Mangoola Coal Continued Operations Major Project

Critical Review of the Assessment of Impacts to Terrestrial Ecology

December 2020

Prepared by Ziggy Andersons for Muswellbrook Shire Council

Contents

Executive Summary

I was requested by Muswellbrook Shire Council to undertake a critical review of the Mangoola Coal Continued Operations State Significant Development Application (SSD 8642) as it relates to the assessment of the impact to terrestrial ecology. I considered, in particular, the assessment of the direct, indirect, and cumulative impacts to the Muswellbrook Endangered Population of *Diuris tricolor* and of any matters that would have a material impact on the outcome of the impact assessment. The below is a summary of the findings of my critical review.

The vegetation plots within a portion (Vegetation Zone 6) of the native vegetation on the Mangoola Coal Continued Operations (MCCO) Development Footprint were not undertaken at the appropriate time of year to maximise the detectability of native species. Four of the six vegetation plots within Vegetation Zone 6 were undertaken in July (winter) when many native groundcover species are dormant (for example terrestrial orchids). If the vegetation surveys were undertaken at an appropriate time of year the 160.04 hectare Vegetation Zone 6 would potentially require offsetting.

The Applicant's Consultant undertook a subsequent 'sensitivity analysis' to demonstrate that there was unlikely to be any changes to the outcome if the surveys within Vegetation Zone 6 were done at a more appropriate time of year and more species were recorded. However, a site attribute (species richness) which required considerable change to alter the outcomes of the calculations was used in the 'sensitivity analysis' instead of an equally appropriate attribute (native groundcover other) that required only a very small change to alter the outcomes of the calculations. The Applicant's Consultant should and could have redone the plots at the appropriate time of year consistent with the *The NSW Guide to Surveying Threatened Plants* (OEH 2016) instead of undertaking the 'sensitivity analysis'.

The proponent has not adequately surveyed for threatened flora within the Development Footprint, particularly for the Muswellbrook Endangered Population of *Diuris tricolor* (*Diuris tricolor*) and the threatened orchid *Prasophyllum petilum*. The threatened flora survey method and effort applied was inconsistent with the relevant guidelines and insufficient surveys were undertaken in areas identified by the Applicant's Expert as being potential orchid habitat.

The surveys that are greater than five years old which the Applicant's Consultant relied on for meeting survey effort requirements are not able to be utilised as per the relevant guidelines due to their age. Where extrapolation was used in lieu of targeted surveys for *Prasophyllum petilum* none of the data used to generate the predicted densities was provided, and no statistical analysis was applied to the calculations used to derive the predicted densities which is a requirement of the relevant guidelines. Using the orchid densities predicted by the Applicant's Expert Dr Stephen Bell higher numbers of individuals of both species would be expected in the Development Footprint.

There is considerable discrepancy between the number of *Diuris tricolor* assessed as part of the existing Mangoola Coal Project (PA 06_0014) (two individuals) versus the indeterminate number (a high number based on the figures provided) recorded by the Applicant's Consultant and Expert within the Mangoola Coal Project Disturbance Footprint in subsequent post approval surveys. There are considerably less *Diuris tricolor* records on the DPIE Bionet Atlas compared to the number recorded by MCCO's Consultants. The provision of these records is a condition of the respective licenses where work is done pursuant to the license with this data being critical for the assessment and subsequent

review of the assessment of the cumulative impact of this and other projects by regulatory authorities.

The BAR and EIS do not adequately address the cumulative impacts of the proposal on biodiversity (section 4.4.6 of the BAR). The cumulative impacts of the Mangoola Coal project (Part 3A) and the MCCO project on the *Diuris tricolor* Endangered Population is a significant percentage loss (30%) of the Scientific Committee Final Determination predicted area of habitat for this species. The cumulative impact to *Diuris tricolor* cannot be addressed through mitigation measures or the provision of offsets as these measures do not reduce the total area of known and potential habitat being directly impacted upon as a result of these projects.

