. Steel was also used after European contact.
- Nets - for catching fish and birds.
- Spears - with a variety of point types.
- Fish traps - either of stone, or wood.

An early account describes two villages in the Moree Plains region:

Each hut was semi-circular, or circular, the roof conical, and from one side a flat roof stood forward like a portico, surrounded by two sticks. Most of them were close to the trunk of a tree, and they were covered, not as in other parts, by sheets of bark, but with a variety of materials, such as reeds, grass and boughs. (Mitchell, 1839).

Food

Heritage Concepts (2009) note that Mitchell (1839) primarily described the utilisation of riverine resources in the Moree Plains area. This included the use of fish traps and nets. Other observers noted widespread consumption of yams, water yams, melons and other fruits, berries, roots and tubers. The observation by Balme (1986) of spears and kangaroo cloaks clearly indicates that macropod species were a hunted. Strict ritual codes applied to the gathering and consumption of foods.
Social organisation and ritual practices

As noted above in the description of Aboriginal estate and range, the connection of Aboriginal people to ‘country’ was patrilineal. Nevertheless, life was considerably shaped according to the moiety to which an Aboriginal person belonged. Moieties were matrilineal, and an individual took the moiety of their maternal grandmother. Moiety membership dictated social interactions, including whom one could marry or speak to. Thus, society was not only divided according to moiety, but moieties served as modes of affiliation and social cohesion which transcended tribal and territorial patriarchal boundaries (Heritage Concepts, 2009, p. 36).

A complex web of interrelations and status came into play around ritual, in particular around initiation ceremonies. Boys went through a complex system of initiation, including tooth avulsion. Boobera Lagoon, west of the proposal area, is listed as an Aboriginal place on the Australian Register of the National Estate (Place ID 14805). It has associations with a Rainbow Serpent Dreaming (Heritage Concepts, 2009). The surrounds of the Lagoon contain Aboriginal burials, and local Aboriginal tradition is that the area was used as an initiation site (Uncle R. Haines -pers com. 2016).

3.1.2 OEH Aboriginal Heritage Information Management System (AHIMS)

The location of Aboriginal sites is considered culturally sensitive information. It is advised that the information in this section, including the AHIMS data appearing on the heritage map for the proposal, be removed from this report if it is to enter the public domain.

OEH maintains the Aboriginal Heritage Information Management System (AHIMS), a database of registered sites in NSW. A search of the AHIMS database was undertaken on 8 January 2016, for the following area, which returned the details listed below and illustrated on Figure 2 below.

No Aboriginal sites listed on the OEH AHIMS site register are located within the proposal area.

A total of 27 Aboriginal sites are recorded within the AHIMS site register search area (see Figure 2). OEH lists 20 standard site features that can be used to describe a site registered with AHIMS, and more than one feature can be used for each site. The frequency of recorded site types is summarised in Table 1 below. The 28 sites identified within the search area comprise the following types:

Table 1: Frequency of site features from AHIMS data.

<table>
<thead>
<tr>
<th>Site feature</th>
<th>Number</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified tree (carved or scarred)</td>
<td>21</td>
<td>75</td>
</tr>
<tr>
<td>Artefact</td>
<td>7</td>
<td>25</td>
</tr>
</tbody>
</table>
Figure 2: OEH AHIMS site register search – regional context
Figure 3: OEH AHIMS site register results – Detail 1
Figure 4: OEH AHIMS site register results – Detail 2
Figure 5: OEH AHIMS site register results – Detail 3
3.1.3 Recorded Aboriginal Sites in the Vicinity of the Proposal area

In accordance with the OEH code of practice, this section outlines a summary of recorded Aboriginal sites listed on the AHIMS site register in the vicinity of the proposal area.

Four groups of registered sites are located in proximity to the proposal area, outlined below, from south to north.

**Mungle Back Creek**

These five sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study (see Section 3.1.3 below). The complex is located on either side of Mungle Back Creek, adjacent to the southern end of the proposal area, to the east of the Newell Highway. The recorded locations place the scarred trees on the north side of the Mungle Back Creek, and the artefact scatter on the south.

- AHIMS No. 02-4-0039 (Mungle Creek Scarred Tree 1). Bimble box, one scar (137x26cm)
- AHIMS No. 02-4-0040 (Mungle Creek Scarred Tree 2). Bimble box, one scar (123x30cm)
- AHIMS No. 02-4-0041 (Mungle Creek 3). Surface scatter comprising over 200 artefacts, consisting largely of silcrete and quartz but also including quartzite, chert, chalcedony, tuff and silicified sandstone. Much of the site was covered with sediment from flooding, but there were areas of wash-out with high visibility
- AHIMS No. 02-4-0048 (Mungle Creek Scarred Tree 5). Bimble box (dead), one scar (115x20cm)
- AHIMS No. 02-4-0056 (Mungle Creek Scarred Tree 4). Bimble box (dead), one scar (79x32cm)

**Mungle Creek Tributary**

These two sites were recorded during fieldwork undertaken for the Brigalow Belt South Bioregion study. They are located on the east side of the Highway, adjacent to a first-order tributary of Mungle Creek. This was described as an ephemeral tributary or drainage depression, at the time of the recording.

- AHIMS No. 02-4-0049 (Whalan Creek 15). Artefact scatter on a gentle slope, comprising an estimated 20-50 artefacts over an area of 170x80m². The raw material was predominantly silcrete.
- AHIMS No. 02-4-0050 (Whalan Creek Scarred Tree 16). Bimble box with one scar.

**The Rocks**

Three scarred trees and two artefact scatters were identified during a survey undertaken prior to proposed extension of former Council borrow site located to the east of the proposal area, just south of the intersection with the Dolgelly-Boggabilla Road. This gravel pit currently sits largely within areas previously recorded as Aboriginal site AHIMS Artefact Scatter 02-4-0024 and possibly AHMS Artefact Scatter 02-4-0024.

The associated report for these sites is not available through AHIMS. However, from site cards it appears that the surface scatters (AHIMS Nos. 02-4-0024 and 02-4-0025) are likely to originally have been one site, partly destroyed by the historical use of the gravel pit (Figure 6). AHIMS site 02-04-
0025 is not well defined on the site card (Figure 7) and appears to possibly overlap partially with the proposed ancillary facility at The Rocks. The location given for AHIMS No. 02-4-0024 on the site card map (Figure 6) indicates the location of artefacts in close proximity to the proposal area.

- AHIMS No. 02-4-0023 (The Rocks Site 1). Site card not available. The general layout of The Rocks is reproduced from the AHIMS site card in Figure 6. This shows that the western perimeter of The Rocks is defined as well outside the proposal area of this report.
- AHIMS No. 02-4-0024 (The Rocks Scarred Tree 1). Bimble box (alive) with one scar of coolamon shape (100x11cm). This item appears to be a duplication of AHIMS No 02-4-0024 which is a large artefact scatter, described below.
- AHIMS No. 02-4-0025 (The Rocks Site 2). Stone artefact scatter, consisting of at least 46 artefacts of silcrete, chert, quartz and petrified wood, located on the highest part of the ridge. The site was deflating in parts, with areas destroyed by the gravel pit and a service trench for an optic fibre line. Although the AHIMS coordinates for this site place it close to the proposal area, the site description and site card map indicate that 02-4-0025 is at closest 100m east of the proposal area (Figure 7). The site may be impacted by a proposed ancillary compound.
- AHIMS No. 02-4-0026 (The Rocks Scarred Tree 2). Probable bimble box (dead), with one scar of canoe shape (240x800cm).
- AHIMS No. 02-4-0027 (The Rocks Scarred Tree 3). Probable bimble box (dead, fallen), with one scar of shield shape (140x15cm).

Figure 6: Sketch of sites recorded at The Rocks (from AHIMS No. 02-4-0024 site card, red marking added for this report).
Whalan Creek

These six sites were recorded as a site complex, during fieldwork undertaken for the Brigalow Belt South Bioregion study. The recorded locations are on the west side of the Highway; the artefact scatter and four of the trees are located on the south side of Whalan Creek, and the fifth tree is on the north side of the Creek.

- AHIMS No. 02-4-0055 (Whalan Creek 1). Artefact scatter consisting of over 10,000 artefacts across an area of 2km x 100m. Dominant raw materials are silcrete and quartzite, with petrified wood, chert, chalcedony, tuff and quartz also present. Artefacts are visible on tracks and in erosion scars.
- AHIMS No. 02-4-0057 (Whalan Creek Scarred Tree 2). Bimble box (dead) with one scar (120x85cm).
- AHIMS No. 02-4-0058 (Whalan Creek Scarred Tree 3). Bimble box with two scars (120x30cm and 68x10cm).
- AHIMS No. 02-4-0059 (Whalan Creek Scarred Tree 4). Bimble box with one scar (56x29cm).
- AHIMS No. 02-4-0060 (Whalan Creek Scarred Tree 5). Bimble box (dead) with one scar (102x6cm).
- AHIMS No. 02-4-0061 (Whalan Creek Scarred Tree 6). Bimble box with one scar (148x30cm).
Implications for the proposal area

Both scarred trees and artefacts are more likely to occur in proximity to permanent water.

The vast majority of sites identified in the vicinity of the proposal area (75%) are scarred trees. The number and location of these trees is unlikely to directly reflect the preferential use of the landscape by Aboriginal people in the past. Rather, factors such as the location of scarred trees in road reserves, and their protection from agricultural land clearance will have resulted in a preferential preservation of scarred trees along current roadways.

The number and location of identified stone artefact or stone artefact scatter sites is likely to be related to a number of factors. Stone tools are often identified due to the number of items (both tools and waste) created in the production, maintenance and use of flaked stone artefacts, conditions of ground visibility and the permanent nature of the material which often survives even considerable historical disturbance.

A further factor in the percentages and locations of identified site types is likely to be the extent of previous archaeological investigations and the conditions under which these investigations were undertaken. Sites are unlikely to have been identified other than through archaeological survey, and these are generally only undertaken in response to significant development. In an agricultural zone such as surrounds the proposal areas, it is unlikely that much archaeological investigation will have been undertaken outside of the immediate proximity of roads and works areas.

In conclusion, the possibility exists for previously unidentified modified trees to occur in the road reserves of the proposal area. Stone artefacts, whether isolated or in scatters may occur wherever ground visibility permits their detection.

3.1.4 Background Reports

A preliminary report for the proposal was undertaken by Artefact in early 2016 (Artefact Heritage, August 2016). This identified a number of sites and reidentified a number of AHIMS registered sites. However, none of the sites identified during this investigation are within the proposal area. Registered sites reidentified in this previous report have been listed in the AHIMS section above. The sections of the current alignment which were previously examined in Artefact in August 2016 have been resurveyed for the current report.

In addition to Artefact (August 2016), a number of previous archaeological studies have been undertaken in the local area, and the available reports are summarised below.

Boggabilla Common (Dennison, 1985)

A survey of Boggabilla Common was undertaken as part of a training program for the TLALC, in conjunction with Tranby College. The survey began at the corner of South Street and the Bruxner Highway, and extended south along the western side of the Highway for a distance of approximately 1.5km.

