Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Ref: EPBC 2012/6388

Mr Clay Preshaw
Acting Team Leader
Mining Projects
Department of Planning & Infrastructure
23-33 Bridge Street SYDNEY 2000

Dear Mr ~~Preshaw~~ Clay

**Wallarah 2 Coal Project, NSW**

Thank you for your invitation to comment on the Environmental Impact Statement (EIS) for the Wallarah 2 Coal Project. I apologise for our delay in responding. I note that the department has also had discussions with the Wyong Areas Coal Joint Venture (WACJV: the proponent) regarding advice received from the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development, and met with the proponent and their consultants to discuss water related issues on 25 July 2013.

Please find below the department's comments in relation to the draft EIS. This advice is provided on a without prejudice basis to assist the proponent in meeting the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The department is generally satisfied with the information provided in the EIS, and subsequent water-related information and clarification provided to the department in response to the IESC's advice.

The department raised concerns with the proponent's consultants, Hansen Bailey, regarding the statement made in the EIS that "the proposed offsets are considered sufficient to meet federal offset requirements". In response, the proponent undertook further assessment of the proposed offset package against the department's *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012)* and the *Offsets Assessment Guide*. This assessment is provided in the report, *Wallarah 2 Coal Project EPBC 2012/6388: Assessment of Biodiversity offset Package against the EPBC Offsets Assessment Guide, June 2013* (Attachment A). According to the report the proposed offsets meet the minimum requirements for all the EPBC listed threatened species that will be significantly impacted by the proposal, with the exception for the Giant Barred Frog (*Mixophyes iteratus*). The proposed offset package meets only 91.4% of the minimum offset requirements for this species. The proponent has been advised that the reminder of offset can be met through either further direct or indirect offset. The department generally requires offset packages to be finalised and agreed prior to approval of the action.

In April 2013 the department requested the IESC consider the draft Wallarah 2 Coal Project Environmental Impact Statement (February 2013). On 24 May 2013 the Committee provided their advice (Attachment B). I understand that during this period the Environmental Impact Statement was revised, and placed on public exhibition. WACJV provided a detailed response to the IESC's concerns (Attachment C), and advised that most of the issues raised in the IESC's advice were addressed by information contained in the revised Environmental Impact Statement (April 2013). WACJV met with the department on 25 July 2013 to discuss the water-related impacts of the proposal, and present further information addressing these matters on 31 July

2013 (Attachment D). The department is satisfied that the information presented addresses the IESC's concerns regarding the lack of sufficient modelling, monitoring and mitigation information.

On 31 July 2013 the department also wrote to the proponent indicating that the Wallarah 2 Coal Project has been assessed as being likely to have a significant impact on a water resource as per the provision of sections 24D and 24E of the EPBC Act, and inviting their comments. The department will notify you once a final decision on whether or not the water trigger applies to this project has been made.

If you have any questions on the above advice, please contact Mark Jenkins on (02) 6274 1558 or email mark.jenkins@environment.gov.au.

Yours sincerely

Mahani Taylor
Director
NSW Section
South-Eastern Australia Environment Assessments
22 August 2013

17 June 2013

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**WALLARAH 2 COAL PROJECT EPBC REF. 2012/6388. ASSESSMENT OF BIODIVERSITY OFFSET PACKAGE AGAINST THE EPBC OFFSETS ASSESSMENT GUIDE**

Dear Dianne,

The Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC), during their review of the draft Environmental Impact Statement (EIS) for the Wallarah 2 Coal Project (the Project) were concerned that the quantification of protected matters potentially occurring on site and impacted by the proposal, the nature and scale of these impacts as well the proposed mitigation measures and offsets to minimise and compenste for these impacts appeared to be inadequate.

SEWPaC determined that the level of detail for the proposed avoidance, mitigation measures and offset package was inadequate and needed to be further addressed to provide certainty that impacts on Matters of National Environmental Significance (MNES) were adequately compensated. Specifically, SEWPaC required revisions to the EIS to demonstrate how the proposed offset was consistent with the new Commonwealth Offsets policy (the Policy).

The Policy is accompanied by an Excel calculator tool that is referred to in the new EPBC Act Offsets Policy as the *Offsets Assessment Guide*. The *Offsets Assessment Guide* is used to assess the adequacy of biodiversity offsetting measures in addressing development impacts on MNES. The *Offsets Assessment Guide* was released in late 2012 and was unavailable when the proposed Biodiversity Offset Package (BOP) for the Wallarah 2 Coal Project was being developed.

Cumberland Ecology has now conducted an assessment for the Project using current data to enter information into the *Offsets Assessment Guide*. The purpose of this letter is to present the key findings of the EPBC Offset Assessment and to discuss the implications for the Project. The scores, rationales and assumptions

used in the *Offsets Assessment Guide* have been explained in detail and are appended to this letter.

# 1. Background

## 1.1 The Offset Assessment Guide

The *Offsets Assessment Guide* (SEWPaC 2012) was designed for SEWPaC's use to assist in the assessment of the suitability of direct offsets proposed for development projects. It provides a prescriptive method for measuring the loss of biodiversity values at a development site and the gain in biodiversity values at an offset site. The offset assessment guide expresses the value of a proposed direct offsetting measure as a percentage of the development's offsetting requirement.

The biodiversity impacts of a development are considered to be adequately compensated for by SEWPaC if the direct biodiversity offsets meet at least 90% of the offsetting requirement. Under the new EPBC Act Offsets Policy, the remaining 10% of a development's offsetting requirement can comprise indirect offsets, such as a financial contribution to research or education programs.

## 1.2 Predicted Impacts to Matters of National Environmental Significance

The Wallarah 2 Coal Project involves the development of an underground mine and associated surface infrastructure. As part of the development and operation of the mine, it was recognised that the Project will require the direct removal of habitat for a number of MNES. Other predicted indirect impacts from the development and operation of the mine include potential subsidence during the mining process.

Direct impacts on MNES from the removal of native vegetation and habitat have been assessed in accordance with the *Offsets Assessment Guide*. The *Offsets Assessment Guide* currently does not include assessments of indirect impacts from subsidence.

The Ecological Impact Assessment determined several MNES that occur or have potential to occur within the Project Boundary. The current assessments against the *Offsets Assessment Guide* have largely been limited to the MNES listed as controlled action species during the determination of the Project as a controlled action. These include:

- *Angophora inopina* (Charmhaven Apple);
- *Tetratheca juncea* (Black-eyed Susan);
- Giant Barred Frog (*Mixophyes iteratus*); and
- Spotted-tailed Quoll (*Dasyurus maculatus*).

In addition to the listed control action species, assessments have also been conducted for two further species. These are:

- *Acacia bynoeana* (Bynoe's Wattle); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

*Acacia bynoeana* has been assessed as one known individual is likely to be cleared from the impact areas. Although the Grey-headed Flying-fox was not recorded within the impact areas, the species is highly mobile and has been recorded within other parts of the Project Boundary.

### 1.3 Biodiversity Offset Package

To address these ecological impacts, a substantial BOP with a "maintain or improve" approach was developed. The BOP incorporates retention, improvement and management of areas of moderate to good quality vegetation and revegetation of degraded grassland areas to woodland habitat. All proposed offset areas are to be conserved in perpetuity. Using the Offsets Assessment Guide.

## 2. Impact Assessment

Each MNES identified above was assessed within the *Offsets Assessment Guide* to determine the total quantum of impact in hectares based on area of impact and quality of the habitat impacted. The completed assessment spreadsheets are provided in **Appendix A**. **Table 1** below summarises the assessed impact to each MNES.

**Table 1 Total Quantum of Impacts for each MNES**

| MNES | EPBC listing | Area Impacted (ha) | Quality | Total Quantum of Impact (adjusted ha) |
|---|---|---|---|---|
| *Angophora inopina* (Charmhaven Apple) | Vulnerable | 47.7 | 7/10 | 33.39 |
| *Tetratheca juncea* (Black-eyed Susan) | Vulnerable | 50.5 | 6/10 | 30.30 |
| *Acacia bynoeana* (Bynoe's Wattle) | Vulnerable | 42.9 | 4/10 | 17.16 |
| Giant Barred Frog (*Mixophyes iteratus*) | Endangered | 10.4 | 4/10 | 4.16 |
| Spotted-tailed Quoll (*Dasyurus maculatus*) | Endangered | 48.4 | 4/10 | 19.36 |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | Vulnerable | 48.4 | 4/10 | 19.36 |

## 2.1 Offset Assessment

The offsets for each MNES comprise several components, which are assessed separately within the *Offsets Assessment Guide* (**Appendix A**). The assessments were conducted using the area of habitat present in the impact and offset areas of the Project for each of the six MNES.

Additional offset assessments included assessment of the proposed revegetation of exotic grasslands to moderate quality woodland. The proposed revegetation offset was assessed only for *Angophora inopina* and *Tetratheca juncea* as the revegetation is aimed specifically at these two species

**Table 2** below lists the offset components for each MNES. Each component is assessed based on a number of variables including current and future quality, risks and confidence in achieving the desired outcome. Summary tables providing justification of values entered into the *Offsets Assessment Guide* are provided in **Appendix B**.

### Table 2 Offset Components for each MNES

| MNES | Offset Components |
|---|---|
| *Angophora inopina* (Charmhaven Apple) | Part 1 - Protection and management of 135.4 ha of moderate to good quality habitat for *Angophora inopina* |
| | Part 2 - Revegetation of 31.41 ha of degraded grassland to moderate to good quality woodland habitat for *Angophora inopina* |
| *Tetratheca juncea* (Black-eyed Susan) | Part 1 - Protection and mangement of 192.8 ha of moderate to good quality habitat for *Tetratheca juncea*. |
| | Part 2 - Revegetation of 31.41 ha of degraded grassland to moderate to good quality woodland habitat for *Tetratheca juncea*. |
| *Acacia bynoeana* (Bynoe's Wattle) | Protection and management of 169.4 ha of moderate to good quality habitat for *Acacia bynoeana* |
| Giant Barred Frog (*Mixophyes iteratus*) | Protection and management of 27.3 ha of moderate to good quality habitat for the Giant Barred Frog |
| Spotted-tailed Quoll (*Dasyurus maculatus*) | Protection and management of 118.8 ha of moderate to good quality habitat for the Spotted-tailed Quoll |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | Protection and management of 118.8 ha of moderate to good quality habitat for the Grey-headed Flying Fox |

# 3. Results

**Table 3** summarises the results of each MNES and offset component. For each MNES assessed, the current BOP is estimated to provide greater than the minimum 90% direct offset required by SEWPaC. This indicates that no further direct offsets are required for the Project for predicted impacts to MNES.

**Table 3 Summary of Results for each MNES**

| MNES | Total Quantum of impact (adjusted ha) | Offset areas | | Total |
|---|---|---|---|---|
| | | *Retained* | *Revegetated* | |
| *Angophora inopina* (Charmhaven Apple) | 33.39 | 135.4 ha (137.03%) | 31.41 ha (16.54%) | 166.8 ha (153.57%) |
| *Tetratheca juncea* (Black-eyed Susan) | 30.30 | 192.8 ha (202.82%) | 31.41 ha (18.23%) | 224.2 ha (221.05%) |
| *Acacia bynoeana* (Bynoe's Wattle) | 17.16 | 169.4 ha (247.98%) | | 169.4 ha (247.98%) |
| Giant Barred Frog (*Mixophyes iteratus*) | 4.16 | 27.3 ha (91.47%) | | 27.3 ha (91.47%) |
| Spotted-tailed Quoll (*Dasyurus maculatus*) | 19.36 | 118.8 ha (101.60%) | | 118.8 ha (101.60%) |
| Grey-headed Flying-fox (*Pteropus poliocephalus*) | 19.36 | 118.8 ha (168.15%) | | 118.8 ha (168.15%) |

We would be happy to discuss any aspect of this assessment in further detail. Please do not hesitate to contact either myself, or Gitanjali Katrak, on (02) 9868 1933

Yours sincerely

Dr David Robertson
Director
David.Robertson@cumberlandecology.com.au

# 4. References

Cumberland Ecololgy (2013). *Wallarah 2 Coal Project Ecological Impact Assessment – Final Report*. Carlingford Court, NSW.

SEWPaC (2012). *Environment Protection and Biodiversity Conservation Act 1999 Envionmental Offsets Policy October 2012*. Department of Sustainability, Environment, Water, Populations and Communities, Canberra.

*Appendix A*

# Offset Assessment Guide Spreadsheets

## A.1 Contents

This appendix contains the following offsets assessment guide spreadsheets

1. *Angophora inopina* – Part 1 (Retained Habitat);
2. *Angophora inopina* – Part 2 (Revegetation);
3. *Tetratheca juncea* – Part 1 (Retained Habitat);
4. *Tetratheca juncea* – Part 2 (Revegetation);
5. *Acacia bynoeana;*
6. Giant Barred Frog;
7. Spotted-tailed Quoll; and
8. Grey-headed Flying Fox.