The targeted herpetological surveys undertaken for the MCCO project are not consistent with *The Threatened Species Survey and assessment: Guidelines for developments and activities (working draft)* (DEC 2004). Therefore, the surveys conducted cannot be considered as adequate, in regard to the *Biodiversity Conservation Act* and *Environmental Protection Biodiversity Conservation Act* listed species *Delma impar* and *Aprasia parapulchella*. The BAR failed discuss or even consider the potential presence of *Delma impar* despite there being records of this species within the locality on the Department of Planning Industry and Environment (DPIE) BioNet database that predate the submission of the development application. In addition, the DPIE Threatened Biodiversity Profile Data Collection (TBPDC) identifies much of the vegetation that occurs on the Development Footprint as being potential habitat for both these reptile species.

Declaration

My name is Ziggy Andersons;

I have read the Expert's Code of Conduct set out in Appendix A and I agree to be bound by it;

I am an employee of Muswellbrook Shire Council at the time of signing;

I have experience and qualifications relevant to the content of this Expert Report including:

- I have a Bachelor of Science (Botany Major) (2010) from the University of New England;
- I am a Biodiversity Assessment Method Accredited Consultant #BAAS17103 under the Biodiversity Conservation Act 2016; and
- I have over 10 years' experience as an ecologist (see attached CV)

Ziggy Andersons

27/11/2020

Glossary

Applicant – Mangoola Coal Operations Pty Limited

Applicant's Consultant – Umwelt (Australia) Pty Limited

Applicant's Expert – Dr Stephen Bell

BAR – Biodiversity Assessment Report

BBCC – BioBank Credit Calculator

BC Act – Biodiversity Conservation Act 2016

BCD – Biodiversity Conservation Division of DPIE

DPIE – NSW Department of Planning Industry and Environment

Development Footprint - The total area of impact associated with the Mangoola Coal Continued Operations Project.

EEC – Endangered Ecological Community

EIS – Environmental Impact Statement

EPBC Act – Environmental Protection and Biodiversity Conservation Act 1999

ESD – Ecological Sustainable Development

FBA – Framework for Biodiversity Assessment

Mangoola Coal Project – The existing approved Mangoola Mine (PA 06_0014)

NGCO – Native Ground Cover Other

NPSR – Native Plant Species Richness

PCT – Plant Community Type

RTS – Response to Submissions

RFI – Request for Information

SAS – Site Attribute Score

TBPDC – Threatened Biodiversity Profile Data Collection

VIS – Vegetation Information System

Adequacy of Vegetation Plots Within Zone 6

1. The vegetation plots within a portion (Vegetation Zone 6) of the native vegetation on the Mangoola Coal Continued Operations (MCCO) Development Footprint were not undertaken at the appropriate time of year to maximise the detectability of native species. Four of the six vegetation plots within Vegetation Zone 6 were undertaken in July (winter) when many native groundcover species are dormant (for example terrestrial orchids). If the vegetation surveys were undertaken at an appropriate time of year, Vegetation Zone 6 would potentially require offsets for an additional 160.04 hectares of native vegetation.

2. The Applicant's Consultant undertook a subsequent 'sensitivity analysis' to demonstrate that there was unlikely to be any changes to the outcome if the surveys within Vegetation Zone 6 had they been done at a more appropriate time of year and more species were recorded. However, a site attribute (species richness) which required considerable change to alter the outcomes of the calculations was used in the 'sensitivity analysis' instead of an equally appropriate attribute (native groundcover other) that required only a very small change to alter the outcomes of the calculations. The Applicant's Consultant should and could have redone the plots at the appropriate time of year consistent with the *The NSW Guide to Surveying Threatened Plants* (OEH 2016) instead of undertaking the 'sensitivity analysis'.