The survey resulted in the identification of 25 scarred trees and 28 scars in total. Twelve of the scars were interpreted as resulting from the manufacture of canoes, eight from shields, and three from coolamons, and five were unidentified in the report. Maximum dimensions of some of the scars are given. These are recorded in millimetres, but review of the photographs suggests that the units are likely to be centimetres:

- Canoe 140x30, 215x60, 250x75
- Shield 160x50, 120x30, 150x40, 90x30, 150x30, 150x40
• Coolamon 110x15, 44x20

The survey also resulted in the identification of a hammer stone, and another stone artefact at the base of one of the scarred trees. Campsites were also noted in the general area, but were not recorded as they were not within the proposal area.

S87 Seismic Program Area (Bonhomme, 1987)

This investigation covered an area south of Bruxner Road, approximately 23km to the west of the present proposal area. It involved targeted survey along proposed seismic lines. It was found that artefacts occurred as continuous scatters around the lagoons and as isolated sites along the creek. Most of the sites recorded were small, consisting of fewer than 10 artefacts; however, sites consisting of hundreds of artefacts were identified in places along the creek and around the lagoons.

It was suggested that the focus of activities in these areas was the rich food resources and also the exposure of high quality gravels suitable for flaking. Bonhomme noted that there was evidence of the use of gravels in Whalan Creek as sources of stone for flaking. And the presence of grindstone fragments near watercourses, as a result of grinding vegetable foods. Bonhomme noted that watercourses were probably the main lines of communication across the plains.

Consultation was undertaken with representatives of the North West Regional Aboriginal Land Council, Toomelah Local Aboriginal Land Council and Moree Local Aboriginal Land Council. These representatives informed the archaeologist of the presence of known archaeological sites along Whalan Creek, and Mosquito Creek.

It was noted that the most archaeologically sensitive areas will be creek lines, lagoons, and prior stream levees. The management recommendations indicated that areas within 100m of watercourses should be considered to be archaeologically sensitive. However, open sites were likely to be covered by alluvial deposit, as the region is largely floodplain. As a result, these types of sites are likely to be found only in areas that have been disturbed or eroded or in areas which are not regularly flooded.

The report included a list of site types that may be present within the region:

• Open campsites. Usually recorded on eroded areas of floodplain and on areas not frequently flooded.
• Bora rings. None survive today, but carved trees may remain to mark the presence of a ceremonial ground.
• Burials. Including Aboriginal burials associated with contact sites, including the Old Toomelah Mission cemetery, and older burials, which could be expected to occur in sand along creeks and watercourses and prior stream levees.
• Scarred trees.
• Carved trees. Most have been destroyed or removed to museums or private collections, and it is not expected that any more are present.
• Natural mythological site. Boobera Lagoon.
• Contact sites. Euraba Mission site, Old Toomelah Mission and Cemetery.
• Waterhole / well. Two waterholes have been identified on Whalan Creek, and were tentatively identified as Aboriginal wells. Bonhomme suggests that digging wells near dry watercourses may have been part of the water procurement strategy in the otherwise waterless plain.

A broad Aboriginal cultural heritage assessment of the Brigalow Belt South Bioregion, which includes the southern part of the present proposal area, was undertaken to inform broad-based land use planning and allocation issues. The approach taken was intended to identify patterns between landform and site distribution. The association between site location and water that is found more generally across NSW was confirmed in the proposal area. However, the distance from water varied depending on the nature of the watercourse – the stream order appeared to be relevant, as did the type.

The project also included a process of oral history recording among the local Aboriginal community, which touched on many themes of relevance to the proposal area. With regard to heritage specifically, the following points were made:

This section includes community members’ views on the management of physical and documentary heritage including the importance of Aboriginal involvement and control of the management process. There are also expressions of concern about the destruction that has occurred historically, and continues to occur, of cultural heritage sites and items. The need to preserve the physical landscapes, particularly rivers and forests, as the necessary location for the transmission of cultural knowledge is highlighted.

Moree Plains Local Government Area (Heritage Concepts, 2009)

An Aboriginal heritage study was undertaken as part of the review of the Moree Plains Shire Local Environmental Plan. The report contained the following assessment of the archaeological resource of the area, with regard to environmental characteristics (29-30):

To sum up, flat flood plain areas are likely to quickly cover over any archaeological materials, which are subsequently only exposed through erosion of the soil, whether through sheet wash associated with flooding, stream bank destabilisation or wind erosion. The former two types of erosion are also more likely to remove artefacts depending on the strength of the flood waters.

Areas not frequently inundated are more likely to retain surface artefacts as they are not carried away by flood waters or covered over with flood deposits. Erosion on these high points in the landscape is more likely to create lag deposits owing to the flat topography. Conversely, sites located on the shallow soils of the higher slopes are more likely to be translocated downhill through colluvial and/or fluvial erosive events. Sites are also expected along the prior stream formations; however, sand quarrying of these areas has been extensive. Lastly, a general under-representation of surface archaeological remains on the alluvial deposits is expected owing to the intensive forms of agriculture occurring throughout the Moree district.

It was suggested that archaeological site patterning could be expected to be different for the two biophysical regions within the LGA; the Northern Outwash province of the Brigalow Belt South and the Castlereagh Barwon province of the Darling Riverine Plains. Proximity to water has been found to be a significant factor affecting site location. However, evidence suggests that sites in the
western sector of the LGA, more subject to flooding, tend to be located away from the flood zones of rivers and streams, and situated on slightly higher, well drained areas.

**Moree Solar Farm** (New South Wales Archaeology, 2009)

This assessment covered an area of 120 hectares to the southeast of Moree, approximately 80km south of the proposal area. The investigation did not result in the identification of any Aboriginal objects, and it was considered that any undetected or subsurface artefacts would be disturbed and present in very low densities.

**Archaeological Implications**

Previous archaeological investigations in the locality have demonstrated that significant numbers of scarred trees are present, particularly in relatively protected areas such as road reserves.

Artefact scatters are present in the area, ranging from low to high densities. These tend to be associated with proximity to creeks or lagoons and would result from open camping activities. However, the area is subject to at-times major flooding, and flood waters are likely to move artefact deposits or obscure them with silt. Therefore, artefacts are more likely to be detected on localised high points or ridges, beyond the reach of floodwaters. There do not appear to have been any subsurface archaeological investigations in the locality of the proposal area.

Burials are unlikely to occur in the proposal area, as they are characteristically constrained to sandy rises. These have not been identified within the proposal area.

### 3.2 Landscape Context

#### 3.2.1 Geology and Soils

The proposal area is predominantly located within two distinct geological formations, which are divided at the Whalan Creek (Figure 8). To the north of the Whalan Creek the landscape is generally level or mildly undulating and consists of extensive floodplains incised by drainage channels. The substrate is Qa - Quaternary alluvials, consisting of river deposited mud, silt, sand and gravel dating from 2.5 million years ago (mya) to the present. Soils within this subregion are dominated by the grey and brown clays on the plains, and brown loamy sands on the rises of former levees and channels (NSW Geology Plus, 2016).

South of the Whalan Creek geology consists primarily of Ks – Cretaceous sedimentary rocks. These are sandstone, calcareous sandstone, siltstone and shale which were deposited in a shallow marine environment between 66 to 145 million years ago. The area is frequently incised by waterways and over lain by alluvial fans. The topography is characterised by sloping plains. Soils within the subregion are dominated by red loams and heavy brown clays (NSW Geology Plus, 2016; eSpade, 2015). The course of Mungle Back Creek is visible on Figure 8 as an extent of Qa (Quaternary alluvials). The proposal area includes small extents of Qc (Quaternary colluvial deposits) in its southern extreme.

In both parts of the proposal area lithology is characterised by river-deposited or colluvial sediments up to a depth of 20m. Typically, this comprises of a soft alluvium to a depth of 3-4m underlain by compacted alluvial clays and gravels. These clays are subject to considerable shrink-swell cycles which results in their characterisation as self-mulching soil (Artefact Heritage, August 2016). The archaeological potential for identification of surface artefacts on these soils is impacted by the soil’s shrink swell properties which swallows surface material as the sediment contracts during dry periods.
Artefacts may fall down cracks in the soil profile when the soil is dry, and soil heaving when wet may disturb archaeological context (Kibblewhite, Toth, & Hermann, 2015).
Figure 8: The proposal area showing local geological formations (1: 250,000 Goondiwindi Map Sheet)
3.2.2 Watercourses

The presence of local waterways is provided here as mapped on Six Maps (SixMaps, 2016). Watercourses in the local area comprise predominantly of ephemeral watercourses and shallow incised tributaries of nearby major watercourses. In the section north of Whalan Creek, and from north to south, it is crossed by a tributary of the Morella Watercourse, a tributary of Maynes Lagoon, and several unnamed drainage lines which are likely man-made, or altered natural drainage lines.

Whalan Creek is not within the proposal area. Immediately south of Whalan Creek, the Mobbindry Creek passes close to the north of the proposal area. The proposal area crosses Wallaby Creek and several unnamed drainage lines which are likely man-made, or altered natural drainage lines. The linear extent of the proposal area terminates approximately 300m north of Mungle Back Creek. An ancillary facility is located approximately 400m south of Mungle Back Creek.

Culverts along the Newell Highway appear likely to often result from the need to drain waters which may otherwise pool along the elevated embankment of the highway, and may not reflect the presence of prior natural waterways.

3.2.3 Land-use and Vegetation

Prior to European colonisation the vegetation of the Moree Plains would have consisted of open riverine woodland and grassland (Heritage Concepts, 2009).

From the 1830s pastoral settlers, primarily squatters, started to move into the Moree Plains Region. The town of Moree was gazetted in 1844 and formal sales of land in the region commenced in 1862 (Heritage Concepts, 2009). Boggabilla and surrounds first grew due to local pastoralism, and as a staging point for cattle en-route from Moree to Queensland. Artesian wells were drilled around Boggabilla to service passing cattle and drovers (Somerville, 2013).

The map below (Figure 9) is a 1961 illustration that includes historical Travelling Stock Routes. A main Travelling Stock Route (TSR) was located along the northern section of the proposal area, and frequently corresponds to the current alignment of road reserves. The effects of trampling by large numbers of cattle will have resulted in some disturbance to the soils of the proposal area that once comprised part of a TSR.

The section of the Newell Highway within the proposal area was developed after the 1970s when the road was bitumenised. The level, swampy and well-watered proposal area can be prone to flooding, and in-fill was imported to build up the road. Much of the road has been laid on large quantities of imported road base, after extensive compression of the unsealed gravel surface in the road corridor (Ozroads, 2016).
3.3 Regional Character

Background information demonstrates that scarred trees are the predominant recorded Aboriginal sites. This predominance is likely due to the preservation of such trees in road reserves, and due to the greater visibility and identifiability of trees over other sorts of Aboriginal artefacts. The large number of scarred trees identified are likely only a small fraction of those once present. This is partly calculated from the fact that the apparent totality of identified scarred trees (allowing for misidentification) are Bimble Box (*Eucalyptus populnea*). The timbers of this tree have been recorded as very hard and primarily suited to rural structural uses such as fence posts and rails (Queensland Government, 2010). It is highly likely then, that in addition to tree clearing for agricultural and pastoral purposes, scarred Bimble Box trees will have been utilised as a source of fencing timber.

The other locally recorded Aboriginal sites are stone artefact scatters, generally of low density. The most frequently recorded stone materials are silcrete, followed by quartzite and chert.
Results of previous studies show that sites are more likely to occur in proximity to waterways. Gently sloping locations surrounding waterways are more likely to contain high density sites. Artefact scatters are most likely to be identified in areas of erosion within these landforms. Exposures along ridge crests may contain isolated artefacts or low density scatters and may be most readily identified in locations where they have been elevated above silt-bearing floodwaters.