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Angophora inopina |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 47.7 ha of moderate to good quality habitat for Angophora inopina | **Area** | 47.7 | Hectares | |
| | | | **Quality** | **7** | Scale 0-10 | |
| | | | **Total quantum of impact** | 33.39 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 33.39 | Adjusted hectares | Part 1 - Protection and management of 135.4 ha of moderate to good quality habitat for Angophora inopina | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 135.4 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 5% | 47.39 | 95% | 45.02 | 43.26 | 45.75 | 137.03% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 81.2 | **Future area with offset (adjusted hectares)** | 128.6 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | **7** | **Future quality without offset (scale of 0-10)** | **6** | **Future quality with offset (scale of 0-10)** | **8** | 2.00 | 70% | 1.40 | 1.37 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 33.39 | 45.75 | 137.03% | **Yes** | $0.00 | N/A | $0.00 |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **$0.00** | **$0.00** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Angophora inopina |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
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| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 47.7 ha of moderate to good quality habitat for Angophora inopina | **Area** | 47.7 | Hectares | |
| | | | **Quality** | **7** | Scale 0-10 | |
| | | | **Total quantum of impact** | 33.39 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 33.39 | Adjusted hectares | Part 2 - Revegetation of 31.41 ha of degraded grassland to moderate to good quality woodland habitat for Angophora inopina | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 31.41 | **Risk of loss (%) without offset** | 0% | **Risk of loss (%) with offset** | 10% | -3.14 | 95% | -2.98 | -2.87 | 5.52 | 16.54% | No | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 31.4 | **Future area with offset (adjusted hectares)** | 28.3 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 20 | **Start quality (scale of 0-10)** | **0** | **Future quality without offset (scale of 0-10)** | **0** | **Future quality with offset (scale of 0-10)** | **6** | 6.00 | 40% | 2.40 | 2.31 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 33.39 | 5.52 | 16.54% | **No** | $0.00 | #DIV/0! | #DIV/0! |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **#DIV/0!** | **#DIV/0!** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Tetratheca juncea |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 50.5 ha of moderate to good quality habitat for Tetratheca juncea | **Area** | 50.5 | Hectares | |
| | | | **Quality** | **6** | Scale 0-10 | |
| | | | **Total quantum of impact** | 30.30 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 30.30 | Adjusted hectares | Part 1 - Protection and mangement of 192.8 ha of moderate to good quality habitat for Tetratheca juncea | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 192.8 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 3% | 71.34 | 95% | 67.77 | 65.11 | 61.46 | 202.82% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 115.7 | **Future area with offset (adjusted hectares)** | 187.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | **6** | **Future quality without offset (scale of 0-10)** | **5** | **Future quality with offset (scale of 0-10)** | **7** | 2.00 | 70% | 1.40 | 1.37 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 30.3 | 61.46 | 202.82% | **Yes** | $0.00 | N/A | $0.00 |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **$0.00** | **$0.00** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Tetratheca juncea |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 50.5 ha of moderate to good quality habitat for Tetratheca juncea | **Area** | 50.5 | Hectares | |
| | | | **Quality** | **6** | Scale 0-10 | |
| | | | **Total quantum of impact** | 30.30 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 30.30 | Adjusted hectares | Part 2 - Revegetation of 31.41 ha of degraded grassland to moderate to good quality woodland habitat for Tetratheca juncea | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 31.41 | **Risk of loss (%) without offset** | 0% | **Risk of loss (%) with offset** | 10% | -3.14 | 95% | -2.98 | -2.87 | 5.52 | 18.23% | No | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 31.4 | **Future area with offset (adjusted hectares)** | 28.3 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 20 | **Start quality (scale of 0-10)** | **0** | **Future quality without offset (scale of 0-10)** | **0** | **Future quality with offset (scale of 0-10)** | **6** | 6.00 | 40% | 2.40 | 2.31 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 30.3 | 5.52 | 18.23% | **No** | $0.00 | #DIV/0! | #DIV/0! |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **#DIV/0!** | **#DIV/0!** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Acacia bynoeana |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 42.9 ha of moderate to good quality habitat for Angophora inopina | **Area** | 42.9 | Hectares | |
| | | | **Quality** | **4** | Scale 0-10 | |
| | | | **Total quantum of impact** | 17.16 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 17.16 | Adjusted hectares | Protection and management of 169.4 ha of moderate to good quality habitat for Acacia bynoeana | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 169.4 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 3% | 62.68 | 95% | 59.54 | 57.21 | 42.55 | 247.98% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 101.6 | **Future area with offset (adjusted hectares)** | 164.3 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | 4 | **Future quality without offset (scale of 0-10)** | 3 | **Future quality with offset (scale of 0-10)** | 5 | 2.00 | 70% | 1.40 | 1.37 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 17.16 | 42.55 | 247.98% | **Yes** | $0.00 | N/A | $0.00 |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **$0.00** | **$0.00** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Mixophyes iteratus |
| **EPBC Act status** | Endangered |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **1.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 10.4 ha of moderate to good quality habitat for the Giant Barred Frog | **Area** | 10.4 | Hectares | |
| | | | **Quality** | **4** | Scale 0-10 | |
| | | | **Total quantum of impact** | 4.16 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 4.16 | Adjusted hectares | Protection and management of 27.3 ha of moderate to good quality habitat for the Giant Barred Frog | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 27.3 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 5% | 9.56 | 95% | 9.08 | 7.15 | 3.81 | 91.47% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 16.4 | **Future area with offset (adjusted hectares)** | 25.9 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | **4** | **Future quality without offset (scale of 0-10)** | **3** | **Future quality with offset (scale of 0-10)** | **4** | 1.00 | 65% | 0.65 | 0.58 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 4.16 | 3.81 | 91.47% | **Yes** | $0.00 | #DIV/0! | #DIV/0! |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **#DIV/0!** | **#DIV/0!** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Spotted-tailed Quoll |
| **EPBC Act status** | Endangered |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **1.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 48.4 ha of moderate to good quality habitat for the Spotted-tailed Quoll | **Area** | 48.4 | Hectares | |
| | | | **Quality** | **4** | Scale 0-10 | |
| | | | **Total quantum of impact** | 19.36 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 19.36 | Adjusted hectares | Protection and management of 118.8 ha of moderate to good quality habitat for the Spotted-tailed Quoll | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 118.8 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 5% | 41.58 | 95% | 39.50 | 31.12 | 19.67 | 101.60% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 71.3 | **Future area with offset (adjusted hectares)** | 112.9 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | **4** | **Future quality without offset (scale of 0-10)** | **4** | **Future quality with offset (scale of 0-10)** | **5** | 1.00 | 65% | 0.65 | 0.58 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 19.36 | 19.67 | 101.60% | **Yes** | $0.00 | N/A | $0.00 |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **$0.00** | **$0.00** |

# Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

| Matter of National Environmental Significance | |
|---|---|
| **Name** | Grey-headed Flying fox |
| **EPBC Act status** | Vulnerable |
| **Annual probability of extinction**<br>Based on IUCN category definitions | **0.2%** |

| Key to Cell Colours |
|---|
| User input required |
| Drop-down list |
| Calculated output |
| Not applicable to attribute |

## Impact calculator

| Protected matter attributes | Attribute relevant to case? | Description | Quantum of impact | | Units | Information source |
|---|---|---|---|---|---|---|
| ***Ecological communities*** | | | | | | |
| **Area of community** | No | | **Area** | | | |
| | | | **Quality** | | | |
| | | | **Total quantum of impact** | 0.00 | | |
| ***Threatened species habitat*** | | | | | | |
| **Area of habitat** | Yes | Clearing of 48.4 ha of moderate to good quality habitat for the Grey-headed Flying Fox | **Area** | 48.4 | Hectares | |
| | | | **Quality** | **4** | Scale 0-10 | |
| | | | **Total quantum of impact** | 19.36 | Adjusted hectares | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Description** | **Quantum of impact** | | **Units** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | |
| ***Threatened species*** | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | |

## Offset calculator

| Protected matter attributes | Attribute relevant to case? | Total quantum of impact | Units | Proposed offset | Time horizon (years) | | Start area and quality | | Future area and quality without offset | | Future area and quality with offset | | Raw gain | Confidence in result (%) | Adjusted gain | Net present value (adjusted hectares) | % of impact offset | Minimum (90%) direct offset requirement met? | Cost ($ total) | Information source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Ecological Communities*** | | | | | | | | | | | | | | | | | | | | |
| **Area of community** | No | | | | **Risk-related time horizon (max. 20 years)** | | **Start area (hectares)** | | **Risk of loss (%) without offset** | | **Risk of loss (%) with offset** | | | | | | | | | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 0.0 | **Future area with offset (adjusted hectares)** | 0.0 | | | | | | | | |
| | | | | | **Time until ecological benefit** | | **Start quality (scale of 0-10)** | | **Future quality without offset (scale of 0-10)** | | **Future quality with offset (scale of 0-10)** | | | | | | | | | |
| ***Threatened species habitat*** | | | | | | | | | | | | | | | | | | | | |
| **Area of habitat** | Yes | 19.36 | Adjusted hectares | Protection and management of 118.8 ha of moderate to good quality habitat for the Grey-headed Flying Fox | **Time over which loss is averted (max. 20 years)** | 20 | **Start area (hectares)** | 118.8 | **Risk of loss (%) without offset** | 40% | **Risk of loss (%) with offset** | 5% | 41.58 | 95% | 39.50 | 37.95 | 32.55 | 168.15% | Yes | |
| | | | | | | | | | **Future area without offset (adjusted hectares)** | 71.3 | **Future area with offset (adjusted hectares)** | 112.9 | | | | | | | | |
| | | | | | **Time until ecological benefit** | 10 | **Start quality (scale of 0-10)** | **4** | **Future quality without offset (scale of 0-10)** | **4** | **Future quality with offset (scale of 0-10)** | **6** | 2.00 | 70% | 1.40 | 1.37 | | | | |
| **Protected matter attributes** | **Attribute relevant to case?** | **Total quantum of impact** | **Units** | **Proposed offset** | **Time horizon (years)** | | **Start value** | | **Future value without offset** | | **Future value with offset** | | **Raw gain** | **Confidence in result (%)** | **Adjusted gain** | **Net present value** | **% of impact offset** | **Minimum (90%) direct offset requirement met?** | **Cost ($ total)** | **Information source** |
| **Number of features**<br>e.g. Nest hollows, habitat trees | No | | | | | | | | | | | | | | | | | | | |
| **Condition of habitat**<br>Change in habitat condition, but no change in extent | No | | | | | | | | | | | | | | | | | | | |
| ***Threatened species*** | | | | | | | | | | | | | | | | | | | | |
| **Birth rate**<br>e.g. Change in nest success | No | | | | | | | | | | | | | | | | | | | |
| **Mortality rate**<br>e.g Change in number of road kills per year | No | | | | | | | | | | | | | | | | | | | |
| **Number of individuals**<br>e.g. Individual plants/animals | No | | | | | | | | | | | | | | | | | | | |

## Summary

| Protected matter attributes | Quantum of impact | Net present value of offset | % of impact offset | Direct offset adequate? | Cost ($) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Direct offset ($) | Other compensatory measures ($) | Total ($) |
| **Birth rate** | 0 | | | | $0.00 | | $0.00 |
| **Mortality rate** | 0 | | | | $0.00 | | $0.00 |
| **Number of individuals** | 0 | | | | $0.00 | | $0.00 |
| **Number of features** | 0 | | | | $0.00 | | $0.00 |
| **Condition of habitat** | 0 | | | | $0.00 | | $0.00 |
| **Area of habitat** | 19.36 | 32.55 | 168.15% | **Yes** | $0.00 | N/A | $0.00 |
| **Area of community** | 0 | | | | $0.00 | | $0.00 |
| | | | | | **$0.00** | **$0.00** | **$0.00** |

*Appendix B*

# Offset Assessment Guide - Data values and Rationale

## B.1 Contents

This appendix contains the following forms providing assumptions and rationales used for the assessment of the following MNES:

1. *Angophora inopina* – Part 1: Retained Habitat (Table 4);
2. *Angophora inopina* – Part 2: Revegetation (Table 4);
3. *Tetratheca juncea* – Part 1: Retained Habitat (Table 5);
4. *Tetratheca juncea* – Part 2: Revegetation (Table 5);
5. *Acacia bynoeana* (Table 6);
6. Giant Barred Frog (Table 7);
7. Spotted-tailed Quoll (Table 8); and
8. Grey-headed Flying Fox (Table 9).

The references and information sources utilised to conduct these assessments include


- Cumberland Ecology (2013). *Wallarah 2 Coal Project Ecological Impact Assessment – Final Report*.
- Dorrough, J., J. Stol, and S. McIntyre. (2008). *Biodiversity in the Paddock: a Land Managers Guide*. Future Farm Industries CRC.
- Gillespie, M. J., K. S. Baker, and D. R. Mulligan. (2001). Native Understorey Species Regeneration at NSW Coal Mines. Final Report. Australian Coal Association Research Program, Brisbane, QLD.
- McIntyre, S., J. G. McIvor, and K. M. Heard. (2002). *Managing and Conserving Grassy Woodlands*. CSIRO Publishing, Collingwood.
- OEH (2013a). Charmhaven Apple – profile. Office of Environment and Heritage, Hurstville.
- OEH (2013b). Black-eyed Susan – profile. Office of Environment and Heritage, Hurstville.
- OEH (2013c). Bynoes Wattle – profile. Office of Environment and Heritage, Hurstville.
- OEH (2013d). Giant Barred Frog – profile. Office of Environment and Heritage, Hurstville.