3. As per the MCCO EIS Appendix 13 – Biodiversity Assessment Report (BAR) (Umwelt 2019a), the vegetation communities within the Development Footprint were assigned to Plant Community Types (PCTs). PCTs were aligned with types described in the Vegetation Information System Classification Database (VIS). PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box Shrub - Grass Open Forest of the Central and Lower Hunter (HU817) was determined by the Consultant to be the dominant PCT, occupying 357.53 ha or approximately 57% of the 623.3 hectare (ha) Development Footprint.

4. PCT 1603 conforms to the *Biodiversity Conservation Act 2016* (BC Act) listed Central Hunter Grey Box - Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions Endangered Ecological Community (EEC) (Section 3.2.2.3 BAR).

5. The Consultant determined this PCT occurred in two different condition states and therefore split the vegetation into two zones, Zone 5 (197.49 ha) and Zone 6 (160.04 ha); Zone 5 was described as Moderate to Good – Derived Native Grassland (Section 3.2.1.5 BAR); and Zone 6 as Low Condition – Derived Native Grassland (Section 3.2.1.6 BAR).

6. The data used to determine condition state was derived from vegetation plots undertaken as per the assessment method used, the Framework for Biodiversity Assessment (FBA). However, four of the six vegetation plots within Zone 6 were conducted during Winter (July) (Umwelt 2019a). The remaining two vegetation plots were undertaken in March (Umwelt 2019c). The Department of Planning Industry and Environment Biodiversity Conservation Division (BCD) stated that by undertaking vegetation plots in July it '*raises the question of potential bias in the assessment method'* (BCD 2019).

7. The Scientific Committee Final Determination for the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions Endangered Ecological Community (for which PCT1603 qualifies (Section 3.2 of BAR)) states that '*at any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers*' (DPIE 2020).

8. Two examples of flora species that lay dormant, are only detectable seasonally, and are predicted to occur with the PCT1603 attributed to Zone 6 are the two threatened terrestrial orchids *Diuris tricolor* and *Prasophyllum petilum.* Both of these species have been recorded within this vegetation community and throughout the Development Footprint as a whole. *Diuris tricolor* only flowers in September and October, and *Prasophyllum petilum* from

September to December. The detectability of both species is also dependant on prevailing climatic conditions with '*dry winters in the Hunter Valley generally result in below average flowering in terrestrial orchids'* (Bell 2019).

9. In response to the BCD's concerns (BCD 2019) relating to the timing and the consequent adequacy of the vegetation plots undertaken within Vegetation Zone 6, the Applicants Consultant undertook a 'sensitivity analysis' (Pg. 43-44 Umwelt 2019c). Tha Applicant's Consultant used the sensitivity analysis to attempt to demonstrate that the timing of the surveys was in fact appropriate. However, the Applicant's Consultant should and could have redone the plots at the appropriate time of year consistent with the *The NSW Guide to Surveying Threatened Plants* (OEH 2016) based on the date on the response to submissions document instead of undertaking the 'sensitivity analysis'.

10. Based on the use of the floristic data collected, Vegetation Zone 6 generated a site value score of 16.67 (Section 3.2.1.6 BAR). The threshold for vegetation requiring an offset is a site value score of 17. Had Vegetation Zone 6 passed the threshold requiring offsetting, it would have resulted in the requirement for an additional 160.04 ha to be offset or an approximate 40% increase in the MCCO project's offset requirements.

11. Using the data provided within the BAR, I replicated the results of the BioBank Credit Calculator (BBCC) presented within the BAR. By applying the same attribute data from plots collected at the appropriate time of year (March) (plots M020_Q and MQ44) to the four plots undertaken in July, I calculated a site value score greater than 17. This indicates that if all the surveys were undertaken at the appropriate time of year, Vegetation Zone 6 would likely require offsetting.

12. While replicating the Applicant's Consultant's analysis of the BBCC for Vegetation Zone 6, I determined that their sensitivity analysis used a parameter (species richness) that is much less likely to change the outcome of the BBCC calculations.