Land use in the local area has largely consisted of stock grazing, with extensive areas of crop cultivation, notably cotton-growing. Ground disturbance from crop cultivation is likely to be more significant than in pastoral properties, and will have disturbed sites. The impact from stock grazing is likely to be minimal in comparison. Agricultural alteration of water courses to create dams or channels will also have resulted in disturbance to sites.

3.4 Predictions

No recorded Aboriginal sites have been clearly located within the proposal area. No areas of sensitivity or potential have previously been defined within the proposal area.

Based on information from the OEH AHIMS site register search, previous archaeological investigations in the local area, landscape and regional context, the most likely site types to occur within the proposal area include:

**Modified Trees (Carved or Scarred):** Modified trees are generally associated with ceremonial sites or burial grounds. According to previous studies in the area, this is most likely to occur within low gradient slopes or flat landforms in areas suitable for habitation or ceremonial practice. Land clearance and timber extraction will have likely removed or destroyed a large number of modified trees, lowering the likelihood of encountering them in this region.

**Artefact sites:** Open artefact sites and areas of PAD may occur in areas not subject to high levels of erosion and generally in proximity to watercourses. Larger watercourses are likely to be associated with denser deposits of artefacts. Elevated landforms proximal to larger watercourses are most likely to be associated with such denser artefact deposits. Lower density artefact deposits may occur at any point in the landscape. Stone artefact material is likely to consist predominantly of silcrete, chert and quartzite.
4.0 SURVEY METHODOLOGY

Archaeological survey of the proposal area in accordance with Stage 2 of the PACHCI and the OEH code of practice was conducted on foot on the 28th, 29th and 30th of November 2016 and the 1st and 2nd of December 2016. The survey was undertaken by Michael Lever (Senior Heritage Consultant, Artefact Heritage) and Alyce Haast (Heritage Consultant, Artefact Heritage). Lever and Haast were accompanied by elders and representatives of TLALC and Gomeroi People.

The proposal area was divided into five survey units shown overall in Figure 10. These survey units are depicted in detail in Figures 11 to 19, and described below. The width of survey units varied according to the accessibility and visibility of ground surfaces. This is reflected in mapping of survey units in Section 5 below.

- **Survey Unit One** is the extent of South Street Boggabilla and its adjoining graded roadway that terminates at a boat ramp on the Macintyre River. This area is located on the levee, swale and terrace of a major waterway. This landform markedly differs from landforms in the rest of the proposal area. Survey extent in this area was approximately 20 meters either side of the center of the graded access roadway.

- **Survey Unit Two** is the ancillary facility in the reserve adjacent to Boggabilla Cemetery, and also the northern section of the Newell Highway and its reserves from below Boggabilla to Whalan Creek. These areas are situated on the same geological formation and appear likely to have undergone similar processes of clearance and grading.

- **Survey Unit Three** is the extent of the Newell Highway south of Whalan Creek, to the terminus of the proposed roadworks north of Mungle Back Creek.

- **Survey Unit Four** is the ancillary facility located east of the Newell Highway at the former Council borrow site. This area is distinct from other locations in the proposal area in that while it has been subject to intensive excavation, its roads have not been directly impacted through sealed road construction and it is situated within what appears to be preserved bushland.

- **Survey Unit Five** is the proposed ancillary facility on the north-east corner of the Newell Highway and North Star Road. This area may not have been impacted by road construction.

A handheld Global Positioning System (GPS) was used to track the path of the survey team and record the coordinates of survey transects, including the locations of any areas of archaeological potential or archaeological sites identified in the field. Detailed aerial maps marked with grid coordinates and showing locations of AHIMS sites, and sites previously identified, were carried in the field by Artefact Heritage staff. TLALC and Gomeroi representatives were provided a copy of these maps for their own reference. Using Google Maps, polygons of the proposal area and existing heritage items in proximity of the proposal area were checked in real-time against paper maps and landscape recognition. The coordinate system projection used for all site recording was GDA94 MGA 56.

Information from the AHIMS site register search indicates that no previously recorded Aboriginal sites are located within the proposal area, although AHIMS sites 02-4-0024 and 02-4-0025 are poorly mapped as located very close to or within the proposal area. The recording of site locations in the past has often been less accurate than is currently possible with modern GPS facilities. As such, the location of these sites in relation to the proposal area was checked by the survey team where practicable.
A large proportion of the identified sites in the proximity of the proposal area are Scarred Trees. These are most likely to occur in relatively undisturbed areas including road reserves. The proposal area is largely comprised of road reserve. Stone artefact sites are more likely to be identified in areas of greater surface visibility. These include locations along the modified road corridor where vegetation has been cleared, or areas where ground cover is naturally thinner.

Inaccuracies in recorded site location and the potential for recorded sites to be located within the proposal area could be satisfactorily resolved for scarred trees by inspecting every mature tree in the proposal area, and recording any scarred trees encountered.

The potential for the presence of inaccurately recorded existing stone artefact sites within the proposal area was accounted for by reference to site card data including maps, the identification of correct site location through reference to local landmarks on the ground and the inspection of soils where mapping indicated a possible overlap of sites into the proposal area.

All ground exposures were examined for Aboriginal objects (stone artefacts, or other traces of Aboriginal occupation).

A photographic record was kept of all survey units. Photographs were taken to record aspects of survey units including surface exposures, vegetation, disturbance and areas of archaeological potential. Scales were used for photographs where appropriate.

4.1 Comprehensive Survey

The proposal area was subject to comprehensive and effectively total archaeological survey, with the exception of Survey Unit Five (see below). The survey team numbered between five and nine which allowed for good coverage of ground surface. The team spread out evenly and walked each survey unit in a systematic fashion. Any areas of surface exposure or old growth trees were inspected in detail. Overall surface visibility was generally low, meaning that the opportunity for identification of stone artefacts on the ground surface was limited.

Surface visibility in Survey Unit Five was nil due to dense grass cover. This vegetation was frequently up to 1m high, rendering it impossible to assess safe footing. Survey Unit Five could not be surveyed.
Figure 10: Index map of survey units

Legend
- Survey Unit 1
- Survey Unit 2
- Survey Unit 3
- Survey Unit 4
- Survey Unit 5

Newly Identified Sites
- Artefact
- Scarred Tree
- Artefact Scatter 1
- MCB PAD01

Survey Units
151204 Mungle Back Creek to Boggabilla
LGA: Gwydir

Scale: 1:110,000
Size: A4
Date: 1/02/2017

Metres
Figure 11: Survey unit detail map 1
Figure 12: Survey unit detail map 2
Figure 13: Survey unit detail map 3
Figure 14: Survey unit detail map 4
Figure 15: Survey unit detail map 5
Figure 16: Survey unit detail map 6
Figure 17: Survey unit detail map 7
Figure 18: Survey unit detail map 8
Figure 19: Survey unit detail map 9
Figure 21: Survey unit detail map 11

Legend
- Proposal Area
- Ancillary Facilities
- Survey Unit 3
- Survey Unit 4
- Chainages

Newly Identified Sites
- Scarred Tree
- Known Site Extents
- Artefact Scatter 1

Survey Units
Detail Map 11
151204 Mungle Back Creek to Boggabilla
LGA: Gwydir

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0 120 240 480 Metres
Figure 22: Ancillary area detail map (survey unit detail map 11a)
Figure 23: Survey unit detail map 12
Figure 24: Survey unit detail map 13
Figure 25: Survey unit detail map 14
Figure 26: Survey unit detail map 15
Figure 27: Survey unit detail map 16
Figure 28: Survey unit detail map 17
5.0 SURVEY RESULTS

5.1 Survey Unit 1

Survey Unit 1 is located along South Street Boggabilla and on graded unsealed track in parts of Lot 7045 and 7046 DP1031001 (Moree Plains). It has a total length of approximately 500 metres.

South Street Boggabilla is a sealed roadway located here on a levee some five metres above the level of the Macintyre River (Figure 30). It joins a graded dirt track which enters the river reserves and travels through the elevated dry levee terrace, where exotic grasses cover ground surfaces (Figure 31). The track then descends approximately two meters into a localised floodplain with riparian trees and areas of rush or sedges (Figure 32). The track and approximately 20 meters to either side of its centerline were inspected.

This localised floodplain is considerably damper than its surrounds and includes expanses of riverine and wetland flora including rushes. This location is less likely to have been utilised extensively by Aboriginal people given that during this survey in November, its soils were still relatively damp.

The proposed pumping station is to be located in this localised swale / floodplain and will connect to the McIntyre River though an above-ground hose / pipe.

Figure 29: Cross section of Landform at the roadway in Survey Unit 1, east of South St Boggabilla. Not to Scale. View to north.

Native vegetation in the survey area seems to have been cleared. The primary ground cover is exotic grasses. Juvenile River She-Oak (*Casuarina cunninghamiana*) trees line the top of the riverbank, while mature specimens of River Red Gum (*Eucalyptus camaldulensis*) are present growing out from the banks. The level nature of the plateau and its demarcation from the sloped river bank can be seen in Figure 36. To the east of the graded track on the terrace are two sets of covered seating and BBQs located on concrete slab (Figure 36).

A concretised boat ramp and a shed are situated further towards the river bank in the north east of this area.
No Aboriginal sites were located in this Survey Unit. One. An area of Potential Archaeological Deposit (PAD) was identified about 40°m to the north of Survey Unit One, as follows:

The surveyed access track turns north near the McIntyre River, and rises slightly on a level terrace that runs north-east to south west along the riverbanks. Here the track is situated some two meters above the Macintyre River (Figure 29). Where soils are exposed, they are very fine alluvial silts (Figure 32). Little introduced gravel is evident in the track here which seems to have been formed largely through de-vegetation and grading. This terrace is readily defined by the margin of the localised floodplain to the west, the Macintyre River to the east, and dense uncleared vegetation outside of the proposal area to the north and south.

Figure 30: View west along South Street (Survey Unit 1).

Figure 31: View east from South Street showing graded track, dry vegetation of levee, and descent to green vegetation of localised floodplain in background (Survey Unit 1).

Figure 32: Soil visibility showing light alluvial silts (Survey Unit 1).

Figure 33: View to east showing graded track descending into localised floodplain (Survey Unit 1).
Figure 34: View to west of localised floodplain at bottom of swale (Survey Unit 1)

Figure 35: View to east across graded turnaround on river terrace– MBC PAD01

Figure 36: View to south east across graded unsealed road showing river terrace and seating & BBQ facilities (MBC PAD01)

Figure 37: View north along riverbank showing elevated terrace of MBC PAD01 to left
5.2 Survey Unit 2

Survey Unit Two consists of two parts. The first, and northern section is the ancillary facility in the reserves adjacent to Boggabilla Cemetery. The second part of Survey Unit Two includes areas of the Newell Highway and its reserves from below Boggabilla to Whalan Creek. Survey Unit Two has a total approximate length of 16 kilometres. It comprises the Newell Highway and its eastern road reserves, intersection improvements to both sides of the Newell Highway, and one extent of approximately 4.5 kilometres on the western side of the highway. Survey Unit Two is wholly situated on the same geological formation. It is quite homogenous in landform and vegetation and appears likely to have undergone similar processes of clearance and grading. Survey Unit Two is predominantly level and is intersected by several unnamed drainage lines and two named waterways, Maynes Lagoon, and the Morella Watercourse.