- OEH (2013e). Spotted-tailed Quoll – profile. Office of Environment and Heritage, Hurstville.
- OEH (2013f). Grey-headed Flying Fox – profile. Office of Environment and Heritage, Hurstville.
- Rawlings, K., D. Freudenberger, and D. Carr. (2010). *A Guide to Managing Box Gum Grassy Woodlands*. Caring for our Country Environmental Stewardship, Canberra.
- SEWPaC (2008a). *Approved Conservation Advice for Angophora inopina*. Department of Sustainability, Environment, Water, Populations and Communities, Canberra.
- SEWPaC (2008b). *Approved Conservation Advice for Tetratheca juncea*. Department of Sustainability, Environment, Water, Populations and Communities, Canberra.
- SEWPaC (2013a). *Angophora inopina* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT
- SEWPaC (2013b). *Tetratheca juncea* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT
- SEWPaC (2013c). *Acacia bynoeana* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT
- SEWPaC (2013d). *Mixophyes iteratus* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.
- SEWPaC (2013e). *Dasyurus maculatus maculatus (SE mainland population)* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.
- SEWPaC (2013f). *Pteropus poliocephalus* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.
- Wyong Shire Council (2013). *Regional Airport concept moves step closer: Media release*.

  http://www.wyong.nsw.gov.au/about-council/videos/media-release-2013/regionalairportendorsed/

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 47.7 ha | Total area of potential *A. inopina* habitat to be cleared. | Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES |
| | Quality of Impact Area | 7/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>*Site Condition Score*<br>Site condition score = 6/10. Habitat within the Impact Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br><br>*Site Context Score*<br>Site Context = 8/10. Connectivity with the wider locality is variable across the Impact Area. The Impact Area is present within a stronghold area for this species. | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013a<br>SEWPaC 2013a |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | *Stocking Rate Score*<br>Stocking Rate Score = 7/10. Several individuals recorded within the Impact Area. However many appear to be in poor condition. Likely to form part of a large population within the locality and wider region. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 135.4 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 7/10<br><br>Future (no offset) = 6/10<br><br>Future (with offset) = 8/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>The offset properties are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 6/10. Habitat within the proposed Offset Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br>Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. The Proposed Offset Area is not subject to any protection/conservation scheme and impacts from surrounding land uses have the potential to increase | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013a<br>Rawlings et al., 2010<br>SEWPaC 2013a |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | further than current conditions.<br>Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation. The presence of young regrowth indicates capability for assisted regeneration. Native grassland areas already show indications of natural regeneration to woodland following cessation of slashing activity. Revegetation work within these and adjacent areas will also assist in the natural regeneration within these patches.<br><br>*Site Context*<br>Current = 8/10. Connectivity with the wider locality is variable across the proposed Offset Area. All Offset Areas are present within a stronghold area for this species.<br>Future (no offset) = 7/10. Currently surrounded by agricultural land uses and semi-rural development. Potential for decreased connectivity with other remnants in the wider locality.<br>Future (with offset) = 9/10. Potential for increased connectivity in conjunction with revegetation works.<br><br>*Stocking Rate Score*<br>Current = 7/10. Recorded within Tooheys Road North and Tooheys Road South offsets. Likely to form part of a larger population within the locality and wider region.<br>Future (no offset) = 6/10. Currently surrounded by agricultural land uses and semi-rural development. Potential for reduction in population due to increasing impacts from surrounding land uses. | |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | Future (with offset) = 8/10. Potential to increase abundance of species. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag following planting. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | SEWPaC 2008a<br>Wyong Shire Council 2013 |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection mechanism is unlikely to completely remove risks due to residual factors such as illegal clearing and natural disasters such as fires and drought. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 70% | Confidence in quality is 70% as ongoing and adaptive management under the BMP will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve | This is based upon observations by Cumberland Ecology that woodland |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | through assisted natural regeneration. Management measures, such as exclusion fencing and buffer planting are likely to protect the vegetation from ongoing edge impacts and allow it to establish. | regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |
| OFFSET AREAS - REVEGETATED | Area of habitat in Offset Area (ha) | 31.41 ha | Located in Tooheys Road South and Hue Hue Road offsets | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 0/10<br><br>Future (no offset) = 0/10<br><br>Future (with offset) = 6/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>The offset properties are located adjacent to impact areas<br><br>*Site condition score* | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008. |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | Current = 0/10. Habitat for this species does not occur within these areas.<br>Future (no offset) = 0/10. Habitat for this species would not occur within these areas without the offset.<br>Future (with offset) = 5/10. Significant revegetation work is proposed to restore habitat for this species within the offset.<br><br>*Site Context*<br>Current = 1/10. Area present within stronghold region of this species but does not provide connected woodland in its current form.<br>Future (no offset) = 1/10. Currently used for grazing purposes and unlikely to provide connected woodland in the future.<br>Future (with offset) = 7/10. Potential to become connected with other remnants in the locality.<br><br>*Stocking Rate Score*<br>Current = 0/10. Not recorded within this component of the offset and no habitat currently available.<br>Future (no offset) = 0/10. Currently surrounded by agricultural land uses and unlikely to decrease further than current conditions.<br>Future (with offset) = 5/10. Potential to support the species. | McIntyre et al., 2002<br>OEH 2013a<br>Rawlings et al., 2010<br>SEWPaC 2013a |
| | Time horizon | 20 years | The life of the mine greater than 20 years – a large proportion of revegetation will be well advanced after this time. | Cumberland Ecology 2013 |
| | Time until | 20 years | Time to ecological benefit can potentially up to 20 years before the trees and shrubs | Durrogh et al., 2008. |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | ecological benefit | | mature and the understorey approaches the anticipated future quality. | McIntyre et al., 2002 |
| | Risk of loss without offset | 0% | Risk of loss without offset is estimated to be 0% as this habitat is absent from this component of the Offset Areas. | |
| | Risk of loss with offset | 10% | Risk of loss with offset estimated to be 10% because although a protection mechanism is likely to extinguish risk of future development, it is unlikely to completely remove risks associated with due to residual factors such as illegal clearing and natural disasters such as fires and drought. Furthermore, revegetation of degraded areas generally has lower success rates than assissted revegetation of naturally regenerating areas. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 40% | Confidence in quality is 40% as significant revegetation work is required to restore the community. Ongoing and adaptive management under the BMP will increase the chances of success. Revegetation work in adjacent areas and management of feral animals is likely to protect the vegetation from ongoing edge impacts and allow it to establish. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will |

## Table 4 Data values and Justification for the Assessment of *Angophora inopina*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | | have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 50.5 ha | Total area of potential *T. juncea* habitat to be cleared. | Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES |
| | Quality of Impact Area | 6/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>*Site Condition Score*<br>Site condition score = 6/10. Habitat within the Impact Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br><br>*Site Context Score*<br>Site Context = 6/10. Connectivity with the wider locality is variable across the Impact Area. The Impact Area is present towards the southern extent of the species distribution. The species is known to occur in conservation reserves in the locality and wider LGA. Population or sub population on the site is likely to be disjunct from other populations/subpopulations in the locality given the predominance of asexual reproduction. | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013b<br>SEWPaC 2013b |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | *Stocking Rate Score*<br>Stocking Rate Score = 5/10. Scattered individuals/clumps recorded within the Impact Area. There is some potential to form part of a larger population within the locality and wider region, despite a predominance of asexual reproduction. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 192.8 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 6/10<br><br>Future (no offset) = 5/10<br><br>Future (with offset) = 7/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 6/10. Habitat within the proposed Offset Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br>Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. Proposed Offset Area is not subject to any protection/conservation scheme and | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013b<br>Rawlings et al., 2010<br>SEWPaC 2008b<br>SEWPaC 2013b |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | impacts from surrounding land uses have the potential to increase further than current conditions.<br>Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation. The presence of young regrowth indicates capability for assisted regeneration. Native grassland areas already show indications of natural regeneration to woodland following cessation of slashing activity. Revegetation work within these and adjacent areas will also assist in the natural regeneration within these patches.<br><br>*Site Context*<br>Current = 6/10. Connectivity with the wider locality is variable across the Offset Area. The proposed offsets are located towards the southern extent of the species distribution. The species is known to occur in conservation reserves in the locality and wider LGA. Population or sub population on the site is likely to be disjunct from other populations/subpopulations in the locality given the predominance of asexual reproduction<br>Future (no offset) = 6/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other remnants in the wider locality but is unlikely to increase significantly over current conditions, given the predominance of asexual reproduction.<br>Future (with offset) = 6/10. Some potential for increased connectivity in conjunction with revegetation works but is likely to be limited due to the predominance of asexual reproduction. | |

## Table 5 Data values and Justification for the Assessment of *Tetratheca juncea*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | *Stocking Rate Score*<br>Current = 6/10. Large numbers of clumps recorded within the Tooheys Road North and Hue Hue Road offsets. Some scattered individuals also present in the Tooheys Road South offsets. Has some potential to form part of a larger population within the locality and wider region, despite a predominance of asexual reproduction.<br>Future (no offset) = 5/10. Currently surrounded by agricultural land uses and semi-rural development. Potential for reduction in population due to increasing impacts from surrounding land uses.<br>Future (with offset) = 7/10. Potential to increase abundance of species. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag following planting. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | Wyong Shire Council 2013 |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection mechanism is unlikely to completely remove risks due to residual factors such as | Cumberland Ecology 2013: Chapter 8 |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | illegal clearing and natural disasters such as fires and drought. | |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 70% | Confidence in quality is 70% as ongoing and adaptive management under the BMP will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve through assisted natural regeneration. Management measures, such as exclusion fencing and buffer planting are likely to protect the vegetation from ongoing edge impacts and allow it to establish. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |
| OFFSET AREAS - REVEGETATED | Area of habitat in Offset Area (ha) | 31.41 ha | Located in Tooheys Road South and Hue Hue Road offsets | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 0/10<br><br>Future (no | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | offset) = 0/10<br><br>Future (with offset) = 6/10 | species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 0/10. Habitat for this species does not occur within these areas.<br>Future (no offset) = 0/10. Habitat for this species would not occur within these areas without the offset.<br>Future (with offset) = 5/10. Significant revegetation work is proposed to restore habitat for this species within the offset.<br><br>*Site Context*<br>Current = 1/10. Area present within stronghold area of this species. Does not provide connected woodland in its current form.<br>Future (no offset) = 1/10. Currently used for grazing purposes and unlikely to provide connected woodland in the future.<br>Future (with offset) = 7/10. Potential to become connected with other remnants in the locality.<br><br>*Stocking Rate Score*<br>Current = 0/10. Not recorded within this component of the offset and no habitat currently available.<br>Future (no offset) = 0/10. Currently surrounded by agricultural land uses and unlikely to decrease further than current conditions.<br>Future (with offset) = 5/10. Potential to support the species. | MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013b<br>Rawlings et al., 2010<br>SEWPaC 2008b<br>SEWPaC 2013b |
| | Time horizon | 20 years | The life of the mine greater than 20 years – a large proportion of revegetation will be | Cumberland Ecology 2013 |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | well advanced after this time. | |
| | Time until ecological benefit | 20 years | Time to ecological benefit can potentially take up to 20 years before the trees and shrubs mature and the understorey approaches the anticipated future quality. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 0% | Risk of loss without offset is estimated to be 0% as this habitat is absent from this component of the Offset Areas. | |
| | Risk of loss with offset | 3% | Risk of loss with offset estimated to be 10% because although a protection mechanism is likely to extinguish risk of future development, it is unlikely to completely remove risks associated with due to residual factors such as illegal clearing and natural disasters such as fires and drought. Furthermore, revegetation of degraded areas generally has lower success rates than assissted revegetation of naturally regenerating areas. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 40% | Confidence in quality is 50% as significant revegetation work is required to restore the community. Ongoing and adaptive managment under the BMP will increase the chances of success. Revegetation work in adjacent areas and management of feral animals is likely to protect the vegetation from ongoing edge impacts and allow it to establish. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will |

**Table 5 Data values and Justification for the Assessment of *Tetratheca juncea***

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | | have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

## Table 6 Data values and Justification for the Assessment of *Acacia bynoeana*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 42.9 ha | Total area of potential *A. bynoeana* habitat to be cleared. | Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES |
| | Quality of Impact Area | 4/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>Site Condition Score<br>Site condition score = 6/10. Habitat within the Impact Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br><br>*Site Context Score*<br>Site Context = 5/10. Connectivity with the wider locality is variable across the Impact Area. The Impact Area is present towards the northern distribution of the species distribution and is not in the vicinity of any stronghold (the Blue Mountains) for this species. | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013c<br>SEWPaC 2013c |

## Table 6 Data values and Justification for the Assessment of *Acacia bynoeana*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | *Stocking Rate Score*<br>Stocking Rate Score = 2/10. A single individual was recorded within the Impact Area. Has some potential to form part of a larger population within the locality and wider region, despite seed production being minimal. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 169.4 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 4/10<br><br>Future (no offset) = 3/10<br><br>Future (with offset) = 5/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 6/10. Habitat within the proposed Offset Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects.<br>Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. The proposed Offset Area is not subject to any protection/conservation scheme and impacts from surrounding land uses have the potential to increase further than current conditions. | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013c<br>Rawlings et al., 2010<br>SEWPaC 2013c |