13. Based on the vegetation plot data provided in the BAR for Vegetation Zone 6 (Appendix D of the BAR) Native Plant Species Richness (NPSR) (the metric Umwelt used in the Applicant's Consultant's Sensitivity Analysis that is a measure of species diversity) came in at 10.17% of benchmark for PCT-1603 generating a Site Attribute Score (SAS) of 1. Based on Table 2 (Page 13) of the FBA, the SAS of 1 for NPSR has a range of >10 - <50% benchmark which means that, at 10.17%, the zone's percentage benchmark score is at the bottom of the broad percentage benchmark range for a SAS score of 1.

14. PCT-1603 has a NPSR benchmark of 41, using a native species richness score of 10 (which represents the average native species recorded in all plots in zone 6) it would take an additional 11 or a doubling of native species to be recorded within the vegetation plot to result in any change to the BBCC output. Therefore, it would take a considerable increase in native species to 'push' the site attribute score up into a SAS of 2 and a resulting change to the BBCC outcome.

15. I then ran scenarios using changes in Native Ground Cover (Other) (NGCO), the site attribute that is also highly likely to change based on seasonality. Native Ground Cover Other is a measure of how many times a native species (other than tree, shrub or grass) occurs at 1 of 50 points along a 50m transect.

16. With PCT-1603 having a NGCO benchmark of 20-40 Zone 6 came in at 93% of Benchmark. This means that NGCO sits close to the upper limit for SAS 2 which has a lower range of 50 – <100%. Therefore to 'push' the SAS to 3 and the site value score to 17.19 triggering an offset requirement for Vegetation Zone 6, it would only require <u>four more native groundcover individuals</u> (not species) other than grass to occur within any one of the six vegetation plots; or <u>one additional native groundcover individual (not species) in four of the six plots</u>.

17. The four plots within Zone 6 that were undertaken in July need to be undertaken again at an appropriate time of year that maximises the detectability of native species in particular groundcover (other) and they should be stratified randomly in vegetation representative of the condition state of Zone 6 as per Section 5.3.2 of the FBA. This plot data will then need to be used to re-run the BBCC.

Adequacy of Threatened Flora Surveys

18. The proponent has not adequately surveyed for threatened flora within the Development Footprint, particularly for the Muswellbrook Endangered Population of *Diuris tricolor* (*Diuris tricolor*) and the threatened orchid *Prasophyllum petilum*. The threatened flora survey method and effort applied was inconsistent with the relevant guidelines and insufficient surveys were undertaken in areas identified by the Applicant's Expert as being potential orchid habitat.

19. The surveys which are greater than five years old which the Applicant's Consultant relies on for meeting survey effort requirements are not able to be utilised as per the relevant guidelines due to their age.

20. Where extrapolation was used in lieu of targeted surveys for *Prasophyllum petilum* none of the data used to generate the predicted densities was provided, and no statistical analysis was applied to the calculations used to derive the predicted densities which is a requirement of the relevant guidelines.

21. Using the orchid densities predicted by the Applicant's Expert Dr Stephen Bell higher numbers of individuals of both species would be expected in the Development Footprint.

Threatened Flora Surveys

22. The BAR identifies *The NSW Guide to Surveying Threatened Plants* (OEH 2016) as being one of the '*Key Resources, Policies and Documents*' (Section 1.4 of BAR) used during the preparation of the BAR for the MCCO Project.

23. Section 6.6.1.5 of the FBA states that '*Threatened species surveys for any species other than amphibians must be undertaken in accordance with the OEH threatened species survey guidelines*' (my emphasis).