Vegetation in road reserves was predominantly exotic grass, with some areas of native shrub regrowth. Trees were almost all Bimble Box (*Eucalyptus populnea*) with infrequent individual or sparse stands of River She-Oak (*Casuarina cunninghamiana*) and Silver-Leaved Ironbark (*Eucalyptus melanphloia*). The proportion of Bimble to other tree species decreased with proximity to Whalan Creek and the darker red soils predominant around it and to its south.

Good soil visibility (>70%) was frequently present in the ancillary facility adjoining Boggabilla Cemetery, where access by vehicles appears to have worn away the already parched thin grass cover (Figure 22 and Figure 23). Where visible, soils matched modelling as fine, light coloured silts. Surface visibility throughout the rest of the survey area was generally very low, at less than 5%, due to road surface, road gravel, and dense grass and vegetative ground cover, in addition to at times dense shrub regrowth (Figure 26, Figure 27 and Figure 28). Greater soil visibility was observed along property boundaries, particularly where graded tracks or breaks were present (Figure 29).

Four Aboriginal sites were identified in this Survey Unit. These will be described at detail later in Section 5. They comprise two isolated stone artefacts (Artefacts 1 and Artefact 3), both found within 1 metre of the Newell Highway, one newly identified Scarred Tree (Scarred Tree 6) and one Scarred Tree which had been previously identified as a possible Scarred Tree (Artefact Heritage, August 2016). This has now been confirmed by Elders and archaeologists to be an Aboriginal Scarred Tree (Scarred Tree 2).
Figure 38: View southwest within the ancillary facility adjoining Boggabilla Cemetery showing ground exposure (Survey Unit 2).

Figure 39: View south within the ancillary facility adjoining Boggabilla Cemetery showing parched grass cover (Survey Unit 2).

Figure 40: View to southeast along Newell Hwy showing thick mown and uncut grass ground cover (Survey Unit 2).

Figure 41: View to north along Newell Hwy showing mixed gravel, grass and tarmac ground cover (Survey Unit 2).

Figure 42: View south east from Newell Hwy showing thick grass groundcover in road verge (Survey Unit 2).

Figure 43: View south along Newell Hwy showing new regrowth grass ground cover up to the Highway (Survey Unit 2).
5.3 Survey Unit 3

Survey Unit Three is the extent of the Newell Highway from south of Whalan Creek, to the terminus of proposed roadworks north of Mungle Back Creek. Survey Unit Three has an approximate length of 16 kilometres. It comprises the Newell Highway and predominantly its eastern road reserves. Small portions of the Survey Unit include areas in road reserves on the western side of the Highway and the locations of intersection improvements on both sides of the Newell Highway.

Surface visibility here varied widely, from exposed extents of soil surrounding intersections, to areas of dense vegetation. Surface visibility throughout the rest of the survey area was generally very low, at less than 5%, due to road surface, road gravel, and dense grass and vegetative ground cover, in addition to at times dense shrub regrowth. Greater soil visibility was observed along property boundaries, particularly where graded tracks or breaks were present.

The landscape here is level and highly similar to that north of Whalan Creek (Figure 46). However, here the distinct geology is visible in changes to soil colour and vegetation (Figure 47). The red soils of this area support a variety of larger trees including River Red Gum (Eucalyptus camaldulensis) and other Eucalypts in addition to ongoing presence of Bimble Box (Eucalyptus populnea). Other than in localised exposures, ground visibility was very poor due to thick exotic grasses and shrub regrowth (<5%). Greater soil exposure was obtained along graded tracks to the east of the Highway, and along intersections and turnoffs (Figure 49).

In one area, an extensive area of soil was bare at the site of a proposed roadside bay on the eastern side of the Highway approximately 700 metres south of Dolgelly-Boggabilla Road (Figure 48).

This area is incised by a number of drainage lines and is proximal to Mungle Back Creek. Despite being a named waterway, Mungle Back Creek appears to be an ephemeral water course. In the vicinity of the proposal area it does not have a readily identifiable continuous incised course. It has a shallow rounded cross section which resembles a periodic floodway more than a watercourse (Figure 49). Given that permanent sources of water such as the Whalan Creek are nearby, it is doubtful that Mungle Back Creek will have exercised large influence in the local deposition of Aboriginal artefacts.

Two Aboriginal sites were identified in Survey Unit 3. These will be discussed in Section 5. They included a Scarred Tree, and an isolated stone artefact.
Figure 46: View south along eastern side of Highway showing level terrain & low surface visibility (Survey Unit 3).

Figure 47: View south along a soil exposure / track to the east of the Highway. Distinctive red soils are visible (Survey Unit 3).

Figure 48: View northeast from eastern side of Highway showing staff surveying exposed soils (Survey Unit 3).

Figure 49: View north from eastern side of Highway at turnoff to ancillary facility, showing soil exposure characteristic at intersections (Survey Unit 3).

Figure 50: View to west along Mungle Back Creek slightly east of Survey Unit 3.
5.4 Survey Unit 4

Survey Unit 4 comprises a large open area of approximately 5 hectares. This Survey Unit consists of former Council borrow site, generally bounded by unsealed roadways. To the west these roadways widen into what appears likely to have been a truck turnaround area evidenced by exposed level dirt. Ground visibility here was often 100%. However, due to the wide scale removal of soils and substrate, realistic exposure of natural surfaces was often nil.

While much of Survey Unit 4 appears to have been impacted by gravel extraction activities, the soils and land immediately surrounding it appear relatively undisturbed. Survey Unit Four has relatively little exotic grass ground cover, or dense ground cover of any nature. In places this is clearly due to the disturbance to soils and the removal of fertile overburden associated with the gravel pit. In other locations, however, this appears due to preservation of an indigenous open forest, including mature trees, with a dense understorey of low shrubs that prevent grassy undergrowth and ground cover. In areas between trees and understorey, soil surfaces are often exposed, with only a sparse cover of weeds or indigenous groundcover (Figure 54).

One Scarred Tree was re-identified located five meters west of the proposal area (Scarred Tree 4). An artefact scatter was also identified seven meters north of the proposal area (Artefact Scatter 1). This artefact scatter is part of AHIMS site 02-4-0024. These sites will be discussed at greater length in Section 5.

Figure 51: View to east along northern perimeter of pit, showing spoil heap dividing between preserved vegetation to left and extraction area to right (Survey Unit 4)

Figure 52: View to east across extraction pit (Survey Unit 4)
5.5 Survey Unit 5

Survey Unit 5 is a proposed ancillary facility on the north-east corner of the Newell Highway and North Star Road. This does not appear to have been subject to previous disturbance. Survey Unit 5 was totally covered in thick, dense vegetation to an average depth of one meter. It was not deemed safe to survey this area. Vegetation was so thick that it was not possible to view underlying ground surfaces sufficiently to assess any possible trip or fall hazards that may have been present. The presence of snakes was an added safety consideration. In addition to safety concerns, there was no visibility of ground surface, and little purpose would have been served by risking entry to this area. It could be visually confirmed however, that no mature trees likely to be Aboriginal Scarred Trees were present in Survey Area 5 (Figure 56).
Figure 56: Survey Unit 5 showing thick vegetation cover. View to Newell Highway from south east.

5.6 Survey Coverage

A summary of survey coverage, in accordance with the OEH code of practice, is outlined in Tables 2 and 3 below. Total area surveyed is approximately 310 hectares.
### Table 2: Survey coverage summary – Survey Unit 1

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<th>Survey Unit 1 Landform</th>
<th>Survey Unit Area (sq m)</th>
<th>Landform as % Total</th>
<th>Visibility (%)</th>
<th>Exposure (%)</th>
<th>Effective Coverage Area (sq m)</th>
<th>Effective Coverage Arтеfacts</th>
<th>Scarred Trees</th>
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5.7 Reidentified AHIMS sites

The OEH AHIMS site register search confirmed that no previously recorded Aboriginal sites are located within the proposal area.

However, as discussed in Section 3.1.3, the location of two sites, AHIMS sites 02-4-0024 and 02-4-0025, is uncertain. This is due to the fact that the spatial data associated with these recordings is unclear, and possibly subject to errors from coordinate system and/or projection changes since they were originally recorded.

The survey did not identify AHIMS site 02-4-0025 within the proposal area. Mapping for this site is poor (Figure 5) and suggests that the only existing area of soil in which this site may occur in the proposal area is several meters to the south and southwest of the ancillary facility at the former Council borrow site. This area consists of graded dirt track in which visibility and exposure were generally 100%. Close inspection of these soils did not identify any artefacts, and it is therefore suggested that AHIMS site 02-4-0025 does not extend into this part of the proposal area.

Ground survey around the northern perimeter of Survey Unit Four, at the old Council pit identified an artefact scatter. The position of these artefacts relative to the proposal area could not be precisely determined in the field. A sample of artefacts located closest to the proposal area were therefore recorded and their positions logged with GPS.

These artefacts have been confirmed as outside of the proposal area and are part of the previously recorded artefact scatter 02-4-0024.

Materials observed in surface artefacts at 02-4-0024 included silcrete, chert, quartz, quartzite and petrified wood. Artefacts ranged from large primary reduction flakes to smaller angular fragment.

Sample images are given below as illustration of the nature of soil exposure and frequency of artefacts located here.
5.8 Identified Areas of PAD

MBC PAD01

MBC PAD01 is located in Survey Unit 1 on an elevated terrace between the local floodplain swale and the bank of the Macintyre River. The location of the terrace is schematically illustrated in Figure 29 and is shown on Figure 11. MBC PAD01 is defined by the riverbank to the east, and the lip of a local floodplain to the west and south. To the north, it is defined by mature tree growth and dense vegetation which is outside of the proposal area, and could not be accessed due to the density of growth. Excluded from this PAD are the existing road, an excavated and concreted boat ramp, two BBQ and seating structures, and the footprint of a concrete-based pumping house.

The site is within 200m of a major permanent watercourse, and is level and elevated above the river providing a potentially attractive location for intensive use by Aboriginal people in the past. Although some generalised disturbance has occurred here through the grading of a track, the alluvial silts here have potential for archaeological sensitivity to depth. At the cutting into the riverbank for the concretised boat ramp, these silts could be observed to reach at least 1.5m depth. Some localised disturbance has also occurred through construction of concrete bases for BBQs and picnic tables, for
a pumping station, and a boat ramp. Nevertheless, the vast majority of ground surface appears natural other than for the effects of grading, compaction and some gravel deposition.

The Macintyre River is a major regional watercourse which likely played a focal role in the lives of Aboriginal people in the past. This, combined with the apparently undisturbed and deep local alluvial silts combines to give MCB PAD01 a moderate to high archaeological potential.

Figure 61: View east across MBC PAD01, Macintyre River in the background.

Figure 62: View south east across MBC PAD01, seating and BBQ areas in the background

Figure 63: View south east across MBC PAD01 with Boat Ramp access visible in center background.

Figure 64: View south across MBC PAD01 showing road entering from west, rising up from localised floodplain.
Figure 65: Location of MBC PAD01
5.9 Newly Identified Aboriginal Sites

Previously unrecorded Aboriginal sites identified during the survey include three isolated artefacts and six Aboriginal Scarred Trees. These are collectively listed in Table 7, are mapped in Figures 65 to 69 and discussed individually in detail, below. Impacts to all previously and newly identified sites have been avoided through redesign of roadway and ancillary areas.