## Table 6 Data values and Justification for the Assessment of *Acacia bynoeana*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation. The presence of young regrowth indicates capability for assisted regeneration. Native grassland areas already show indications of natural regeneration to woodland following cessation of slashing activity. Revegetation work within these and adjacent areas will also assist in the natural regeneration within these patches.<br><br>*Site Context*<br>Current = 5/10. Connectivity with the wider locality is variable across the proposed Offset Area. The proposed offsets are present towards the northern distribution of the species and are not in the vicinity of any stronghold (the Blue Mountains) for this species.<br>Future (no offset) = 5/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other remnants in the wider locality but is unlikely to increase significantly over current conditions, given the limited seed production and dispersal for this species.<br>Future (with offset) = 5/10. Some potential for increased connectivity in conjunction with revegetation works but is likely to be limited due to the limited seed production and dispersal for this species.<br><br>*Stocking Rate Score*<br>Current = 1/10. No individuals were recorded within the proposed Offset Area. However one individual was recorded east of the Tooheys Road offset properties. | |

## Table 6 Data values and Justification for the Assessment of *Acacia bynoeana*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | Future (no offset) = 0/10. Currently surrounded by agricultural land uses and semi-rural development. Potential for reduction in population due to increasing impacts from surrounding land uses.<br>Future (with offset) = 1/10. Potential to increase abundance of species is limited due to small size of populations in a locality. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag following planting. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | Wyong Shire Council 2013 |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection mechanism is unlikely to completely remove risks due to residual factors such as illegal clearing and natural disasters such as fires and drought. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in | Averted Loss | Confidence in averted loss is set at 95% assuming there is a very high level of | Cumberland Ecology 2013: Chapter |

## Table 6 Data values and Justification for the Assessment of *Acacia bynoeana*

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | result % | = 95% | protection afforded by the conservation agreement. | 8 |
| | | Increase in Quality = 70% | Confidence in quality is 70% as ongoing and adaptive management under the BMP will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve through assisted natural regeneration. Management measures, such as exclusion fencing and buffer planting are likely to protect the vegetation from ongoing edge impacts and allow it to establish. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

## Table 7 Data values and Justification for the Assessment of Giant Barred Frog

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 10.4 ha | Total area of potential Giant Barred Frog habitat to be cleared. | Reassessment of potential habitats for Giant Barred Frog listed in Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES: |
| | Quality of Impact Area | 4/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>*Site Condition Score*<br>Site condition score = 6/10. Habitat within the Impact Area has limited areas of riparian and swamp forest in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches high edge to areas ratios, resulting in an increased susceptibility to edge effects. There are some 2nd order streams present which provide some potential breeding habitat for this species.<br><br>*Site Context Score*<br>Site Context = 4/10. Connectivity with the wider locality is variable across the Impact Area. The Impact Area is not in the vicinity of any known stronghold (Coffs Harbour) for | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013d<br>SEWPaC 2013d |

## Table 7 Data values and Justification for the Assessment of Giant Barred Frog

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | this species. Lack of baseline data limits the assessment of the distribution of this species. However, the disturbance areas are not located near the boundaries of known distribution for this species.<br><br>*Stocking Rate Score*<br>Stocking Rate Score = 1/10. No individuals were recorded within the Disturbance Area. However 4 individuals were recorded within Project Boundary areas to the west of the infrastructure areas. There is some potential to form part of a larger population within the locality and wider region, although this may be limited due to the ephemeral nature of smaller water bodies in the area. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 27.3 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Reassessment of potential habitats for Giant Barred Frog listed in Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 4/10<br><br>Future (no offset) = 3/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score* | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008. |

## Table 7 Data values and Justification for the Assessment of Giant Barred Frog

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | Future (with offset) = 4/10 | Current = 6/10. Habitat within the proposed Offset Area has areas of riparian and swamp forest in moderate to good condition. The vegetation is consists largely of young regrowth vegetation with scattered mature trees. However some scattered patches high edge to areas ratios, resulting in an increased susceptibility to edge effects. There are some 2nd order streams present which provide some potential breeding habitat for this species.<br>Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. The proposed Offset Area is not subject to any protection/conservation scheme and impacts from surrounding land uses have the potential to increase further than current conditions.<br>Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation. The proposed feral species management will further reduce threats to this species.<br><br>*Site Context*<br>Current = 4/10. Connectivity with the wider locality is variable across the Proposed Offset Area. The Offset Area is not in the vicinity of any known stronghold (Coffs Harbour) for this species. Lack of baseline data limits the assessment of the distribution of this species. However, the disturbance areas are not located near the boundaries of known distribution for this species.<br>Future (no offset) = 4/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other remnants in the wider locality but is unlikely to increase significantly over current conditions.<br>Future (with offset) = 4/10. Some potential for increased connectivity in conjunction with | McIntyre et al., 2002<br>OEH 2013d<br>Rawlings et al., 2010<br>SEWPaC 2013d |

## Table 7 Data values and Justification for the Assessment of Giant Barred Frog

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | management plans but is likely to be limited due to the ephemeral nature of the smaller water bodies in the area.<br><br>*Stocking Rate Score*<br>Current = 1/10. No individuals were recorded within the Offset Area. However individuals were recorded at four locations within Project Boundary areas to the west of the infrastructure areas. There is some potential to form part of a larger population within the locality and wider region, although this may be limited due to the ephemeral nature of smaller water bodies in the area.<br>Future (no offset) = 0/10. Currently surrounded by agricultural land uses and semi-rural development. Potential for reduction in population due to increasing impacts from surrounding land uses<br>Future (with offset) = 1/10. Assessment of the potential to increase abundance of species is limited due to lack of data on breeding success for this species. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management and feral species management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection | Wyong Shire Council 2013 |

## Table 7 Data values and Justification for the Assessment of Giant Barred Frog

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection mechanism is unlikely to completely remove risks due to residual factors such as illegal clearing and natural disasters such as fires and drought. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 65% | Confidence in quality is 65% as ongoing and adaptive management under the BMP will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve through assisted natural regeneration. Management measures, such as control of weeds and feral species will reduce the threats to the Giant Barred Frog. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

## Table 8 Data values and Justification for the Assessment of Spotted-tailed Quoll

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 48.4 ha | Total area of potential Spotted-tailed Quoll habitat to be cleared. | Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES |
| | Quality of Impact Area | 4/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>*Site Condition Score*<br>Site condition score = 6/10. Habitat within the Impact Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects. The Impact Area has moderate to good foraging habitat for this species but is likely to be more limited for breeding habitat due to limited availability of caves and rocky outcrops for den sites.<br><br>*Site Context Score*<br>Site Context = 5/10. Connectivity with the wider locality is variable across the Disturbance Area. The Disturbance Area is well within the known distribution for this species. | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013e<br>SEWPaC 2013e |

## Table 8 Data values and Justification for the Assessment of Spotted-tailed Quoll

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | *Stocking Rate Score*<br>Stocking Rate Score = 1/10. No individuals were recorded within the Disturbance Area. However this species moves over large home ranges and has been historially recorded in the locality and wider LGA. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 118.8 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 4/10<br><br>Future (no offset) = 4/10<br><br>Future (with offset) = 5/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 6/10. Habitat within the Offset Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects. The Offset Area has moderate to good foraging habitat for this species but is likely to be more limited for breeding habitat due to limited availability of caves and rocky outcrops for den sites. Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. The proposed Offset Area is not subject to any protection/conservation | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013e<br>Rawlings et al., 2010<br>SEWPaC 2013e |

## Table 8 Data values and Justification for the Assessment of Spotted-tailed Quoll

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | scheme and impacts from surrounding land uses have the potential to increase further than current conditions.<br>Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation and thus habitat quality for this species. The proposed feral species management will further reduce threats to this species.<br><br>*Site Context*<br>Current = 5/10. Connectivity with the wider locality is variable across the Offset Area. These areas are well within the known distribution for this species<br>Future (no offset) = 5/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other remnants in the wider locality but is unlikely to increase significantly over current conditions.<br>Future (with offset) = 6/10. Some potential for increased connectivity in conjunction with management plans.<br><br>*Stocking Rate Score*<br>Current = 1/10. No individuals were recorded within the Disturbance Area. However this species moves over large home ranges and has been historially recorded in the locality and wider LGA.<br>Future (no offset) = 1/10. Currently surrounded by agricultural land uses and semi-rural development. . Some potential for decreased connectivity with other populations in the wider locality but is unlikely to increase significantly over current | |

## Table 8 Data values and Justification for the Assessment of Spotted-tailed Quoll

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | conditions, given the wide-ranging nature of this species.<br>Future (with offset) = 1/10. Assessment of the potential to increase abundance of species is limited due to the wide home ranges of individuals. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management and feral species management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | Wyong Shire Council 2013 |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection mechanism is unlikely to completely remove risks due to residual factors such as illegal clearing and natural disasters such as fires and drought. | Cumberland Ecology 2013: Chapter 8 |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in | Confidence in quality is 65% as ongoing and adaptive management under the BMP | This is based upon observations by |

## Table 8 Data values and Justification for the Assessment of Spotted-tailed Quoll

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | Quality = 65% | will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve through assisted natural regeneration. Management measures, such as control of weeds and feral species will reduce the threats to the Spotted-tailed Quoll. | Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

## Table 9 Data values and Justification for the Assessment of Grey-headed Flying Fox

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| IMPACT | Area of habitat in Impact Area (ha) | 48.4 ha | Total area of potential Grey-headed Flying-fox habitat to be cleared. | Cumberland Ecology 2013. Chapter 7 – Impact Assessment on MNES |
| | Quality of Impact Area | 4/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance are important factors influencing the viability of the species.<br><br>*Site Condition Score*<br>Site condition score = 6/10. Habitat within the Impact Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects. The Impact Area has moderate to good foraging habitat for this species but is unlikely to be used for roosting and breeding due to the absence of camp sites within the disturbance area.<br><br>*Site Context Score*<br>Site Context = 4/10. The species is a highly mobile species that can travel large distances. Connectivity with the wider locality is likely to be high but variable across the Impact Area. The Impact Area is well within the known distribution for this | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES<br><br>OEH 2013f<br>SEWPaC 2013f |

## Table 9 Data values and Justification for the Assessment of Grey-headed Flying Fox

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | species but is not near any known strongholds for this species.<br><br>*Stocking Rate Score*<br>Stocking Rate Score = 3/10. No individuals were recorded within the Impact Area. However this species has been recorded within areas of the Project Boundary to the west of the Impact Area. This species is highly mobile and there is a high likelihood of this species passing through the Impact Area while foraging. | |
| OFFSET AREAS - RETAINED | Area of habitat in Offset Area (ha) | 118.8 ha | Located in Tooheys Road South, Tooheys Road North and Hue Hue Road offset areas | Cumberland Ecology 2013: Chapter 7 – Impact Assessment on MNES |
| | Quality of Offset Area | Current = 4/10<br><br>Future (no offset) = 4/10<br><br>Future (with offset) = 6/10 | *Quality Weighting*<br>Site Condition = 33%; Site Context = 33%; Stocking Rate = 33%<br>The weighting is shared equally between condition, context and stocking rate because condition of habitat, connectivity and patch size, and abundance of the species are important factors influencing the viability of the community.<br>Offset areas are located adjacent to impact areas<br><br>*Site condition score*<br>Current = 6/10. Habitat within the Offset Area consists of woodland and open forest areas, with hollowing, in moderate to good condition. However some scattered patches consist of canopy species only while others have high edge to areas ratios, resulting in an increased susceptibility to edge effects. The Offset Area has moderate to good foraging habitat for this species but is unlikely to be used for | Cumberland Ecology 2013: Chapter 5 - Results, Chapter 6 - Impact Assessment, Chapter 7 – Impact Assessment on MNES, Chapter 8 – Impact Mitigation<br><br>Durrogh et al., 2008.<br>McIntyre et al., 2002<br>OEH 2013f<br>Rawlings et al., 2010<br>SEWPaC 2013f |

## Table 9 Data values and Justification for the Assessment of Grey-headed Flying Fox

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | roosting and breeding due to the absence of camp sites within the disturbance area.<br>Future (no offset) = 5/10. There is increasing development in the locality and wider LGA. The proposed Offset Area is not subject to any protection/conservation scheme and impacts from surrounding land uses have the potential to increase further than current conditions.<br>Future (with offset) = 8/10. The Offset Area is proposed to be protected in perpetuity. The cessation of grazing activities in adjacent areas is likely to contribute to the improvement of the condition of the vegetation and thus habitat quality for this species. The proposed feral species management will further reduce threats to this species.<br><br>*Site Context score*<br>Current = 4/10. The species is a highly mobile species that can travel large distances. Connectivity with the wider locality is likely to be high but variable across offset areas. These areas are well within the known distribution for this species but are not near any known strongholds for this species.<br>Future (no offset) = 4/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other populations in the wider locality but is unlikely to increase significantly over current conditions.<br>Future (with offset) = 5/10. Some potential for increased connectivity in conjunction with management plans.<br><br>*Stocking Rate Score*<br>Current = 3/10. No individuals were recorded within the offset areas. However this | |