24. The NSW Guide to Surveying Threatened Plants (OEH 2016) states that '*The preferred approach recommended in this guide is the parallel field traverse (i.e. parallel transects sensu Cropper 1993). Detectability of threatened plants is increased by using the parallel field traverse method because it systematically covers the entire area of suitable habitat within a site and it can be applied to a diverse range of species, habitats and sites. The use of survey plots/quadrats or a random meander within an area of suitable habitat is not considered adequate (in comparison to parallel field transects) to meet the objectives of this guide'* (my emphasis). Alternatively, '*Large areas of suitable habitat can be assessed using a two-phase grid-based systematic survey approach*.'

25. The NSW Guide to Surveying Threatened Plants (OEH 2016) states that '*Surveys undertaken more than five years prior to the proposal lodgement date may be used to inform the assessment process but cannot be used in place of a targeted species survey. This is to ensure results are current with respect to site condition, structural attributes and species' presence'* (my emphasis)

26. With the BAR being dated June 2019, the threatened flora surveys undertaken in 'Spring' 2013 (yellow lines on Figure 2.3 of the BAR) are unable to be used to satisfy survey effort requirements as per The NSW Guide to Surveying Threatened Plants (OEH 2016).

27. As indicated in Figure 2.3 of the BAR, the threatened species surveys within the Development Footprint were undertaken by way of random meander and therefore were conducted inconsistent with the relevant guideline.

28. The survey effort for threatened flora may *appear* substantial as presented by Umwelt in Figure 2.3 of the BAR (**Figure 1**). However, if one excludes the 2013 surveys due to their age and the survey effort outside of the Development Footprint and instead concentrate on the area covered within the Development Footprint (the dark blue polygon in Figure 2.3 of Appendix 13 BAR) (**Figure 1**) the effort applied was far from a comprehensive survey for threatened flora. Therefore, the Applicant's Consultant's assessment of the impact of the proposed project on threatened flora is not consistent with the relevant guidelines.

29. The BAR determined that the project will result in the removal of 1,326 individuals of *Diuris tricolor*. However, this is unlikely to be a true reflection of the number of individuals that will be directly impacted upon by the MCCO project. This is due to the threatened flora survey effort and methodology applied being inconsistent with the relevant policies and guidelines and therefore more individuals are likely to be present than were recorded. In addition, even if surveys were conducted in accordance with the relevant policies and guidelines, the Applicant's own literature, which specifically relates to the Development Footprint, states that '*more than 80% of individuals are likely to be overlooked in any single-day survey*' (Vizer 2013).

30.