Table 7: Newly identified Aboriginal sites

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<td>Unit 2</td>
<td>240237</td>
<td>6828491</td>
<td>In road gravel~1m east of eastern road marking</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>Unit 3</td>
<td>233140</td>
<td>6815782</td>
<td>In road gravel~1m east of eastern road marking</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>Unit 2</td>
<td>239137</td>
<td>6827049</td>
<td>In road gravel~1m west of western road marking</td>
<td>Single lithic artefact</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>Unit 2</td>
<td>237704</td>
<td>6825550</td>
<td>Trunk 20.4m west of western road marking. Canopy 16.4m west of western road marking</td>
<td>Bimble Box culturally scarred tree.</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>Unit 2</td>
<td>238921</td>
<td>6826738</td>
<td>Near Maynes Lagoon, east of Highway</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 3</td>
<td>Unit 4</td>
<td>233351</td>
<td>6817630</td>
<td>Abutting road adjacent to ancillary facility at gravel pit</td>
<td>Scarred Bimble Box, dead face of scar fallen to ground.</td>
</tr>
<tr>
<td>MBC Scarred Tree 4</td>
<td>Unit 4</td>
<td>233362</td>
<td>6817469</td>
<td>About 5’m from ancillary facility at gravel pit</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
<tr>
<td>MBC Scarred Tree 5</td>
<td>Unit 3</td>
<td>2333256</td>
<td>6816436</td>
<td>On turnoff to east of highway</td>
<td>Bimble Box Small cultural scar.</td>
</tr>
<tr>
<td>MBC Scarred Tree 6</td>
<td>Unit 1</td>
<td>238756</td>
<td>6826673</td>
<td>Trunk 22m west from western road marking. Canopy 19m from western road marking</td>
<td>Bimble Box culturally scarred tree</td>
</tr>
</tbody>
</table>
Figure 66: Location of MBC Artefact 1
Figure 67: Location of MBC Scar Tree 2, MBC Scar Tree 6 and MBC Artefact 3
Figure 68: Location of MBC Scar Tree 1
Figure 69: Location of MBC Scar Tree 3 and MBC Scar Tree 4
Figure 70: Location of MBC Scarred Tree 5 and MBC Artefact 2
5.9.1 MBC Artefact 1

MBC Artefact 1 was located by Aboriginal elders in road gravel approximately one meter from the Newell Highway. The artefact is located approximately 370m north of Maynes Lagoon, which is the nearest waterbody. The surrounds are level or slightly inclined landform with effectively zero soil visibility. It is almost certain that this artefact has been transported to its current position either within imported road gravel, or as a result of disturbance to local soils during road construction. The material of the artefact (chert) is not one that has been identified as common in the region of the proposal area. Its details are:

- Material & Colour – Grey & yellow chert
- Dimensions – 20mm x 20mm x 5mm
- Description – Proximal flake fragment with cortex on platform.

Figure 71: MBC Artefact 1 in situ - ventral

Figure 72: MBC Artefact 1 - dorsal

Figure 73: MBC Artefact 1 in situ relative to Newell Highway. Position marked by notebook.
5.9.2 MBC Artefact 2

MBC Artefact 2 was located by Aboriginal elders in road gravel approximately one metre from the Newell Highway. The surrounds are level or slightly inclined landform with effectively zero visibility. The artefact was located on road gravel. It is almost certain that this artefact has been transported to its current position either within imported road gravel, or as a result of disturbance to local soils during road construction. The artefact is located approximately three kilometres south of Whalan Creek which is the nearest permanent waterbody. Details of MBC Artefact 2 are:

- Material & Colour – Fine pink Silcrete
- Dimensions – 35mm x 40mm x 20mm
- Description – Multipurpose core, 4 negative flake scars, cortex on dorsal.

Figure 74: MBC Artefact 2 in situ
Figure 75: MBC Artefact 2 Location relative to Newell Highway indicated by notebook
5.9.3 MBC Artefact 3

MBC Artefact 3 was located by Aboriginal elders in road gravel approximately one metre from the western side of the Newell Highway. The artefact is located approximately 100m north of Maynes Lagoon. The surrounds are level or slightly inclined landform with effectively zero soil visibility. The artefact was located on road gravel. It is almost certain that this artefact has been transported to its current position either within imported road gravel, or as a result of disturbance to local soils during road construction.

- Material & Colour – Yellow silcrete
- Dimensions – 30mm x 35mm x 7mm
- Description – Medial Flake Fragment, 3 negative scars

Figure 76: MBC Artefact 3 in situ - dorsal

Figure 77: MBC Artefact 3 in situ - ventral

Figure 78: MBC Artefact 3 in situ (on notebook) relative to Newell Highway
5.9.4 MBC Scarred Tree 1

MBC Scarred Tree 1 is located in road reserve to the west of the Newell Highway. Its trunk is approximately 20m west of the western road marking of the Newell Highway. The tree was outside the boundaries of the survey area; however, it was highly visible and was therefore identified and recorded. The surrounds are level or slightly inclined landform with effectively zero soil visibility due to thick grass cover. The scar is not totally symmetrical, nevertheless it’s extremely regular and generally symmetrical outline matches the criteria for Aboriginal Scarred Trees (Long, 2005).

Attribution of function to bark removed by Aboriginal people in the past is problematic. Such attribution rests on the assumption that bark use by Aboriginal people potentially hundreds of years ago, resembled the manner in which Aboriginal people used bark when European observers first documented their practices. Aboriginal culture is and has been dynamic and changing, and assumptions of unchanging practice are not easily supported.

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 700mm
  - Maximum height of scar – 970mm
  - Maximum width of scar – 250mm
  - Depth of regrowth at scar – 50mm

Figure 79: MBC Scarred Tree 1  
Figure 80: MBC Scarred Tree 1 view to west from Newell Highway
5.9.5 MBC Scarred Tree 2

MBC Scarred Tree 2 is located outside the proposal area.

MBC Scarred Tree 2 is located to the east of the Newell Highway, immediately north of the intersection with an unnamed unsealed road. It is within 50 metres of Maynes Lagoon. The tree is outside of the proposal area; however, it had been provisionally recorded on a previous survey. Reinspection was desired to establish whether or not it was a scarred tree, and confirmation of its location was necessary to ensure it was not impacted by the proposed works.

This tree was confirmed as an Aboriginal Scarred Tree. The scar is generally symmetrical and is too low to likely have resulted from branch tear. Clearance of vegetation surrounding the scar revealed that the scar was a discrete enclosed cut, and did not continue to ground surface. The presence of an epicormic growth (small subsidiary tree growth in front of the scar) indicates that this scar likely resulted from a sudden removal of bark rather than an extended episode of bark removal such as through cattle-rubbing (Long, 2005).

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 700mm
  - Maximum height of scar – 970mm
  - Maximum width of scar – 250mm
  - Depth of regrowth at scar – 50mm

Figure 81: MBC Scarred Tree 2  
Figure 82: MBC Scarred Tree 2
Figure 83: MBC Scarred Tree 2. View to north east
5.9.6 MBC Scarred Tree 3

MBC Scarred Tree 3 is located outside the proposal area.

MBC Scarred Tree 3 is located outside of and immediately to the west of the unsealed road which partially comprises the boundary of the survey area at the old Council pit, east of the Newell Highway.

The tree is marginally within a preserved zone of woodland between the old Council pit and the Newell Highway. The dry face (dead tree trunk exposed through bark removal) has fallen from the tree and lies immediately in front of the tree. The dry face was inspected, it did not display any features that would indicate that the tree was not culturally scarred. The scar is large and has generated one epicormic growth to its east.

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 270mm
  - Maximum height of scar – 2200mm
  - Maximum width of scar – 230mm
  - Depth of regrowth at scar – could not be measured due to lack of dry face.
- Dimension of dry face:
  - Height – 2100mm
  - Width – 230mm

**Figure 84:** MBC Scarred Tree 3 with fallen dry face at front. View to east

**Figure 85:** MBC Scarred Tree 3 showing proximity to dirt roadways. View to south east.
5.9.7 MBC Scarred Tree 4

MBC Scarred Tree 4 is located five meters west of the proposal area at the old Council pit, east of the Newell Highway. The tree is marginally within a preserved zone of woodland between the old Council pit and the Newell Highway. The highly symmetrical nature of the scar, and the fact that it extends around the natural curve of the tree indicate that the scar is likely to be from Aboriginal activity and not from lightning strike or road traffic accident. In consultation with TLALC elders and members and Gomeroi people it was determined that MBC Scarred Tree 4 is a culturally scarred tree.

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 1500mm
  - Maximum height of scar – 1050mm
  - Maximum width of scar – 330mm
  - Depth of regrowth at scar – 30mm

Figure 86: MBC Scarred Tree 4 showing overhang over road  Figure 87: MBC Scarred Tree 4
5.9.8 MBC Scarred Tree 5

MBC Scarred Tree 5 is located outside of the proposal area at the south-east corner of the Newell Highway and an unsealed private access road.

The scar is small and was identified by TLALC members surveying the exposed ground within and surrounding the mapped survey area.

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 1220mm
  - Maximum height of scar – 380mm
  - Maximum width of scar – 180mm
  - Depth of regrowth at scar – 90mm

Figure 88: MBC Scarred Tree 5 showing exposed soils in surrounds. View south east

Figure 89: MBC Scarred Tree 5

Figure 90: MBC Scarred Tree 5
5.9.9 MBC Scarred Tree 6

MBC Scarred Tree 6 is located outside the proposal area.

MBC Scarred Tree 6 is located approximately 200m south of Maynes Lagoon. It is within an area to the west of the Newell Highway that Roads and Maritime requested be surveyed in addition to previously scheduled areas to the east of the Highway. The tree is located approximately 22m west of the western road marking of the Newell Highway. This scar is largely obscured by dense vegetation.

- Species & age – Mature Bimble Box (*Eucalyptus populnea*)
- Dimension of scar:
  - Height above ground – 550mm
  - Maximum height of scar – 790mm
  - Maximum width of scar – 230mm
  - Depth of regrowth at scar – This could not be accurately measured as the dry face has fallen inwards

Figure 91: MBC Scarred Tree 6. View to west from Newell Highway

Figure 92: MBC Scarred Tree 6. View to west

Figure 93: MBC Scarred Tree 6. View to west
6.0 ANALYSIS AND DISCUSSION

The northern ancillary area and pumping station at South Street Boggabilla contained three landforms, namely the upper river levee/terrace, localised floodplain, and lower river terrace of the Macintyre River. As discussed, part of this lower terrace, located 40 m outside of the proposal area, is considered an area of PAD (MCB PAD01). No Aboriginal sites were identified at this location, and none had been previously identified there.

The remainder of the proposal area is situated south of the northern ancillary area. It is comprised of a largely treeless, level or slightly inclined low lying terrain. This is intersected by a number of permanent waterbodies and waterways. It is difficult to estimate the likely natural flow of local waterways, given the radical changes to local hydrology due to large scale agricultural drainage and damming, in particular for cotton farming.

The largest waterbody near the study area is the Macintyre River. Second largest water body in the proximity of the proposal area after the Macintyre River is Whalan Creek. Significant numbers of artefacts have been found to the west of the Newell Highway, immediately south of Whalan Creek. Significant numbers of artefacts have also been found west of the Newell Highway surrounding the ancillary facility proposed at the old Council pit. These artefacts are more than 600 m south of the Whalan Creek. They are within 100 m of Mobbindry Creek – a tributary of Whalan Creek, and their deposition may be related to this proximity.