## Table 9 Data values and Justification for the Assessment of Grey-headed Flying Fox

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | species has been recorded within areas of the Project Boundary to the west of the offset areas. This species is highly mobile and there is a high likelihood of this species passing through the disturbance area while foraging.<br>Future (no offset) = 3/10. Currently surrounded by agricultural land uses and semi-rural development. Some potential for decreased connectivity with other populations in the wider locality but is unlikely to increase significantly over current conditions, given the wide-ranging nature of this species.<br>Future (with offset) = 4/10. Some potential for increased abundance in the area in conjuction with management plans and revegetation. | |
| | Time horizon | 20 years | The life of the mine greater than 20 years. | Cumberland Ecology 2013 |
| | Time until ecological benefit | 10 years | Cessation of current land use activities and implementation of management plans, such as weed management and feral species management, will benefit this species within a short time frame. However the proposed revegetation of degraded areas can potentially take up to 10 years before the understorey approaches the anticipated future quality. Revegetation work in adjacent areas will likely benefit this offset, although there would be a time lag. | Durrogh et al., 2008.<br>McIntyre et al., 2002 |
| | Risk of loss without offset | 40% | Risk of loss without offset is estimated to be 40% because the proposed offsets are located in an area with increasing semi-rural development. There are no formal protection mechanisms in place to protect the vegetation from some permitted types of clearing or other activities under the current zoning. Other risk factors include dieback and drought. | Wyong Shire Council 2013 |
| | Risk of loss with offset | 5% | Risk of loss with offset estimated to be 5% because a protection mechanism is likely to extinguish risk of further clearing for future development. However, the protection | Cumberland Ecology 2013: Chapter 8 |

## Table 9 Data values and Justification for the Assessment of Grey-headed Flying Fox

| Component | Value in calculation | Score | Rationale | Source |
|---|---|---|---|---|
| | | | mechanism is unlikely to completely remove risks due to residual factors such as illegal clearing and natural disasters such as fires and drought. | |
| | Confidence in result % | Averted Loss = 95% | Confidence in averted loss is set at 95% assuming there is a very high level of protection afforded by the conservation agreement. | Cumberland Ecology 2013: Chapter 8 |
| | | Increase in Quality = 65% | Confidence in quality is 65% as ongoing and adaptive management under the BMP will increase the chances of success. The understorey in the majority of patches is presently in moderate to good condition and has a good opportunity to improve through assisted natural regeneration. Management measures, such as control of weeds and feral species will reduce the threats to the Grey-headed Flying fox. | This is based upon observations by Cumberland Ecology that woodland regeneration is effective in areas protected from grazing in the locality, without any active management. This gives a basis for a high degree of confidence that regeneration in actively managed offsets will have a high chance of averting loss.<br>Durrogh et al 2008<br>Gillespie et al. 2001 |

Independent Expert Scientific Committee
on Coal Seam Gas and Large Coal Mining Development

# Advice to decision maker on coal mining project

**Proposed action: Wallarah 2 Coal Project (EPBC 2012/6388) – New Development**

| | |
|---|---|
| **Requesting agency** | Department of Sustainability, Environment, Water, Population and Communities |
| **Date of request** | 18 April 2013 |
| **Date request accepted** | 18 April 2013 |
| **Advice stage** | Environment Impact Assessment (draft) |
| **Summary of request from the regulator** | The Department of Sustainability, Environment, Water, Population and Communities (the Department) is currently assessing the proposed project in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).<br><br>The Department notifies the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the Committee) of an opportunity to comment on the Draft Environmental Impact Assessment. Specifically, the Department poses the following questions to the Committee:<br><br>1. Does the Committee consider that the proponent has provided sufficient information on water resources and its management to assess the likely significant impacts from its proposed action? – If the information is considered insufficient, what advice regarding areas of inadequacy can the Committee provide?<br><br>2. What are the likely impacts of the proposed mine on surface and ground water resources, in particular, changes to surface and/or ground water dynamics and resources that may support surface habitat for threatened species and communities?<br><br>3. Does the Committee find the water balance and conclusions relating to water management provided by the proponent and attached to this brief to be reasonable? |

## Advice

The Committee was requested to provide advice on the Wallarah 2 Coal Project in New South Wales to the Commonwealth regulator at the Environmental Impact Assessment (Draft) stage. This advice draws upon aspects of the information in the draft Environmental Impact Assessment provided by the proponent, together with the expert deliberations of the Committee. The draft Environmental Impact Assessment and information assessed by the Committee are listed in the source documentation at the end of this advice.

The proposed project is for a new underground coal mine development, producing up to 5 million tonnes per annum of coal for a period of 28 years. The proposed project is located on the central coast of New South Wales in the northeast of the Sydney Basin and in the southern part of the Newcastle Coalfield. The Project

area lies 4.7 km to the southeast of the township of Wyong. Mining will take place between 350 m and 690 m below the surface targeting the Wallarah and Great Northern Coal Seams by means of 46 underground longwalls in an area of 37 km².

The Committee, in line with its Information Guidelines[1], has considered whether the proposed project assessment has used the following:

Relevant data and information: key conclusions

Information provided addresses many of the key areas in the Information Guidelines[1] however, relevant data and information has not been provided on the following:

- the risks associated with potential reduction of surface runoff caused by subsidence and the adverse affects on the Gosford-Wyong Water Supply Scheme;
- the fracture potential of the strata between the targeted coal seam and the surface;
- changes to the regional water balance;
- the potential impacts of the project on aquatic ecology; and
- cumulative impacts associated with current and future mines within the area.

Appropriate methodologies which have been applied correctly: key conclusions

The key methodologies and assessments needed to fully assess the proposed project that have not been provided include:

- a regional water balance, that gives particular consideration to both surface and groundwater impacts to the Gosford-Wyong Water Supply Scheme;
- assessment of subsidence issues associated with longwall mining, relating to the changing of catchment characteristics, variation in groundwater aquifers and potential increased surface water and aquifer interconnectivity;
- a comprehensive risk assessment of the impacts of the proposed project on surface water and groundwater dependent ecosystems; and
- a cumulative impact assessment associated with creek systems flowing from the Mandalong Southern Extension Project directly through the proposed extraction site.

Reasonable values and parameters in calculations: key conclusions

The draft Environmental Impact Assessment generally uses reasonable values and parameters in calculations, with the exception of the use of data from Wallarah Creek in the water balance and the discussion on water quality. The monitoring point located outside the proposed main extraction site may not be an appropriate calibration tool for the site water balance. A lack of supporting information on flood events and impacts on aquatic ecology has also limited the onsite assessments. The proponent has relied heavily on literature reviews to provide analysis and assessments.

*Question 1: Does the Committee consider that the proponent has provided sufficient information on water resources and its management to assess the likely significant impacts from its proposed action? – If the information is considered insufficient, what advice regarding areas of inadequacy can the Committee provide?*

1. The Committee considers that while the proponent has provided water resources and management information, there is limited information on the full suite of groundwater impacts; risks to the regional water balance; subsidence-related impacts; impacts on aquatic ecology; and the project's risk to the Gosford-Wyong Water Supply Scheme.

*Question 2: What are the likely impacts of the proposed mine on surface and ground water resources, in particular, changes to surface and/or ground water dynamics and resources that may support surface habitat*

*for threatened species and communities?*

2. The Committee advises that there are significant risks associated with the proposed project having a detrimental and long-lasting effect on an already stressed water supply catchment. The proposal is located within the Jilliby Jilliby Creek Catchment, a major water source for the Gosford-Wyong Water Supply Scheme, which provides water to 285,000 people within the central coast of New South Wales. The proposal has the potential to significantly reduce surface runoff, with the project area covering 5% of the entire scheme's catchment area.

3. The proposal has the potential to change surface and groundwater dynamics within the Jilliby Jilliby Creek Catchment through subsidence-related impacts. This includes the following:

    a. Subsidence can lead to increased drainage between aquifers, altering water table heights, flow rates and water quality. Groundwater dependent ecosystems, which rely on shallow water tables, have been identified along surface drainage channels within the project boundary. Regular monitoring of the water table in these areas is needed to ensure that any variation in level can be resolved by remediation measures;

    b. The predicted subsidence has the potential to alter flooding regimes, causing localised ponding/damming of catchment runoff waters. This has the potential to cause change in depth of water bodies leading to inundation or water logging of emergent or marginal/riparian vegetation, and causing aquatic habitat alteration due to draining or additional deepening of existing ponds, wetlands or dams;

    c. The proponent has indicated that fracturing as a result of subsidence will extend upwards to a maximum of 200 m from the coal seam. The potential impact caused by fracturing through the entire strata would have detrimental effects, including the reduction of surface flow and draining of shallow aquifers, on which groundwater dependant ecosystems depend. Findings need to be based on both localised modelling, and within a regional context through robust analysis of similar projects in the area, and;

    d. The forested hill areas of the proposed project are susceptible to surface deformation and cracking due to subsidence. This has the potential to destabilise soils and sediments and mobilise these into creeks and streams increasing sediment loads and nutrient loads. It is noted that the proponent will prepare an Erosion and Sediment Control Plan. It is recommended that this plan address these issues, with specific attention given to the potential impact on the Gosford-Wyong Water Supply Scheme.

4. The proposal indicates that brine and salt concentrate could potentially be stored below ground within the extracted coal seam. Monitoring of groundwater quality, particularly in relation to the storage of salt concentrate, along with mitigation measures, would be required to ensure water quality is not degraded. Contamination of the regional groundwater supply could have severe ramifications for the water quality of the Gosford-Wyong Water Supply Scheme. Due to the potential risk involved, a rigorous groundwater monitoring system is needed to identify and then mitigate any impacts.

5. It is recommended that the proponent develop a post-mine management plan to reduce the impacts on water resources from continued depressurisation after mining. The predicted continued depressurisation 500 years after cessation is likely to impact the surrounding water extraction sources by creating a groundwater sink, having the potential to impact on existing groundwater bores and to contribute to cumulative impacts with surrounding mines.

6. There is insufficient evidence to support the proponent's conclusion of negligible cumulative impacts. In particular, the potential cumulative impacts brought about by the potential Mandalong Southern Extension Project are likely to have impacts within the Jilliby Jilliby Creek Catchment. It is recommended that an assessment of cumulative groundwater and surface water impacts be undertaken, incorporating where possible current and future mining and other extractive industries.

7. The proponent's assessments regarding the extent of aquifer connectivity are not justified by the data

provided in the project assessment documentation. To increase confidence in the proponent's assessment of aquifer connectivity, further data collection or validation is needed, both from within the extraction area and at a regional level.

8. The proposed project area includes both threatened and vulnerable flora and fauna species listed under the EPBC Act. The proposal could directly impact populations of EPBC Act listed water dependent species present or potentially present within the proposed project boundary, specifically:

    - two fish species – Australian Grayling (*Prototroctes maraena*) and the Macquarie perch (*Macquaria australasica*);
    - four frog species – Littlejohn's Tree Frog (*Litoria littlejohni*), the Stuttering Frog (*Mixophyes balbus*), the Giant Barred Frog (*Dasyurus maculates maculates*) and the Green and Golden Bell Frog (*Litoria aurea*), and;
    - one groundwater dependent ecosystem – Biconvex Paperbark [paperbark swamp] (*Melaleuca biconvex*).

    The proposal may also directly impact the existing populations of New South Wales *Threatened Species Conservation Act 1995* listed water dependent species present or potentially present within the proposed project boundary, specifically:

    - the Wallum Froglet (*Crinia tinnula*), and;
    - two dragonfly species – the Adams emerald dragonfly (*Archaeophya adamsi*) and the Giant dragonfly (*Petalura gigantean*).

    It is noted that an ecological monitoring program will be established as a component of the Biodiversity Management Plan. This plan is designed to monitor the ongoing status and health of flora and fauna communities that will be retained within the project boundary. It is recommended that the Biodiversity Management Plan specify what mitigation measures are in place for the protection of EPBC Act listed species.

*Question 3: Does the Committee find the water balance and conclusions relating to water management provided by the proponent and attached to this brief to be reasonable?*

9. A regional water balance, which is considered essential to appropriately assess the regional cumulative impacts and risks to the Gosford-Wyong Water Supply Scheme, has not been provided.

10. The proponent has not considered the potential impacts on the surrounding creeks and water quality as a result of uncontrolled discharge from the mine operations dams. The mine operation dams are currently designed to contain a 100 year average recurrence interval 72 hour storm event. Consideration should be given to mine operation dams being redesigned to contain a larger storm event (1 in 1000 year average recurrence interval) to minimise the potential for downstream water quality and ecological impacts.

11. Further assessment is recommended to gauge the extent of water interaction within the extraction boundary. The proponent has assessed the calibration of the runoff model using a gauging station on the Wallarah Creek. It is noted that the station only operated from 1965 to 1976 and is not located within the main project area. This dataset provides limited confidence in the calibration of the surface water balance.

12. The proponent has stated that a water treatment plant will treat mine water to a quality that is similar to the existing Wallarah Creek water quality values, before being discharged into the creek system. Further clarification is needed on what the proponent specifies as 'existing water quality values' proposed for treated water released into the Wallarah Creek. All site and surface water plans should be constructed in accordance with the National Water Quality Management Strategy[2].

13. The release of controlled treated mine water is likely to occur when there is no natural flow in Wallarah Creek, and these releases have the potential to change flow regimes of the creek. The proponent has stated that Wallarah Creek will remain ephemeral in nature, after water releases have been made. It is

recommended that mitigation measures are put in place to conserve the natural flow characteristics of the Wallarah Creek.

14. The proponent has entitlements to extract water from both surface and groundwater sources within the proposed extraction area. The proposed project requires external water to make up the deficit. The proponent has advised that this will be done through town water supplies with relevant licences still to be obtained. It is suggested that an assessment be made on the potential impacts of extracting water from town sources during extreme weather periods including drought conditions.