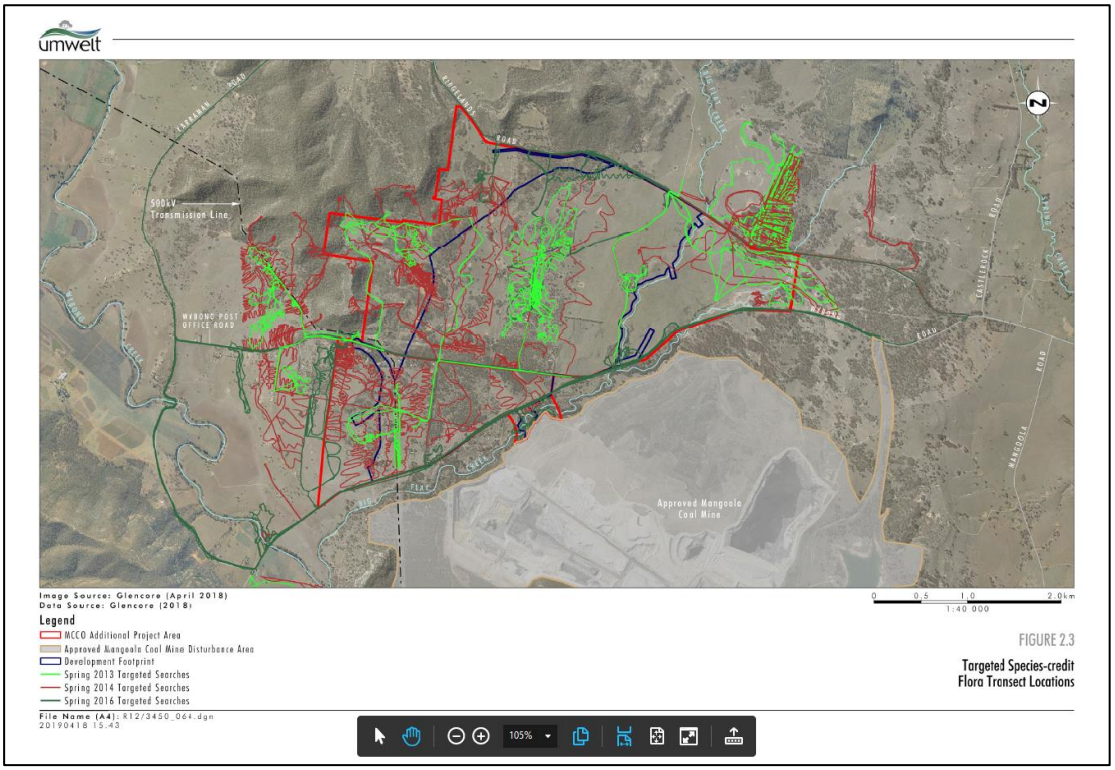

Figure 1: BAR Figure 2.3 – Targeted Species-credit Flora Transect Location

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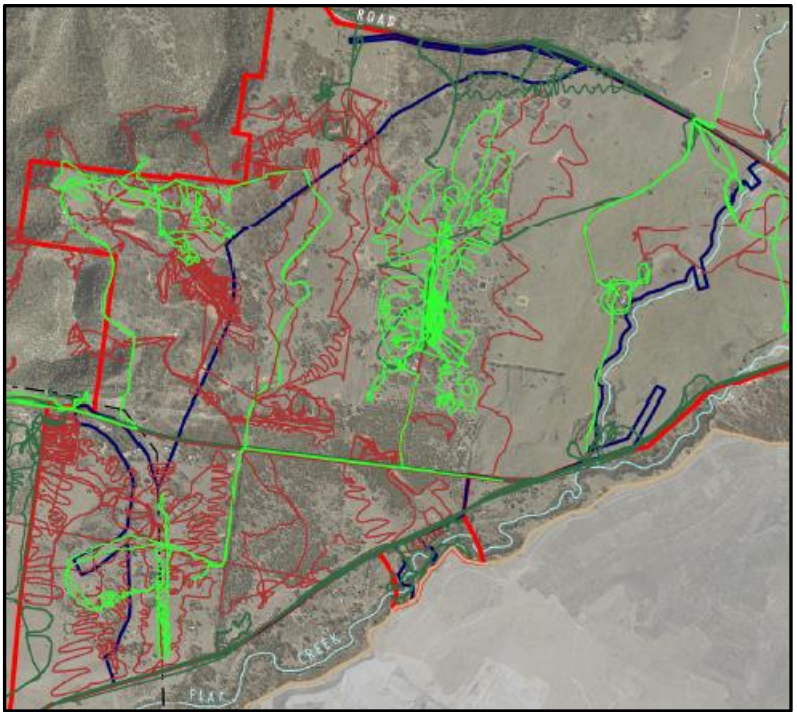

Figure 2: Cropped extract from Figure 2.3 of the MCCO Project BAR

Potential Orchid Habitat

32. Figure 18 of the Expert Report (Bell 2019) (**Figure 3**) is a graphic depiction of how much of the Development Footprint the Applicant's Expert determined as being 'potential orchid habitat'. In addition, the '*BCD regards vegetation zones 1 to 9 as known or potential habitat within the proposed impact area, totalling 567.81 hectares*' (BCD 2019). The TBPDC identifies PCT 1603 as being potential habitat for *Prasophyllum petilum* and *Diuris tricolor*, 492.74 hectares of this PCT occur within the Development Footprint (DPIE 2020).