During survey Maynes Lagoon was dry. The location of two scarred trees proximal to it is more likely a result of preservation that of preferential location. The two scarred trees located near Maynes Lagoon were isolated or in very sparse stands of trees.

The Morella Watercourse was also largely dry during survey, and consists of a chain of lagoons linked by meandering channels which feed into the Boobera Watercourse. No Aboriginal sites or areas of archaeological potential were identified in associated with this watercourse.

The proposal area was also incised by several ephemeral waterways, including Mungle Back Creek. The shallow and poorly defined course of Mungle Back Creek makes it likely that this creek did not play a significant year-round role in Aboriginal life in the past. It is therefore unlikely to constitute an area of archaeological potential.

Areas of major disturbance, including modification of the ground surface, was generally limited to the Newell Highway and its shoulders and intersections, and the old Council pit with its surrounds. AHIMS site AHIMS site 02-4-0024 and newly identified MBC Scarred Tree 4 are within the proposal area at the old council pit.

Overall ground surface visibility was less than 5% due to road surface, road gravel and dense grass cover. Greater surface visibility would have provided a clearer assessment of whether each design area was likely to contain Aboriginal objects beneath the ground surface.

The three isolated artefacts recorded were all located on imported gravel at the road shoulder. They may have originated locally and have been moved to their current location during roadworks. More likely though, they have been brought into the area along with manufactured road gravel. Their location therefore does not inform on the archaeological sensitivity of the landform they were located on.
7.0 SIGNIFICANCE ASSESSMENT

7.1 Significance Assessment Criteria

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. OEH (2011) provides guidelines for heritage assessment with reference to the Burra Charter (Australia ICOMOS 2013) and the Heritage Office guidelines (2001). OEH requires consideration that includes the following:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state’s natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

It is important to note that heritage significance is a dynamic value.

7.2 Archaeological Significance Assessment

A summary of archaeological significance for the proposal area is outlined below in Table 5.

**Table 8: Summary of archaeological significance**

<table>
<thead>
<tr>
<th>Site name</th>
<th>Research Potential</th>
<th>Scientific Value</th>
<th>Representative Value</th>
<th>Rarity Value</th>
<th>Overall archaeological Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHIMS 02-4-0024</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Unknown</td>
</tr>
<tr>
<td>AHIMS 02-4-0025</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Moderate-High</td>
<td>Unknown</td>
</tr>
<tr>
<td>MCB PAD01</td>
<td>Moderate-High</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>Low - Moderate</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>Low - Moderate</td>
<td>Low-Moderate</td>
<td>Moderate</td>
<td>Moderate-High</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Site AHIMS 02-4-0024 and MBCPAD01 were identified close to the proposal area. They have been assessed as demonstrating unknown archaeological significance. The nature, extent and significance of these places cannot be determined without further investigation. However, further archaeological investigation of these sites is not currently warranted as the current proposal will not harm these sites. Mitigation measures have been stipulated to protect these sites from inadvertent harm during the proposed works. (see Section 9).

Scarred Trees have been rated as of moderate to high rarity. Even though numbers of these trees have been located in the region, they almost certainly represent only a very small fraction of the scarred trees once present, and have a limited life-span.

The low significance rating given to individual artefacts reflects that they are not in-situ and their origin can likely not be determined.

### 7.2.1 Cultural Significance

This section will be updated following the AFG and review of this document by registered Aboriginal parties.
8.0 IMPACT ASSESSMENT

The proposal includes 28 kilometres of the Newell Highway and three ancillary facilities.

The proposal area has been redesigned to avoid any impacts to known Aboriginal sites.

Table 9: Summary of impacts

<table>
<thead>
<tr>
<th>AHIMS site # / survey site #</th>
<th>Type of harm</th>
<th>Degree of harm</th>
<th>Consequence of harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHIMS 02-4-0024</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>AHIMS 02-4-0024</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MCB PAD01</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Artefact 1</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Artefact 2</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Artefact 3</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 1</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 2</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 3</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 4</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 5</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
<tr>
<td>MBC Scarred Tree 6</td>
<td>None</td>
<td>None</td>
<td>No loss of value</td>
</tr>
</tbody>
</table>
9.0 MANAGEMENT AND MITIGATION MEASURES

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate against impacts to Aboriginal sites.

The nature of the mitigation measures recommended is based on the assessed significance of the site or sites and the impact assessment.

Potential impacts and mitigation of impact to known Aboriginal sites in the proposal area are described below in Section 9.1.1 and are presented in tabular form in Section 10.

Mitigation of impact to currently unrecorded Aboriginal sites or Aboriginal sites discovered unexpectedly during proposed works will be undertaken through cultural heritage induction of staff and adherence to existing Roads and Maritime procedures outlined in tabular form in Section 10.

This section will be updated following the AFG and review of this document by registered Aboriginal parties.

9.1.1 Impact to recorded Aboriginal sites

There will be no impact to recorded Aboriginal sites as a result of the proposed works. Impact to all identified Aboriginal sites and PAD has been avoided through redesign of the proposal area. Indirect or inadvertent impact on Aboriginal sites will be prevented through the following measures.

**Scarred Trees MCB Scarred Tree 1 – 6**

The extent of a scarred tree site is generally considered to be the drip-line, although an investigation by an arborist would be required to provide detailed information on root systems and what size buffer area is required in order to protect a scarred tree from inadvertent impact.

One identified scarred tree, MCB Scarred Tree 4, is located within five meters of the proposal area. The location of MCB Scarred Tree 4 should be protected during any of the proposed works that may impact on it. This would be best undertaken through definition of a ‘no-go’ zone surrounding MCB Scarred Tree 4 and its buffer zone as determined by an arborist. This ‘no-go’ zone should be supported through the placement of barriers or fencing sufficient to ensure that the tree will not be impacted during the proposed activity.

MCB Scarred Tree 1 – 3, 5 and 6 are also located outside the proposal area. The location of these trees should be indicated on construction plans and the drip line of each tree fenced off where there is potential for inadvertent impact in these areas. An arborist should be engaged where a finer level of detail on buffer zone around each of these trees is required. This is to ascertain whether impact to roots that extend beyond the drip zone would impact the tree.

**Isolated artefacts MCB Artefact 1 – 3**

Impact to these sites has been avoided through redesign of the proposed works. The location of these sites should be marked on construction plans and they should be fenced or buffered from impact by construction-related activity.

This report has identified that sites MCB Artefact 1, 2 and 3 are not associated with any areas of archaeological potential. As such, no archaeological test excavation is recommended at those locations.
**AHIMS 02-4-002, AHIMS 02-4-0025,**

These sites have been protected from impact through redesign of the proposal area. The location of AHIMS 02-4-0024 and AHIMS 02-4-0025 should be marked on construction maps, and should be protected through definition of a ‘no-go’ zone surrounding it. This ‘no-go’ zone should be supported through the placement of barriers or fencing sufficient to ensure that AHIMS 02-4-0024 and AHIMS 02-4-0025 will not be impacted during the proposed activity.

**MBC PAD01**

This site has been protected from impact through redesign of the proposal area. The location of MBC PAD01 should be marked on construction maps, and should be protected through definition of a ‘no-go’ zone surrounding it. This ‘no-go’ zone should be supported through the placement of barriers or fencing sufficient to ensure that MBC PAD01 will not be impacted during the proposed activity.

**9.1.2 Aboriginal Stakeholder Consultation**

The measures recommended here would be addressed under existing measures for Aboriginal consultation as part of the PACHCI Stage 2 process.
10.0 RECOMMENDATIONS

The following recommendations are based on consideration of:

- Legislative, policy and procedural requirements for the assessment of Aboriginal cultural heritage
- The recommendations of the ASR
- ESD principles
- The views and information provided by registered Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- There are three recorded Aboriginal sites located within the proposal area which would be directly impacted by the proposal. One of these sites, MBC Artefact 3 #02-4-0088 is located within the proposal area, while two sites MBC Artefact 1 #02-4-0086 and MBC Artefact 2 #02-4-0087 are so close as to effectively be within the proposal area. i
- There are eight Aboriginal sites including one PAD located near to the proposal area. These comprise:
  - One Potential Archaeological Deposit (PAD) – MBC PAD01 #02-4-0085. at a river terrace on the Macintyre River at Boggabilla. This PAD is not within the footprint of the current planned development
  - Six Scarred trees, which have not been previously recorded were identified and confirmed as Aboriginal Scarred Trees; MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083. These are outside, but close to the current planned development
  - One previously recorded site, The Rocks Site 1 #02-4-0024, is an artefact scatter near the proposal area in the ancillary area at the old Council borrow pit. One previously recorded site, The Rocks Site 2, 02-4-0025 was previously thought to be near the proposal area, but has been determined not to be in the vicinity of the study area.

It is therefore recommended that:

- In areas surveyed for this study where no Aboriginal heritage values have been identified, the proposed activity may commence without further formal archaeological assessment. The proposed activity must adhere to the CEMP and accompanying unexpected finds policy as outlined below.
- An AHIP will be secured for known impacts to Aboriginal heritage in the areas surveyed for this study. The AHIP will be secured to permit salvage of the three isolated artefact sites (MBC Artefact 1 # 02-4-0086, MBC Artefact 2 02-4-0087, MBC Artefact 3 02-4-0088), and to permit any subsequent impacts to their locations. Connected with this, it is recommended Roads and Maritime arrange, in accordance with the recommendations of registered Aboriginal stakeholders and OEH guidelines:
  - Community collection of these artefacts
- Facilitation of reburial procedures or storage facilities for long-term care and management, subject to a Care Agreement with OEH.

- Roads and Maritime arrange for inspection of the locations of the six scarred trees identified in this study (MBC Scarred Tree 1 #02-4-0079, MBC Scarred Tree 2 #02-4-0080, MBC Scarred Tree 3 #02-4-0081, MBC Scarred Tree 4 #02-4-0082, MBC Scarred Tree 5 #02-4-0084, MBC Scarred Tree 6 #02-4-0083) by an arborist or other suitably qualified specialist, to determine the size of buffer required to protect these trees, their canopies and root-balls from impact by the proposed activities. Appropriately robust barriers must be placed between proposed works and the buffer zone advised for each tree while construction is being undertaken. Where additional design refinements are likely to impact to any of the identified scarred trees from the proposal, an addendum CHAR and revised consultation with stakeholders, including a second AFG, would be required. Those sites would then need to be included in the AHIP application to OEH, or included in a second AHIP application where this impact is identified subsequent to issuance by OEH of the first AHIP.

- Although unlikely to be impacted in the course of works, an exclusion zone will be defined by a qualified archaeologist and a barrier will be erected around interface between the construction work zone and MBC PAD01 and The Rocks Site 1 #02-4-0024 while construction is being undertaken.

- A heritage induction will be provided to workers before construction begins. It will inform them of exclusion zones and guidelines to follow if unexpected heritage items or deposits are located during the work.

- A CEMP and accompanying unexpected finds procedure will provide a method to manage potential heritage constraints and unexpected finds during construction works. Aspects of site and cultural area protection that should be included in the CEMP include:
  - Establishing no-harm areas where appropriate. Depending on the nature and timing of works in the vicinity of identified Aboriginal sites or cultural areas that will not be impacted by the proposed works, it may be appropriate to establish visual markers around no-harm areas with appropriate signage to avoid inadvertent impacts.
  - Nature of the visual markers around no-harm areas. The CEMP should document what type of visual marker will be put in place, such as temporary fencing, high visibility tape, and temporary signage.
  - Provide clear guidance to all site workers on access restrictions to no-harm areas including site inductions and tool box talks.
  - Unexpected finds procedure in accordance with the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.