15. The Northern Sydney Basin has been identified as a Bioregional Assessment priority region. Data and relevant information from the proposed project should be made accessible for this Bioregional Assessment to assist the knowledge base for regional scale assessments.

| | |
|---|---|
| **Date of advice** | 24 May 2013 |
| **Source documentation available to the Committee in the formulation of this advice** | Hansen Bailey 2013. Wallarah 2 Coal Project, Environmental Impact Statement. Prepared for Wyong Areas Coal Joint Venture. February 2013 |
| **References cited within the Committee's advice** | [1] Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources available at: http://www.environment.gov.au/coal-seam-gas-mining/project-advice/pubs/iesc-information-guidelines.pdf<br><br>[2] Australian and New Zealand Guidelines for Fresh and Marine Water Quality. National Water Quality Management Strategy (NWQMS). Volume 4. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council for Australia and New Zealand. Canberra. |

Wallarah 2
COAL PROJECT

4 July 2013

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Ms Mahani Taylor
Director, South-Eastern Australia Assessment Branch
Department of Sustainability, Environment, Water, Population & Communities
GPO Box 787
CANBERRA ACT 2601

Dear Ms Taylor,

**WALLARAH 2 COAL PROJECT (EPBC 2012/6388) ADVICE OF THE INDEPENDENT EXPERT SCIENTIFIC COMMITTEE ON COAL SEAM GAS AND LARGE COAL MINING DEVELOPMENT**

Thank you for the written response of 2 July inviting written comment in relation to the IESC advice on the Wallarah 2 Coal Project.

Having fully reviewed the issues raised by the IESC and with reference to the matters responded to by us in correspondence to you of the 20 June 2013, please find attached a review of each issue and some meeting discussion points we feel justify a meeting between ourselves and the appropriate experts advising the Department of Sustainability, Environment, Water, Population & Communities.

I look forward to your response with the view of finalising meeting arrangements.

Yours sincerely

Kenny Barry
Project Manager

cc Mr David Kitto, Director Major Development Assessments Branch, NSW Department of Planning & Infrastructure

# 1 INTRODUCTION

Wyong Areas Coal Joint Venture (WACJV) is seeking development consent for State Significant Development (SSD) under Division 4.1 of Part 4 of the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act) for the Wallarah 2 Coal Project (the Project).

WACJV is also concurrently seeking approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral under section 68 of the EPBC Act was made on 17 May 2012. On 15 June 2012, the Project was declared to be a controlled action and as such it requires approval under the EPBC Act. The Minister's delegate decided that the Project would be assessed through accreditation of the NSW assessment process under the EP&A Act.

In accordance with section 78A(8A) of the EP&A Act, the *Wallarah 2 Coal Project Environmental Impact Statement* (EIS) was prepared by Hansen Bailey Environmental Consultants (Hansen Bailey) (Draft EIS). The draft EIS was provided to the NSW Department of Planning & Infrastructure (DP&I) for regulatory review in October 2012.

Hansen Bailey then revised the EIS to address DP&I's (and other regulator's including Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)) comments on the Draft EIS. A Revised EIS (Draft2 EIS) was provided to DP&I and the SEWPaC, as requested by DP&I, for a second regulatory review in February 2013.

SEWPaC referred the Draft2 EIS to the Independent Expert Scientific Committee (IESC) for its advice on matters pertaining to water resources. The IESC provided its advice on 24 May 2013 (IESC Advice) and identified issues that required further attention.

In February 2013, DP&I provided additional comments on the Draft2 EIS. Hansen Bailey revised the Draft2 EIS which was then approved for public exhibition in April 2013 (Exhibited EIS). The IESC has based its advice on the Draft2 EIS rather than the Exhibited EIS. As a result, there appear to be aspects of the environmental assessment that the IESC has not considered.

WACJV has considered the IESC advice and conclude that further information addressing most matters raised is included in the Exhibited EIS which the IESC has not reviewed. This letter considers each matter raised by the IESC and outlines the relevant information that is provided in the Exhibited EIS or where additional direction and/or clarification is sought.

As previously commented, we would appreciate being able to discuss our technical queries directly with the IESC or representatives to ensure our technical experts fully understand the scale and scope of what is required.

# 2 RESPONSE TO THE IESC ADVICE

*The following section analyses the issues raised by the IESC and explains how these issues have been addressed in the final EIS. This section also outlines the clarification and further information that is required for additional assessment to commence.*

*All references to sections and appendices relate to the Exhibited EIS (dated April 2013).*

## 2.1 ISSUE 1

*The Committee considers that while the proponent has provided water resources and management information, there is limited information on the full suite of groundwater impacts; risks to the regional water balance; subsidence-related impacts; impacts on aquatic ecology; and the project's risk to the Gosford-Wyong Water Supply Scheme.*

**Response**

These general comments are addressed through the responses to the following issues.

## 2.2 ISSUE 2

*The Committee advises that there are significant risks associated with the proposed project having a detrimental and long-lasting effect on an already stressed water supply catchment. The proposal is located within the Jilliby Jilliby Creek Catchment, a major water source for the Gosford-Wyong Water Supply Scheme, which provides water to 285,000 people within the central coast of New South Wales. The proposal has the potential to significantly reduce surface runoff, with the project area covering 5% of the entire scheme's catchment area.*

**Relevant Sections of the EIS**

- Section 7.3.3 of Main Report
- Section 4.6 of Appendix J

**Response in Exhibited EIS**

The EIS demonstrates that the Project will not significantly affect the runoff behaviour within the Project Boundary.

In the Jilliby Jilliby Creek catchment, there is predicted to be a small, localised and temporary reduction in direct runoff due to subsidence and an equivalent increase in alluvial groundwater storage. In the worst case year, the Project will reduce direct surface water runoff in the Jilliby Jilliby Creek Catchment by up to 270 ML/year. Water is not "lost" from the catchment nor is catchment yield measurably affected. Minor localised increases in alluvial storage from infiltrated water (rainfall recharge) will result in a very minor reduction in direct runoff quantity and therefore stream flow. However, an equivalent volume of infiltrated rainfall retained in the alluvium will be added to the base flow component of the stream flow regime. The longer term alluvial groundwater saturation will be equal to or slightly increased

compared to pre-mining conditions. This impact has been quantified in Exhibited EIS in Section 4.6 of Appendix J. Section 4.6 contains additional details including an assessment of the impacts on the flow regime of Jilliby Jilliby Creek. This assessment showed that the impact of the Project on the flow behaviour of the creek was negligible.

**Meeting Discussion Points**

The Project does not propose to directly harvest or extract surface water from land within the subsidence impact limit. There will be only a minor and temporary reduction in direct surface water runoff due to subsidence but no overall expected loss of annual flow or catchment yield because the minor runoff reductions are capable of being offset by increased local base flow to streams.

- Clarification of the primary mechanism by which the Committee believes that such impacts would occur. For example, impacts on surface drainage, loss of baseflow or changes in groundwater flow characteristics

The surface water and groundwater impact assessments have found that the potential reduction in surface water runoff is very small.

- Opportunity to meet and discuss those findings, toward the provision of sufficient information to satisfy the committee's requirements.

## 2.3 ISSUE 3A

*Subsidence can lead to increased drainage between aquifers, altering water table heights, flow rates and water quality. Groundwater dependent ecosystems, which rely on shallow water tables, have been identified along surface drainage channels within the project boundary. Regular monitoring of the water table in these areas is needed to ensure that any variation in level can be resolved by remediation measures.*

**Relevant Sections of the EIS**

- Section 7.2.4 of Main Report
- Section 9 of Appendix I
- Section 7.9.3 of the Main Report
- Sections 6 (e.g., s6.6), 7 and 8 of Appendix O

**Response in Exhibited EIS**

The EIS commits to the monitoring of the shallow water table utilising at least 20 standpipe piezometers. The proposed groundwater monitoring measures are described in Section 7.2.4 of the Main Report.

As well as current alluvial and baserock monitoring at 13 locations in a comprehensive cross-valley network in the Dooralong Valley, the project has recently progressed the reactivation of five previously utilised alluvial monitoring bores in other private property in the Dooralong Valley. This addition will provide further baseline data and monitoring points to assess changes to the shallow groundwater storage induced by subsidence.

**Meeting Discussion Points**

- Scope of future groundwater modelling.

## 2.4 ISSUE 3B

*The predicted subsidence has the potential to alter flooding regimes, causing localised ponding/damming of catchment runoff waters. This has the potential to cause change in depth of water bodies leading to inundation or water logging of emergent or marginal/riparian vegetation, and causing aquatic habitat alteration due to draining or additional deepening of existing ponds, wetlands or dams.*

**Relevant Sections of the EIS**

- Section 6.2 of Appendix O

**Response in Exhibited EIS**

These potential impacts of subsidence on ecology have been addressed in Section 6.2 of the Ecological Impact Assessment (Appendix O). Mitigation measures have also been proposed.

**Meeting Discussion Points**

W2CP is of the opinion that the exhibited EIS demonstrates a robust understanding of the impacts and required mitigation.

- Clarification of the advice and related expectations

## 2.5 ISSUE 3C

*The proponent has indicated that fracturing as a result of subsidence will extend upwards to a maximum of 200 m from the coal seam. The potential impact caused by fracturing through the entire strata would have detrimental effects, including the reduction of surface flow and draining of shallow aquifers, on which groundwater dependant ecosystems depend. Findings need to be based on both localised modelling, and within a regional context through robust analysis of similar projects in the area.*

**Relevant Sections of the EIS**

- Section 7.1.3 of Main Report
- Sections 2.2, 2.4, 2.5 and 2.6 of Appendix G

**Response in Exhibited EIS**

The Subsidence Modelling Study (Appendix G), supported by the detailed Geology Report (Appendix C), demonstrates that vertical fracturing is only predicted to extend to approximately 200 m above the coal seam. Given that the Project will mine at depths of at least 350 m, cracking is not predicted to connect to the surface. As a result, the

consequences referred to in this IESC comment are not predicted to occur even under worst case assessments.

The rock fracturing predictions in the Subsidence Modelling Study were developed using a two-dimensional numerical model known as FLAC (Fast Lagrangian Analysis of Continua). The FLAC model was designed specifically for solving mining and geotechnical engineering problems. A validation exercise was undertaken to confirm the adequacy of the model in simulating the deformation behaviour of the rock mass. For the purposes of the project, case studies were conducted to compare modelled overburden behaviour of a *typical overburden section*, with the regional empirical database, as well as in reference to a number of specific sites including Newcastle Coalfield locations such as Ellalong Colliery. The validation process outlined in Section 2.2 of the Subsidence Modelling Study demonstrated that the model was appropriate for predicting rock deformation mechanics.

**Meeting Discussion Points**

W2CP are confident that the exhibited EIS demonstrates that modelled findings are inclusive of localised and regional context sourced baseline information.

- Clarification of the advice and related expectations

## 2.6 ISSUE 3D

*The forested hill areas of the proposed project are susceptible to surface deformation and cracking due to subsidence. This has the potential to destabilise soils and sediments and mobilise these into creeks and streams increasing sediment loads and nutrient loads. It is noted that the proponent will prepare an Erosion and Sediment Control Plan. It is recommended that this plan address these issues, with specific attention given to the potential impact on the Gosford-Wyong Water Supply Scheme.*

**Relevant Sections of the EIS**

- Section 7.3.4 of Main Report
- Section 6.3 of Appendix J

**Response in Exhibited EIS**

Section 7.3.4 of the Main Report provides a commitment to the preparation of an Erosion and Sediment Control Plan.

**Meeting Discussion Points**

W2CP agrees on the need for the proposed Erosion and Sediment Plan to address potential impacts and management measures relevant to the Gosford-Wyong Water Supply Scheme.

- No discussion required

## 2.7 ISSUE 4

*The proposal indicates that brine and salt concentrate could potentially be stored below ground within the extracted coal seam. Monitoring of groundwater quality, particularly in relation to the storage of salt concentrate, along with mitigation measures, would be required to ensure water quality is not degraded. Contamination of the regional groundwater supply could have severe ramifications for the water quality of the Gosford-Wyong Water Supply Scheme. Due to the potential risk involved, a rigorous groundwater monitoring system is needed to identify and then mitigate any impacts.*

**Relevant Sections of the EIS**

- Section 7.2.3 of Main Report
- Section 6.5.1 of Appendix I

**Response in Exhibited EIS**

Due to the very low rate of recovery of groundwater levels, the mine workings are predicted to behave as a sink for at least 500 years which will inhibit the outward dispersion of brine.

In addition, the salt and brine have a significantly higher density than the formation groundwater. The significant difference in density is expected to promote stratification of the recovering water column with the dense brines residing at the bottom of the water column and formation groundwater favouring the top the top of the column. Changes in water quality are expected to be limited to the higher salinity coal seam aquifer, which is not accessed by any registered bores. The issue of underground brine disposal is assessed in detail in Section 7.2.3 of the Main Report and Section 6.5.1 of Appendix I.

Section 7.2.4 of the Main Report has committed to monitoring of pore pressures after the cessation of mining. This data will verify the effectiveness of the mine workings acting as a sink, thereby inhibiting the outward migration of brine.