33. When extrapolating the survey effort graphically displayed in the cropped extract from Figure 2.3 of the BAR (**Figure 2**) over Figure 18 of the Expert Report (Bell 2019) (**Figure 3**), it is clear that the Applicant has applied insufficient survey effort within potential *Diuris tricolor* and *Prasophyllum petilum* habitat.

34. Figure 18 of the Expert Report (Bell 2019) (**Figure 3**) identifies (as black squares) the woodland area adjacent to the existing Mangoola Mine as being Non-Orchid Habitat. However, there are numerous records for both orchid species within this locality, with Applicants Consultant identifying this same habitat as containing a population of *Prasophyllum petilum* (Figure 3.7 of BAR).

35.

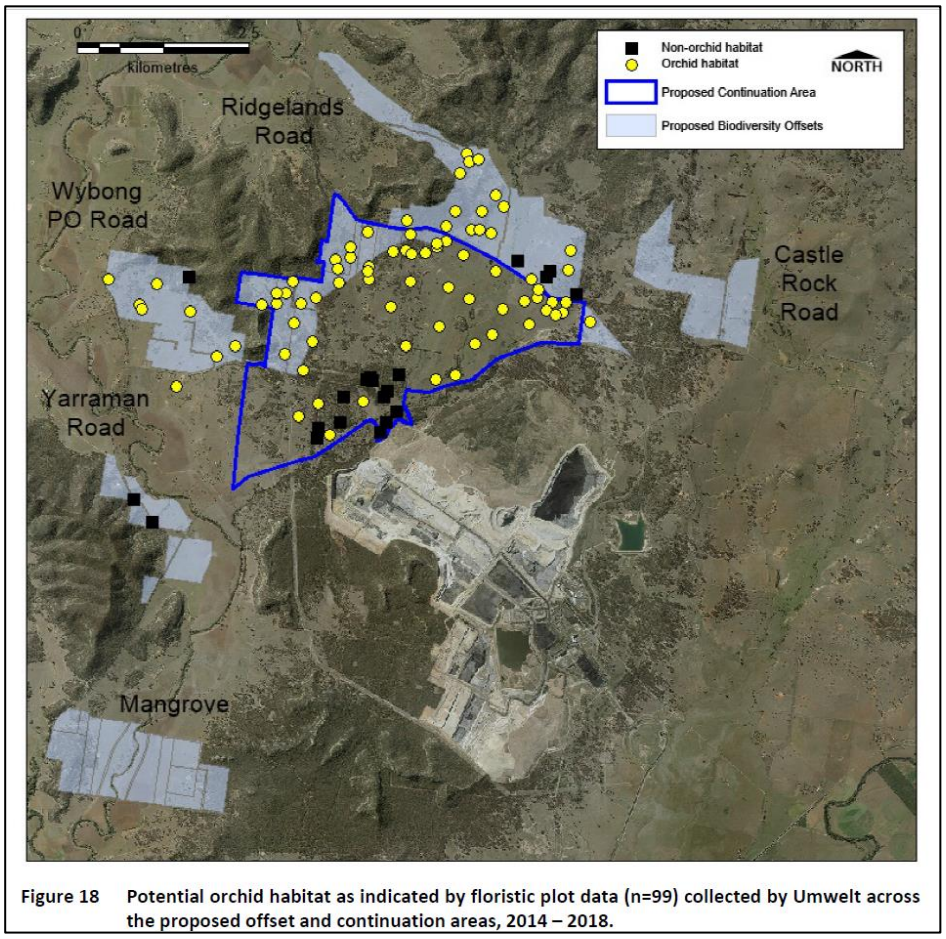

Figure 18 Potential orchid habitat as indicated by floristic plot data (n=99) collected by Umwelt across the proposed offset and continuation areas, 2014 – 2018.