- If any suspected human remains are located during any stage of the proposed works, work should stop immediately and the procedures outlined in the Roads and Maritime Unexpected Heritage Items Procedure 2015 would be followed.
• Should any changes be made to the proposed works that would involve additional impacts to Aboriginal heritage or areas outside of the proposal area, these changes should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups and further investigation may be necessary.
11.0 REFERENCES


McDonald, J -The Australian. (2016, September 5). *Aborigines were building 'stone houses' 9000 Years Ago*. Retrieved from The Australian: http://www.theaustralian.com.au/national-affairs/indigenous/aborigines-were-building-stone-houses-9000-years-ago/news-story/30ef4873a7c8aaa2b80d01a12680df77


APPENDIX E: PACHCI STAGE 2 ASR ADDENDUM
March 2017

Javier Valderrama
Principal Environmental Planner
Arcadis, North Sydney
javier.valderrama@arcadis.com

Dear Javier,

Re: Addendum to PACHCI Stage 2 Aboriginal Archaeological Survey Report:
HW17 Mungle Back Creek to Boggabilla heavy duty pavement project.

Artefact Heritage were engaged by Arcadis on behalf of Roads and Maritime Services (Roads and Maritime) to prepare an archaeological survey report as part of Stage 2 of the Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI). This addressed Aboriginal heritage requirements of the proposed upgrades to the Newell Highway between Mungle Back Creek and Boggabilla, NSW. This report was submitted in February 2017 following Arcadis and Roads and Maritime review (Artefact, 2017).

Changes in the proposed design of the Newell Highway upgrade between Mungle Back Creek and Boggabilla have led to the identification of a potential additional impact area that requires assessment. This area was not subject to archaeological survey during the PACHCI Stage 2 survey. Arcadis have engaged Artefact to prepare an addendum report to investigate this one new area of potential impact. This addendum is intended to be read in conjunction with the original investigations that are included in the PACHCI Stage 2 survey (Artefact 2017).

If you have any queries regarding this assessment and recommendations, please do not hesitate to contact me.

Kind Regards,

Michael Lever
Senior Heritage Consultant
Artefact Heritage
michael.lever@artefact.net.au
0413 564 994
1.0 INTRODUCTION

Previous reporting

Roads and Maritime Services (Roads and Maritime) propose to provide a heavy duty road over approximately 28 kilometres of the Newell Highway between Mungle Back Creek and Boggabilla within the Moree Plains local government area, NSW (the proposal). The main features of the proposal are:

• Provide a heavy duty pavement
• Widen the existing highway or construct a new two lane highway adjacent to the existing highway
• Provide dedicated overtaking lanes
• Upgrade intersections
• Improve access to private property
• Provide road delineation, sign posting and roadside furniture
• Upgrade drainage to improve the Newell Highway flood immunity when feasible and reasonable
• Provide water supply infrastructure to help build and maintain the proposal.

The aim of this report was to identify whether any Aboriginal objects or areas of archaeological potential would be impacted by the proposal, whether an Aboriginal Heritage Impact Permit (AHIP) would be required from the Office of Environment and Heritage (OEH), and to recommend if any further assessment and/or management or mitigation measures are required.

Artefact (2017) identified:

• One registered Aboriginal site (AHIMS site 02-4-0024) in close proximity to the proposal
• Three Isolated Aboriginal stone artefacts in three different locations all located about one meter from the fog line of the Newell Highway
• Six Scarred trees, which had not been previously recorded were identified and confirmed as Aboriginal Scarred Trees.
• One Potential Archaeological Deposit (PAD) – MBC PAD01 at a river terrace on the Macintyre River at Boggabilla

Roads and Maritime have addressed the heritage concerns identified in Artefact (2017) by redesigning the proposal so as to avoid impact to the identified registered site, newly identified sites, and the area of Potential Archaeological Deposit (PAD).

A separate Statement of Heritage Impacts was prepared by Artefact to advise on the potential (non-Aboriginal) historical heritage impacts of the proposal (Artefact, 2017a).

PACHCI Stage 2 Addendum

On behalf of Roads and Maritime, Arcadis has engaged Artefact to carry out a PACHCI Stage 2 Addendum for a design refinement that was made after the preparation of the proposal’s PACHCI Stage 2 report.

The design refinement extends from Ch 102,400 to Ch 107,000 (about 4.6km) and consists of shifting the proposed road design to the west to avoid impact on an existing high voltage...
transmission line. The refinement is expected to reduce the proposal construction traffic disruptions, construction timing and costs.

The survey undertaken for this PACHCI Stage 2 Addendum extents of about 4.6km in the road shoulder and road reserves west of the Newell Highway commencing in the northern end of the proposal about 2.4 km south west of the Newell Highway crossing of Maynes Lagoon, between (Zone 56) 237231.81 E / 6825038.70 S (in the north), and 234273.00 E / 6821479.00 S (in the south). Figure 2, Figure 3, Figure 4 and Figure 5 show the extend of the area surveyed for the design refinement.

Artefact Heritage was engaged by Arcadis to conduct an Aboriginal archaeological survey and assessment of the proposed design areas in accordance with Roads and Maritime PACHCI Stage 2 guidelines. The heritage assessment completed by Artefact forms part of the Review of Environmental Factors (REF) being prepared for Roads and Maritime in accordance with the requirements of Part 5 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).

For purposes of this report the proposal area is one survey unit. This is the extent of land adjoining the Newell Highway between the above coordinates, and extending 20m westwards from the Newell Highway. The proposal area investigated in the current assessment is related to impacts associated with the construction of a heavy pavement roadway. Design of this roadway is not yet final and this report assumes that bulk excavation of soils may take place at any location in the proposal area.

Figure 1: The proposal area
Figure 2: The addendum survey area detail map 1
Figure 3: The addendum survey area detail map 2
Figure 4: The addendum survey area detail map 3
This addendum report presents:

1. Results of revised heritage registry search (AHIMS)
2. Results of field survey carried out in the proposal area.
3. Assessment of potential Aboriginal heritage impact within the proposal area
4. Recommendations for management measures for Aboriginal sites in the proposal area.

This addendum report deals with the findings of the survey of the additional area supplied to Artefact in February 2017. The additional proposal area is located immediately across the Newell Highway from areas previously surveyed. Production of detailed background reporting of the additional proposal area is therefore not warranted. Detailed background of the proposal including Aboriginal ethnohistory, environmental and archaeological contexts, land use history and predictive modelling are outlined in the previously submitted Stage 2 PACHCI (Artefact 2017).

At the request of Arcadis, Artefact also carried out the following tasks during fieldwork for the addendum report, completed on 21 February 2017:

5. Attempt to relocate isolated artefacts identified during the PACHCI Stage 2
6. Revisited the ancillary site at Boggabilla to confirm suitability of new design.

Authorship

This addendum was written by Michael Lever (Senior Heritage Consultant – Artefact). Josh Symons (Principal Heritage Consultant – Artefact) provided management input, sandwiches and reviewed the report.

Aboriginal Stakeholder Consultation

Aboriginal stakeholder consultation was carried out by Roads and Maritime per the PACHCI guidelines. Three representatives of the Toomelah Local Aboriginal Land Council (TLALC) took part in the survey of the addendum area on 21 February 2017. These were Uncle Reg Haines, Malcolm McGrady and David McGrady.

A draft copy of this report should be forwarded to TLALC for review and comment.

Legislative Context


The NPW Act, administered by the OEH provides statutory protection for all Aboriginal objects and places (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 86 of the Act.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only AHIP available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.
As part of the administration of Part 6 of the Act, OEH regulatory guidelines on Aboriginal consultation are in place, which are outlined in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010). Guidelines are also in place for the processes of due diligence as outlined in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (2010) in accordance with the 2010 amendment to the Act. There are no gazetted Aboriginal Places within the proposal area. All Aboriginal objects, whether recorded or not are protected under the Act.

**Native Title Act (1994)**

The NSW *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act. A search of the National Native Tribunal applications register was undertaken for this assessment. The entirety of the proposal area of this report is located within lands subject to the Registered Native Title Claim NC2011/006 by the Gomeroi People, filed on 20/12/2011 (Gomeroi People NC2011/006, 2012). However, the terms of this claim (par. 3) stipulate that any public works commenced before 23 December 1996 are excluded from Native Title Claim NC2011/006. The proposed works may therefore be excluded from the Gomeroi People Native Title Claim NC2011/006.

**Aboriginal heritage investigation guidelines**

The current investigation adheres to Stage 2 of the Roads and Maritime PACHCI and the OEH Code of practice. Stage 2 of the PACHCI involves the identification of Aboriginal sites and areas of archaeological potential within a particular proposal area. The investigation involves an archaeological survey conducted with representatives of the Toomelah Local Aboriginal Land Council. Where it is identified in the PACHCI Stage 2 investigation that Aboriginal sites or areas of archaeological potential will be impacted, Roads and Maritime commences Stage 3 of the PACHCI. Stage 3 includes comprehensive Aboriginal stakeholder consultation, archaeological test excavation (where required), an Aboriginal Focus Group (AFG) meeting, and preparation of an Aboriginal Cultural Heritage Assessment Report (CHAR) to support an AHIP application or SSI approvals. Stage 4 of the PACHCI involves any mitigation measures required following approvals, such as archaeological salvage excavation or surface collection prior to impacts.
2.0 RESULTS OF REVISED HERITAGE REGISTRY SEARCH (AHIMS)

Aboriginal Heritage Information Management System (AHIMS) search

A search of the Aboriginal Heritage Information System was completed on 9 January 2017 (Client ID 261290). There are no registered Aboriginal sites within 2km of the proposal area. The closest registered site is Site 02-4-0071 at Pungbougal Lagoon. This site is a modified tree located about 2.6km west of the proposal area.

The nearest identified (not registered at the time of addendum survey) Aboriginal site is MBC Artefact 3. This is a single silcrete flake located during PACHCI Stage 2 survey, situated in road gravel one meter from the Newell Highway. MBC Artefact 3 is 2.8 km north west of the proposal area.

Aboriginal registered sites in the wider area are dominated by modified trees, followed by low density artefact scatters. A total of 27 Aboriginal sites were recorded during AHIMS search for the PACHCI Stage 2 reporting (Artefact 2017 p8). Of these 21 were modified trees and 7 were lithic sites. One site of raised lithic artefact density was recorded (02-4-0024). This is located 4km south of the proposal area.

Sites identified during the PACHCI Stage 2 fieldwork generally followed this statistical trend. They comprised six modified trees, three isolated lithic artefacts, and one area of PAD.
3.0 RESULTS OF FIELD SURVEY CARRIED OUT IN THE PROPOSAL AREA.

Survey Methodology

The proposal area was surveyed on 21 February 2017. Survey was carried out by Michael Lever and Alyce Haast (Artefact), Jeff Charlton (Roads and Maritime), and Uncle Reg Haines, Malcolm McGrady and David McGrady of TLALC. The entire length of the proposal area was surveyed as one survey unit with participants walking spaced approximately 1m abreast where ground conditions allowed. Road gravel and dense grass and shrubs provided a high level of ground surface cover, with low ground surface visibility in most places. Any areas of soil exposure were investigated, and all old-growth native trees were inspected for evidence of cultural modification. Although soil surfaces were generally concealed, evidence for robust soil disturbance could be detected in the readily apparent artificial landform associated with drainage.