**Meeting Discussion Points**

The Project will specifically monitor pore pressures after the cessation of mining to validate the model prediction that the mine workings will behave as a groundwater sink. This also enhances the monitoring to be implemented for water quality because the confirmation that the mine is a sink demonstrates that there is no dispersion of the brine or salt.

- Clarification of the scope for future groundwater monitoring.

## 2.8 ISSUE 5

*It is recommended that the proponent develop a post-mine management plan to reduce the impacts on water resources from continued depressurisation after mining. The predicted continued depressurisation 500 years after cessation is likely to impact the surrounding water extraction sources by creating a groundwater sink, having the potential to impact on existing groundwater bores and to contribute to cumulative impacts with surrounding mines.*

**Relevant Sections of the EIS**

- Section 7.2.4 of Main Report
- Section 9.2 of Appendix I

**Response in Exhibited EIS**

Whilst the Exhibited EIS has committed to the ongoing monitoring of pore pressures after the cessation of mining, it is important to point out that there is no direct or diffuse link between surrounding extraction sources / useable aquifers and the deep mined coal seam areas. Inflow contributions to the mine workings will be sourced from the adjacent coal seam and immediate fracture zones above and lateral to the mined goaf areas. Similarly, due to very low yield potential, poor water quality and depth restrictions, there are no existing groundwater bores which draw water from the areas interconnected to the deep mined coal seam.

The Project is not expected to cause a long term reduction in the yields of registered bores. Nevertheless, WACJV has committed to replacing the water supply if there is a reduction in yield caused by mining.

**Meeting Discussion Points**

W2CP agree with the development of a post mine management plan.

- Clarification of the advice and related expectations

## 2.9 ISSUE 6

*There is insufficient evidence to support the proponent's conclusion of negligible cumulative impacts. In particular, the potential cumulative impacts brought about by the potential Mandalong Southern Extension Project are likely to have impacts within the Jilliby Jilliby Creek Catchment. It is recommended that an assessment of cumulative groundwater and surface water impacts be undertaken, incorporating where possible current and future mining and other extractive industries.*

**Relevant Sections of the EIS**

- Sections 4.5.7, 7.2.3 and 7.3.1 of Main Report
- Section 4.2 of Appendix I
- Section 2.5 of Appendix J

**Response in Exhibited EIS**

The Exhibited EIS has considered cumulative groundwater impacts with approved mining operations, and determined that there will be no cumulative impacts. The zone of depressurisation at the end of the Project life is shown in Figure 30 in the EIS Main Report. All approved mines and extractive industries are located beyond the zone where the predicted head loss exceeds 2 m.

There may be potential for cumulative impacts with the Mandalong Southern Extension, however, in the absence of a mine plan for the Mandalong Southern Extension, cumulative impacts cannot be assessed.

Water Sharing Plans (WSPs) represent plans for the management of all water use within the relevant catchments in NSW. The following WSPs are relevant to the Project:

- *Water Sharing Plan for the Central Coast Unregulated Water Sources 2009* (Central Coast Unregulated WSP); and
- *Water Sharing Plan for the Jilliby Jilliby Creek Water Source 2003* (Jilliby Jilliby Creek WSP).

These WSPs apply to all naturally occurring water on the ground surface. A Water Access Licence (WAL) under the *Water Management Act 2000* (WM Act) is required for any water taken from a water source under a WSP. The application of the WM Act and relevant WSPs is discussed further in Sections 4.5.7 and 7.3.1 of the Exhibited EIS and Section 2.5 of the Surface Water Impact Assessment (Appendix J).

In the Jilliby Jilliby Creek catchment, there is predicted to be a small, localised and temporary reduction in direct runoff due to subsidence and an equivalent increase in alluvial groundwater storage and subsequent base flow potential to the creek.

In the worst case year (and in the absence of any base flow offset resulting from the increased alluvial recharge from rainfall), the Project is predicted to "take" a maximum of 270 ML/year of stream flow from the Jilliby Jilliby Creek Water Source (Jilliby Jilliby Creek WSP) and 30 ML/year of stream flow from the Wyong River Water Source (Central Coast Unregulated WSP). While this water is not "lost" from the catchment nor is overall catchment yield predicted to be measurably affected, there are sufficient water entitlements in both water sources to accommodate the taking of water by the Project. WACJV has committed to acquiring the necessary WALs for the taking of water from the Jilliby Jilliby Creek and Wyong River Water Sources and has already commenced securing significant water entitlements.

WACJV has already acquired a WAL with a water allocation of 185 units in the Jilliby Jilliby Creek Water Source. The water licensing requirements for the Project are discussed further in Section 7.3.3 of the Main Report.

Provided that water is taken in accordance with WALs, the impacts on a regional scale will be within the levels that are considered by the WSPs to be acceptable.

**Meeting Discussion Points**

The Mandalong Southern Extension is not an approved development. There is no mine plan or detailed hydrogeological information provided in the Preliminary Environmental Assessment, which is the only publicly available information for this proposal. If the Mandalong Southern Extension progresses, following the Wallarah 2 Coal Project, publicly available information from the Exhibited EIS will be available for a cumulative impact assessment to be undertaken in consideration of that project at that time. W2CP would also be happy to co-ordinate with Mandalong on any required program over the longer term.

Further, there is no information available about any other proposed mines or extractive industries in the vicinity of the Project that would warrant consideration as part of a cumulative groundwater assessment. As such, a quantitative assessment of cumulative water impacts is not appropriate.

- The level of detail of any future cumulative impact study

## 2.10 ISSUE 7

*The proponent's assessments regarding the extent of aquifer connectivity are not justified by the data provided in the project assessment documentation. To increase confidence in the proponent's assessment of aquifer connectivity, further data collection or validation is needed, both from within the extraction area and at a regional level.*

**Relevant Sections of the Exhibited EIS**

- Section 7.1.3 of Main Report
- Sections 2.2, 2.4, 2.5 and 2.6 of Appendix G

**Response in Exhibited EIS**

The Subsidence Modelling Study (Appendix G) and Geology Report (Appendix C) demonstrate that vertical fracturing is not predicted to extend to the surface. The extent of rock fracturing has been predicted using the FLAC model. The model predicts that vertical fracturing will extend up to 200 m above the coal seam (see Section 2.5 of Appendix G). Given that the Project will mine with depths of cover greater than 350 m, there is not predicted to be any connectivity between the coal seam and the shallow aquifers.

**Meeting Discussion Points**

The modelling study and subsidence impact assessment have been acknowledged as industry leading practice by the NSW Division of Resources and Energy.

The validation process in Section 2.2 of the Subsidence Modelling Study demonstrates that the FLAC model is suitable for predicting the extent of cracking. Monitoring data to confirm the extent of cracking and validation of the model will be obtained after subsidence has occurred. This process will begin following the completion of the first longwall panel and will continue with the completion of each subsequent panel.

- Clarification of the advice and related expectations

## 2.11 ISSUE 8

*The proposed project area includes both threatened and vulnerable flora and fauna species listed under the EPBC Act. The proposal could directly impact populations of EPBC Act listed water dependent species present or potentially present within the proposed project boundary, specifically:*

- *Two fish species – Australian Grayling (Prototroctes maraena) and the Macquarie perch (Macquaria australasica);*
- *Four frog species – Littlejohn's Tree Frog (Litoria littlejohni), the Stuttering Frog (Mixophyes balbus), the Giant Barred Frog (Dasyurus maculates maculates) and the Green and Golden Bell Frog (Litoria aurea), and;*
- *One groundwater dependent ecosystem – Biconvex Paperbark [paperbark swamp] (Melaleuca biconvex).*

*The proposal may also directly impact the existing populations of New South Wales Threatened Species Conservation Act 1995 listed water dependent species present or potentially present within the proposed project boundary, specifically:*

- *The Wallum Froglet (Crinia tinnula), and;*
- *Two dragonfly species – the Adams emerald dragonfly (Archaeophya adamsi) and the Giant dragonfly (Petalura gigantean).*

*It is noted that an ecological monitoring program will be established as a component of the Biodiversity Management Plan. This plan is designed to monitor the ongoing status and health of flora and fauna communities that will be retained within the project boundary. It is recommended that the Biodiversity Management Plan specify what mitigation measures are in place for the protection of EPBC Act listed species.*

**Relevant Sections of the EIS**

- Sections 7.9.4 and 7.10.4 of Main Report
- Section 8.5 of Appendix O

**Response in Exhibited EIS**

The Exhibited EIS has committed to the preparation of a Biodiversity Management Plan, which will include mitigation measures for all recorded and potentially occurring EPBC Act listed species.

**Meeting Discussion Points**

The preparation of the Biodiversity Management Plan as per the committee's recommendations will be fully adopted.

- No further discussion required

## 2.12 ISSUE 9

*A regional water balance, which is considered essential to appropriately assess the regional cumulative impacts and risks to the Gosford-Wyong Water Supply Scheme, has not been provided.*

**Relevant Sections of the EIS**

- Sections 4.5.7 and 7.3.1 of Main Report
- Sections 2.5 and 4.6 of Appendix J

**Response in Exhibited EIS**

The Surface Water Impact Assessment for the Project included an appropriate water balance model which assessed site water demands, storage inventories and discharge requirements.

The relevant WSPs represent plans for the management of all water use within the relevant catchments. Provided that water is taken in accordance with the relevant WSPs, the impacts on a regional scale will be within the levels that are considered by the WSPs to be acceptable. See response to Issue 6 above.

The Exhibited EIS includes an assessment of the impacts on flows in Jilliby Jilliby Creek (Section 4.6 of the Surface Water Impact Assessment). This assessment shows that the impact of the Project on the flow behaviour of the creek will be negligible.

**Meeting Discussion Points**

The impacts on the regional surface water balance have been assessed with reference to the relevant WSPs. Any surface water taken by the Project, which represents a very small percentage of the total water available in the catchment, would be licensed under the WSPs to ensure that any impacts are within the range of impacts considered acceptable.

- Discussion and Clarification of the advice and related expectations regarding the methodology and level of detail provided within the project report.

## 2.13 ISSUE 10

*The proponent has not considered the potential impacts on the surrounding creeks and water quality as a result of uncontrolled discharge from the mine operations dams. The mine operation dams are currently designed to contain a 100 year average recurrence interval 72 hour storm event. Consideration should be given to mine operation dams being redesigned to contain a larger storm event (1 in 1000 year average recurrence interval) to minimise the potential for downstream water quality and ecological impacts.*

**Relevant Sections of the EIS**

- Section 7.3.3 of Main Report
- Section 4.4 of Appendix J

**Response in Exhibited EIS**

The water balance model for the Project has demonstrated that the mine water management system at the Tooheys Road site can fully contain mine water under all historical rainfall conditions in the area (based on 122 years of rainfall data). The results of the water balance show that there are no discharges from mine water dams (see Section 7.3.3 of the Main Report and Section 4.4 of Appendix J).

**Meeting Discussion Points**

The adopted design approach is consistent with industry best practice for coal mines in Australia.

Whilst it is theoretically possible for a larger, unprecedented rainfall event to cause overflows from the mine water management system, the consequences of such an overflow would be small. The very large volume of clean water inflows during such a rainfall event would strongly dilute and improve the quality of the overflowing mine water that would flow to a brackish-saline coastal lagoon. Furthermore, the flows in the receiving watercourse during an extreme rainfall event would be orders of magnitude larger than the uncontrolled discharge component.

- Clarification of the advice and related expectations.

## 2.14 ISSUE 11

*Further assessment is recommended to gauge the extent of water interaction within the extraction boundary. The proponent has assessed the calibration of the runoff model using a gauging station on the Wallarah Creek. It is noted that the station only operated from 1965 to 1976 and is not located within the main project area. This dataset provides limited confidence in the calibration of the surface water balance.*

**Relevant Sections of the EIS**

- Section 7.3.3 of Main Report
- Section 4.4 of Appendix J

**Response in Exhibited EIS**

Calibration using 11 years of recorded data for the receiving watercourse provides a high level of confidence in the calibration of the rainfall-runoff model. The 11 years of recorded data provide a reasonable representation of the range of climatic conditions. In comparison, most mining projects have less data for calibration.

**Meeting Discussion Points**

The amount of data is considered far in excess of what is required to calibrate a rainfall-runoff model.

- Clarification of the advice and related expectations

## 2.15 ISSUE 12

*The proponent has stated that a water treatment plant will treat mine water to a quality that is similar to the existing Wallarah Creek water quality values, before being discharged into the creek system. Further clarification is needed on what the proponent specifies as 'existing water quality values' proposed for treated water released into the Wallarah Creek. All site*

*and surface water plans should be constructed in accordance with the National Water Quality Management Strategy.*

**Relevant Sections of the EIS**

- Section 4.5.5 of Appendix J

**Response in Exhibited EIS**

The IESC has reviewed a draft version of the EIS (dated February 2013). Water quality parameters for the treated water to be discharged to Wallarah Creek are presented in the Exhibited EIS. This information is presented in detail in Section 4.5.5 of Appendix J.

A Water Management Plan will be developed prior to the commencement of the Project. The Water Management Plan will be consistent with the National Water Quality Management Strategy. Wallarah 2 Coal Project has extensive water quality monitoring data since 1997 which is significantly more than the two year minimum data required under the ANZECC guidelines for assessment and management planning purposes.

**Meeting Discussion Points**

W2CP are confident that the existing water quality values as sought by the IESC are adequately addressed in the exhibited EIS. The project also commits to ensuring that all site and surface water plans will be prepared in accordance with the National Water Quality Management Strategy.