A handheld Global Positioning System (GPS) was used to track the path of the survey team and record the locations of any areas of archaeological potential or archaeological sites identified in the field. Detailed aerial maps marked with grid coordinates were carried in the field by Artefact Heritage staff. The coordinate system projection used for all site recording was GDA94 MGA 56. KMZ files of the proposal area were loaded onto Artefact staff smart phones. This allowed for real-time location of participants relative to proposal area boundaries.

In addition, the proposed MacIntyre River pump site was revisited to confirm whether the proposed works at this location were contained in areas previously surveyed as part of the PACHCI Stage 2 and determined to be of low archaeological potential.

Survey Results

The proposal area is in an area that is homogenous in landform and vegetation and appears likely to have undergone similar processes of clearance and grading throughout (Figure 6). Vegetation in road reserves was predominantly thick exotic grass and weeds, with significant areas of native thorny shrub regrowth (Figure 7). Soil exposures were very low as a result. Trees were very sparse, and almost all were Bimble Box (*Eucalyptus populnea*) with infrequent individual or sparse stands of River She-Oak (*Casuarina cunninghamiana*) and Silver-Leaved Ironbark (*Eucalyptus melanphloia*).

The proposal area consists of the western gravelled road shoulder of the Newell Highway. This immediately abutted the top of a table drain that had been excavated alongside the highway. This drain was present throughout the proposal area, and extended westwards between 15m to 20m from the gravel shoulder. The gravel shoulder was itself frequently grown over by exotic grasses.

Soils in the table drain could frequently not be directly inspected, as extensive thorny shrub growth has occurred along the shoulders of the table drain (Figure 9). Where access could be gained though these shrubs, the profile of the table drain was readily apparent as comprising a cut of approximately .5m to 1.5m depth, vegetated at base by thick exotic grasses (Figure 8).

The proposal area has evidently been subject to considerable disturbance both in the immediate area of the Newell Highway and its graded and gravelled shoulder, and also in the location of the table drain which runs alongside it in this location (Figure 10). Where soils in the western shoulder of the table drain could be inspected, these appeared artificially hummocked and disturbed (Figure 11).
Figure 6: Typical landform of the proposal area. View south

Figure 7: Characteristic levels of ground exposure, dark shrubs of table drain to right

Figure 8: View southwards within table drain. Newell Hwy to left.

Figure 9: View of same area shown in Figure 4, taken from top of table drain at Newell Hwy.

Figure 10: View northwards with table drain to left, Newell Hwy to right.
Figure 11: View to east across western shoulder of table drain. Newell Highway in background, disturbed hummocked soils of table drain shoulders in fore & midground.

Survey Coverage

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<th>Landform</th>
<th>Area m²</th>
<th>Visibility (%)</th>
<th>Exposure (%)</th>
<th>Effective Coverage Area m²</th>
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Survey Findings

No new sites of Aboriginal cultural heritage were identified during survey. No areas of PAD were identified. The proposal area appears to have been wholly disturbed for a distance of 20m westward from the western fog line of the Newell Highway. This disturbance consists of impacts associated with the visible structure of the Newell Highway and its graded and gravelled margins, and is also associated with a table drain that has been excavated to depths of .5m to .5m adjacent to the Newell Highway throughout the proposal area.

Conclusions from Survey

Visibility in the proposal area was low due to dense grass and shrub cover. Nevertheless, disturbance to the ground surface of the proposal area could be gauged from clearly artificial modifications to the ground surface. This disturbance took the form of road structure and shoulder, and excavated table drain. No Aboriginal lithic artefacts were identified in the proposal area. No modified trees were identified in the proposal area. Based on this survey and on the results of previous background reports (Artefact 2017), this assessment identifies that the proposal area is of low archaeological potential.
4.0 ASSESSMENT OF POTENTIAL ABORIGINAL HERITAGE IMPACT WITHIN THE PROPOSAL AREA

Significance Assessment

Assessment Criteria

Archaeological significance refers to the archaeological or scientific importance of a landscape or area. This is characterised by using archaeological criteria such as archaeological research potential, representativeness and rarity of the archaeological resource and potential for educational values. These are outlined below:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

Archaeological significance assessment

Archaeological significance of the additional proposal area has been determined based on both the findings of the original investigations and observations made during field survey, as well as the landscape and archaeological context of the area.

The additional proposal area is assessed as having low representative and rarity values for Aboriginal archaeological material and / or sites. Aboriginal objects may be present in areas of low archaeological significance, but are likely to be in disturbed contexts and / or associated with transient Aboriginal occupation and identified as low density background scatters. The proposal area is assessed as having low levels of both scientific and research potential and demonstrating overall low archaeological significance.

Impact assessment

The proposal area investigated in the current assessment is related to impacts associated with the construction of a heavy pavement roadway. Design of this roadway is not yet final and this report assumes that bulk excavation of soils may take place at any location in the proposal area.

Additional work would impact upon the ground surface, including excavation to varying levels. These sub-surface impacts would be associated with vegetation clearance, stockpiling material and levelling the ground surface.

The proposed additional work would not impact upon any recorded Aboriginal objects. The proposed work would not impact upon any areas of moderate or high archaeological potential.
There would be no known additional impacts to Aboriginal heritage resulting from the proposal. Impacts are in line with those assessed under the Stage 2 PACHCI (Artefact 2017).

Management and mitigation measures

Guiding Principles

The overall guiding principle for cultural heritage management is that wherever possible Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate against impact to Aboriginal sites.

The nature of the mitigation measures recommended is based on the assessed significance of the site or sites. The recommendations are also informed by cultural significance. The TLALC will be sent a draft version of this report for review and comment, which will address cultural significance.

Mitigation Measures

The current assessment has established the proposal area demonstrates low archaeological potential and low archaeological significance. The assessment confirmed no previously recorded Aboriginal sites and/or places and no areas of archaeological potential are located within the proposal area.

No further Aboriginal archaeological investigation is required for the study area.

If unforeseen Aboriginal objects or suspected human remains are uncovered once work commences, work in the vicinity of the find must cease until further advice/approvals have been obtained. For any unexpected finds during project implementation, please refer to the Roads and Maritime Standard Management Procedure for Unexpected Heritage Items (2015).

The conclusions and recommendations below address the additional impact areas which form the focus of this addendum PACHCI Stage 2 report. The recommendations do not address the road alignment and main work associated with the wider Newell Highway project between Boggabilla and Mungla Back Creek. For a full assessment and recommendations for the wider project, please refer to the Stage 2 PACHI (Artefact 2017).

The following recommendations were based on consideration of:

- Statutory requirements under the National Parks and Wildlife Act 1974
- The results of the site survey and assessment
- The interests of Aboriginal stakeholder groups
- The likely impact of the proposed development.

It was found:

- No Aboriginal sites and/or places were located within the proposal areas
- The proposal area was assessed as demonstrating low archaeological potential
- There would be no additional impacts to Aboriginal heritage as a result of the proposal. Impacts are in line with those assessed under the concept design in the Stage 2 PACHI (Artefact 2017).

It is therefore recommended:
• The proposed works are able to proceed without the need for further archaeological and/or Aboriginal heritage assessment
• The assessment of Aboriginal heritage impacts and recommendations provided in the Stage 2 PACHI (Artefact 2017) remain valid.
• If the project design should change or if areas not surveyed are added to the scope of proposed work, further archaeological assessment would be required
• If unforeseen Aboriginal objects or suspected human remains are uncovered once work commences, work in the vicinity of the find must cease until further advice/approvals have been obtained. For any unexpected finds during project implementation, please refer to the Roads and Maritime Standard Management Procedure for Unexpected Heritage Items (2015).
6.0 ATTEMPT TO RELOCATE ISOLATED ARTEFACTS IDENTIFIED DURING THE PACHCI STAGE 2

Methodology & Results

The three isolated artefacts located during previous survey (MBC Artefact 1, MBC Artefact 2, MBC Artefact 3) were small pebble-sized items located in roadside gravel comprised of similar sized gravels. The relocation of these items was therefore likely to be difficult.

The coordinates for each of the three isolated artefacts (MBC Artefact 1, MBC Artefact 2, MBC Artefact 3) were loaded into a handheld GPS unit. In addition, KMZ files of their location were loaded into Google MyMaps and were viewed on Artefact staff smart phones. The approximate location of artefacts was established in the field from print maps, and their precise mapped location was established through walking along the Newell Highway while crosschecking their displayed location on GPS and smart phones. These locations were further crosschecked against photographs of the artefact locations that were taken during the previous stage of survey. Once in the recorded location, artefacts were first checked for by participants walking up and down the road shoulder at close spacing. Where these methods did not locate artefacts within 20 to 30 minutes, a senior consultant further surveyed the location on hands and knees. An average of about 40 minutes with six staff was spent at the location of each artefact. This method resulted in the relocation of one out of three of the artefacts.

RMS has advised that they will produce appropriate mitigation and protection measures for the located artefact, and for the recorded locations of the two artefacts that were not relocated.

Artefact 1

This artefact could not be relocated. This artefact had been identified in road gravel on an area of slightly widened shoulder on the inside of a slight curve, on the eastern side of the Newell Highway. It was considered likely that the artefact had been impacted by vehicular traffic, possibly travelling into the wider shoulder while negotiating the local curve. The artefact may have been dislodged into the dense roadside vegetation.

Artefact 2

This artefact could not be relocated. This artefact had been identified in road gravel in a widened shoulder approaching an informal stop area on the eastern side of the Newell Highway. It was considered likely that the artefact had been impacted by vehicular traffic, possibly while pulling over to access the stop area. The artefact may have been dislodged into the dense roadside vegetation.

Artefact 3

This artefact was relocated. This artefact had been identified in a gravelled, grassy and narrow road shoulder located about 370m north of Maynes Lagoon, and 160m north of a culvert over a drainage line crossing, on the western side of the Newell Highway. It is likely that the narrow nature of the road shoulder, and its proximity to a culvert has acted to discourage traffic from pulling over in this location. The artefact was marked with a hi-visibility flag attached to a steel peg, and the nearest roadside post was marked by RMS staff (Figure 12).
Figure 12: Location of MBC Artefact 3 indicated by small orange flag visible in right foreground
7.0 REVISIT OF THE ANCILLARY SITE AT BOGGABILLA TO CONFIRM SUITABILITY OF NEW DESIGN.

The new proposed location of a pumping station, sealed roadway, turnaround area and area for an intake pipe from the McIntyre River was inspected. This area is located at the boat ramp near South Street Boggabilla and had been inspected during previous survey. The purpose of this second inspection was to confirm that the new proposed works were contained in areas previously surveyed and determined to be of low archaeological potential. This was confirmed. The new proposal area is contained within twenty meters either side of the existing roadway in land that had been previously surveyed and assessed as a localised swale / floodplain that was of low archaeological potential. The new proposal area will not impact on MBC PAD01 that had been identified nearby. The intake pipe for the pumping station has been described as a rubberised or otherwise non-rigid pipe that will be placed without disturbance to underlying soils and which will not cause harm to potential undetected archaeological remains. No further archaeological assessment, survey or excavation is required for the current proposal at this ancillary site.
8.0 REFERENCES


Gomeroi People NC2011/006 . (2012, 1 20). *Native Title Tribunal*. Retrieved from Register of Native Title Claims:
APPENDIX F: PACHCI STAGE 3 ATER (IF REQUIRED)