- Clarification of the advice and related expectations

## 2.16 ISSUE 13

*The release of controlled treated mine water is likely to occur when there is no natural flow in Wallarah Creek, and these releases have the potential to change flow regimes of the creek. The proponent has stated that Wallarah Creek will remain ephemeral in nature, after water releases have been made. It is recommended that mitigation measures are put in place to conserve the natural flow characteristics of the Wallarah Creek.*

**Relevant Sections of the EIS**

- Section 7.3.3 of Main Report
- Sections 4.5.3 and 4.5.4 of Appendix J

**Response in Exhibited EIS**

Impacts on the flow characteristics of Wallarah Creek have been assessed in detail in Section 7.3.3 of the Main Report and Sections 4.5.3 and 4.5.4 of Appendix J. The Project will discharge treated water into Wallarah Creek, increasing flow volumes by approximately 3%. The change in the frequency of flows of greater than 10 ML/day is predicted to be negligible. There is predicted to be an increase in the frequency of flows less than 10 ML/day. Wallarah Creek drains an already disturbed and modified catchment including runoff from the F3 Freeway.

**Meeting Discussion Points**

W2CP agree that appropriate mitigation measures will be put in place to conserve the natural flow characteristics of the Wallarah Creek, and would value further input from the IESC in this regard.

- Clarification of the advice and related expectations

## 2.17 ISSUE 14

*The proponent has entitlements to extract water from both surface and groundwater sources within the proposed extraction area. The proposed project requires external water to make up the deficit. The proponent has advised that this will be done through town water supplies with relevant licences still to be obtained. It is suggested that an assessment be made on the potential impacts of extracting water from town sources during extreme weather periods including drought conditions.*

**Relevant Sections of the EIS**

- Section 7.3.3 of Main Report
- Section 4.2 of Appendix J

**Response in Exhibition EIS**

The Project does not require a water licence to take water from town water supplies. The Project will only require an agreement with the relevant local council .

Water to be sourced from town water supplies is a negligible proportion of the available water supply. The maximum demand of 52 ML in Year 1 represents 0.14% of the 36,750 ML/year allocated for town water supplies (see Section 7.3.3 of Main Report). The Gosford Wyong Councils Water Authority has planned for future development of the water supply scheme to raise the yield of the system to 50,000 ML/year by 2050. Therefore, the impact of the Project on the water supply scheme will only decrease further in the future.

Clause 28 of the *Central Coast Unregulated WSP* states that the extraction limit of 36,750 ML/year is based on drought demand. Therefore, the Project will take only a negligible amount of water from the town water supply during drought conditions.

**Meeting Discussion Points**

The setting of extraction limits under WSPs has accounted for drought conditions. As described earlier, the proponent has already commenced securing water entitlements under the relevant Water Sharing Plans. The assessment has shown that the Project's demand on town water supplies is negligible compared to the available 36,750 ML/year during drought conditions.

- Clarification of the advice and related expectations

### 2.18 ISSUE 15

*The Northern Sydney Basin has been identified as a Bioregional Assessment priority region. Data and relevant information from the proposed project should be made accessible for this Bioregional Assessment to assist the knowledge base for regional scale assessments.*

**Response in Exhibited EIS**

WACJV agrees that data and relevant information from the proposed project can be made accessible for the Bioregional Assessment of the Northern Sydney Basin.

Wallarah 2
COAL PROJECT

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31 July 2013

Ms Mahani Taylor
Director, South-Eastern Australia Assessment Branch
Department of Sustainability, Environment, Water, Population & Communities
GPO Box 787
CANBERRA ACT 2601

Dear Ms Taylor,

**WALLARAH 2 COAL PROJECT (EPBC 2012/6388) INDEPENDENT EXPERT SCIENTIFIC COMMITTEE ADVICE**

We are very grateful for the opportunity to meet last week to discuss the issues raised by the Independent Expert Scientific Committee (IESC) in its advice on the Wallarah 2 Coal Project (the Project). This letter provides additional information in response to questions raised during the meeting. The information in this letter should be read in conjunction with the original response to the IESC's advice (dated 4 July 2013).

This letter provides additional information relating to issues 4, 10, 11 and 13.

**Issue 4**

*The proposal indicates that brine and salt concentrate could potentially be stored below ground within the extracted coal seam. Monitoring of groundwater quality, particularly in relation to the storage of salt concentrate, along with mitigation measures, would be required to ensure water quality is not degraded. Contamination of the regional groundwater supply could have severe ramifications for the water quality of the Gosford-Wyong Water Supply Scheme. Due to the potential risk involved, a rigorous groundwater monitoring system is needed to identify and then mitigate any impacts.*

Response

The Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) has requested further details on the monitoring of electrical conductivity (EC) values in groundwater.

The groundwater monitoring network will include pore pressure monitoring boreholes across

the region to assess strata depressurisation resulting from mining operations. These installations are widely deployed in the mining industry and are known to offer high accuracy and robustness. Each installation will be comprised of up to 8 pore pressure transducers installed as a vertical array in each borehole; the transducer array will be fully grouted into position to prevent up-hole leakage. These installations will deliver semi-continuous monitoring (8 hourly sampling) with data stored on a data logger at the surface. Monitoring will be maintained post-mining until recovery trends are confirmed.

Measurement and monitoring of groundwater quality in the workings post-mining presents a number of challenges due to the depth of the mining operations and the need to obtain water samples for ionic speciation. The Project will mine at depths of cover of 350 m to 690 m. The proponent proposes to establish at least two 'open' boreholes that will facilitate sampling and monitoring of groundwater. These boreholes will be located in areas where the depth of cover is lowest. Whilst the most appropriate apparatus has not been established, it is likely that a salinity sonde fitted with a water sampling cell will be installed semi permanently in the boreholes. This apparatus will allow semi-continuous monitoring of salinity (in situ). The apparatus will be removed from time to time for servicing and at these times, the water sample would be decanted and submitted for ionic speciation (laboratory analyses). Specialised cabling and retrieval apparatus will be developed during the early years of mining to ensure functionality of the installations post mining.

SEWPaC also requested further details of the likely impacts of brine disposal on salinity of groundwater.

The stored salt (solid) waste is expected to remain relatively immobile as re-saturation of the workings and surrounding strata occurs post mining. Immobility is attributed to the sealed storage and to the increased density of the waste which is more than 60% higher than the resident groundwater.

The brine retained in goafs has the potential to disperse and mix with inflowing groundwater during recovery of pore pressures. A worst case would involve complete mixing. Calculations based on the inflowing groundwater uniformly mixing throughout the abandoned workings, indicate a mixed solution would exhibit a salinity of approximately 8,600 mg/L compared to a naturally occurring formation groundwater salinity of approximately 7,500 mg/L. The mixed groundwater, whilst similar to the regional groundwater, is expected to be isolated from the surficial alluvial aquifer by the presence of the Patonga Claystone and the underlying Tuggerah Formation.

**Issue 10**

*The proponent has not considered the potential impacts on the surrounding creeks and water quality as a result of uncontrolled discharge from the mine operations dams. The mine operations dams are currently designed to contain a 100 year average recurrence interval 72 hour storm event. Consideration should be given to mine operation dams being redesigned to contain a larger storm event (1 in 1000 year average recurrence interval) to minimise the potential for downstream water quality and ecological impacts.*

Response

SEWPaC has requested further details of the design parameters for the mine water management system.

The Mine Operations Dam (MOD) has not been sized for the 100 year average recurrence interval (ARI), 72 hour storm event. This design approach is problematic because the critical duration for the sizing of containment systems can be much longer than 72 hours. Instead, the MOD has been sized using a long term continuous simulation rather than a simple calculation of event runoff volume. There are 122 years of recorded rainfall data for the area. The water balance simulation has confirmed that the mine water management system will not overflow during any rainfall conditions in this 122 year period. Designing the mine water storages to contain water for all historical rainfall conditions is considered industry best practice.

SEWPaC has also asked for an indication of the additional dam capacity that would be required to contain a 1,000 year ARI storm. The MOD has a design capacity of 180 ML. Based on the catchment area of the MOD, the runoff volume during a 100 year ARI, 72 hour storm is approximately 25 ML (assuming 100% runoff). In comparison, the runoff volume for a 1000 year ARI, 72 hour storm is approximately 35 ML.

The MOD is a "turkeys nest dam" that receives water pumped from the underground sump and other surface dams. The dam is managed by way of specific operating rules that consider pumping arrangements and freeboard requirements. Operating rules allow for pumping to the MOD to be ceased for a period of time. Where necessary, pumping from the underground sump to the MOD can be temporarily ceased to manage water levels in the MOD during extreme wet periods.

**Issue 11**

*Further assessment is recommended to gauge the extent of water interaction within the extraction boundary. The proponent has assessed the calibration of the runoff model using a gauging station on the Wallarah Creek. It is noted that the station only operated from 1965 to 1976 and is not located within the main project area. This dataset provides limited confidence in the calibration of the surface water balance.*

Response

SEWPaC accepted that 11 years of monitoring data is of sufficient duration to provide confidence in the calibration of the water balance model. However, SEWPaC has asked whether data from prior to 1976 is still reliable for current modelling purposes.

The attached figure provides a comparison of a catchment topographic map with a current aerial photograph. This comparison demonstrates that the existing catchment has a low level of development and is dominated by forest and some cleared areas. The distribution of forested areas does not appear to have changed significantly between 1985 and 2013. Given that the catchment characteristics have not changed significantly in the last 28 years, the

streamflow data recorded from 1965 to 1976 provides a good representation of the hydrologic response of the existing catchment.

Issue 13

*The release of controlled treated mine water is likely to occur when there is no natural flow in Wallarah Creek, and these releases have the potential to change flow regimes of the creek. The proponent has stated that Wallarah Creek will remain ephemeral in nature, after water releases have been made. It is recommended that mitigation measures are put in place to conserve the natural flow characteristics of the Wallarah Creek.*

SEWPaC has requested further details of the impacts of treated water discharges to Wallarah Creek.

It is not possible to discharge water to Wallarah Creek without affecting the natural flow characteristics. However, the maximum discharge rate of 3 ML/day will result in a very low water level within the stream (see Section 4.5.4 in Appendix J of the EIS). Due to the low flow rate and the good condition of bank vegetation, discharges of treated water are not predicted to impact the geomorphology of Wallarah Creek. The Ecological Impact Assessment predicts that riparian vegetation will not be impacted by discharges due to the low flow rate (see Section 6.3.5 in Appendix O of the EIS). Given that treated water discharges are not expected to result in any ecological or geomorphological impacts, mitigation measures should not be necessary.

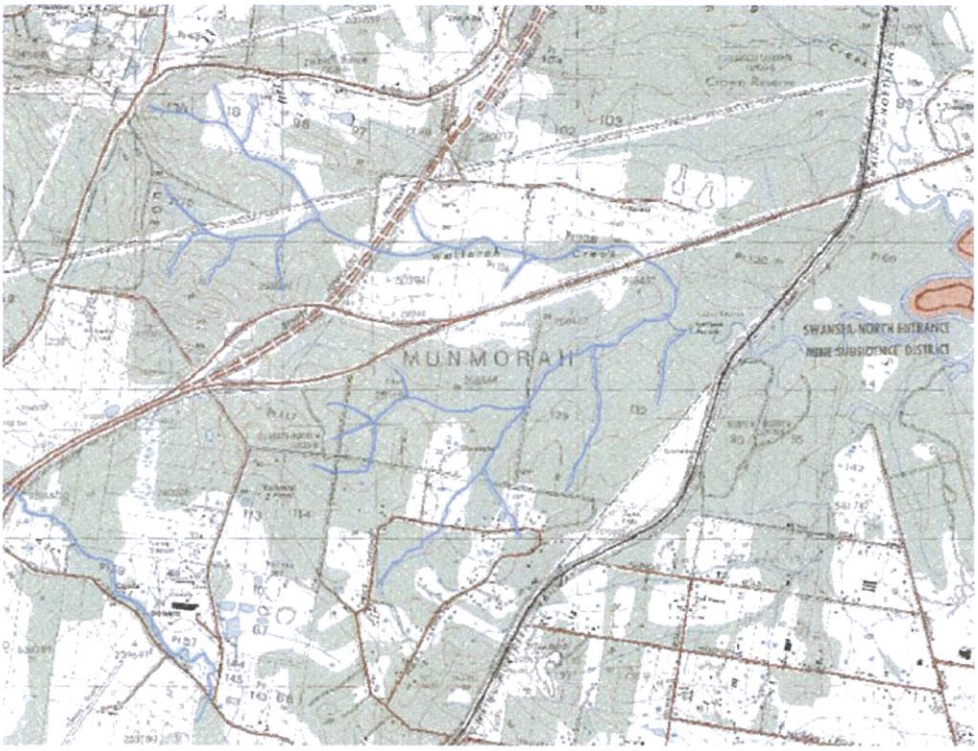
We trust that this information assists SEWPaC in preparing their submission to the NSW Department of Planning and Infrastructure. Please do not hesitate to contact us if you require any further assistance.

Yours sincerely

Kenny Barry
Project Manager

Attached: Comparison of Wallarah Creek Catchment figure

**1985**

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WALLARAH 2 COAL PROJECT

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Comparison of Wallarah Creek Catchment