Figure 3: Figure 18 of the Expert Report (Bell 2019)

<u>*Prasophyllum petilum* Extrapolation</u>

36. In lieu of undertaking surveys of the proposed offset sites, the Applicant's Consultant extrapolated the density of *Prasophyllum petilum* as allowed by *The NSW Guide to Surveying Threatened Plants* (Section 5.2 of OEH 2016). However, the Applicant's Consultant chose to only extrapolate the density of *Prasophyllum petilum* within a limited portion of the Development Footprint and undertook surveys within the remainder of the potential habitat that occurs within the Development Footprint.

37. Regarding the application of extrapolation, The NSW Guide to Surveying Threatened Plants (OEH 2016) states that '*Small groups of individuals (<50 plants) can be counted with reasonable confidence. However, larger populations (>50 plants or >0.1 hectare area of occupancy) can't be counted without noticeable error (Cropper 1993, Keith 2000). In this case it is best to extrapolate the density by sampling over the area of occupancy. Samples can be stratified according to areas of differing density, and counts made within quadrats or transects can be used to estimate the population within occupied habitat'*.

38. In accordance with The NSW Guide to Surveying Threatened Plants (OEH 2016), instead of just extrapolating over an arbitrary portion of the Development Footprint the Applicant should have extrapolated the entirety of the Development Footprint and the fact they did not renders the impact assessment apt to mislead.

39. The Applicant's Consultant's justification for using extrapolation in just the one area was due to '*Survey timing restrictions prevented formal transects being walked across the entirety of the small area of potential habitat*' (3.3.2 of the BAR). The 'single transect' (random meander) that Applicant's Consultant used to extrapolate *Prasophyllum petilum* densities is

not consistent with *The NSW Guide to Surveying Threatened Plants* (OEH 2016) which requires the use of quadrats or transects.

40. Threatened flora surveys within the extrapolation area were undertaken in Spring 2014 with the BAR finalised in June 2019. This gave Applicant's Consultant 5 years to undertake additional surveys.

41. As per *The NSW Guide to Surveying Threatened Plants* (OEH 2016) '*The number of sampling points must be adequate to determine, with confidence, the size of the population. Confidence can be assessed by recording the variance, standard deviation and standard error of the population estimate. The sampling method, raw data and approach taken to estimate the total population of the species must be clearly described and justified in the BAR'*. No details on the level of confidence (statistical analysis) of the extrapolation results were provided in the BAR.

42. Based on the information provided by the Applicant's Consultant the *Prasophyllum petilum* Individual Extrapolation Area polygon does not align with any vegetation type boundaries or abiotic boundaries. Nor is any justification provided within the BAR for the location and extent of the Individual Extrapolation Area polygon which the Applicant's Consultant describes as 'potential habitat area' (3.3.2 BAR).

43. The TBPDC identifies PCT 1603 as being potential habitat for *Prasophyllum petilum*, 492.74 hectares of this PCT occur within the Development Footprint. The Applicant's own surveys recorded 634 individuals throughout the Development Footprint outside of the Individual Extrapolation Area in addition Figure 18 of the Expert Report (Bell 2019) indicates that much more than 13 ha of *Prasophyllum petilum* habitat occurs within the Development Footprint.

44. Only 57 *Prasophyllum petilum* individuals were extrapolated to occur (Umwelt 2019a), which is only slightly more than the 50 individuals that The NSW Guide to Surveying Threatened Plants states '*can be counted with reasonable confidence'.* Therefore, the justification for restricting the extrapolation to 13 ha rather than the 492.74 ha of potential habitat is inconsistent with *The NSW Guide to Surveying Threatened Plants* (OEH 2016).

45. The BAR states that '*the species polygon is shown for presentation purposes and does not reflect an area of habitat*' (3.3.2.1 BAR) which is a direct contradiction to the fact that the Applicant's Consultat identified the entire 13 ha polygon as containing four individuals per hectare.

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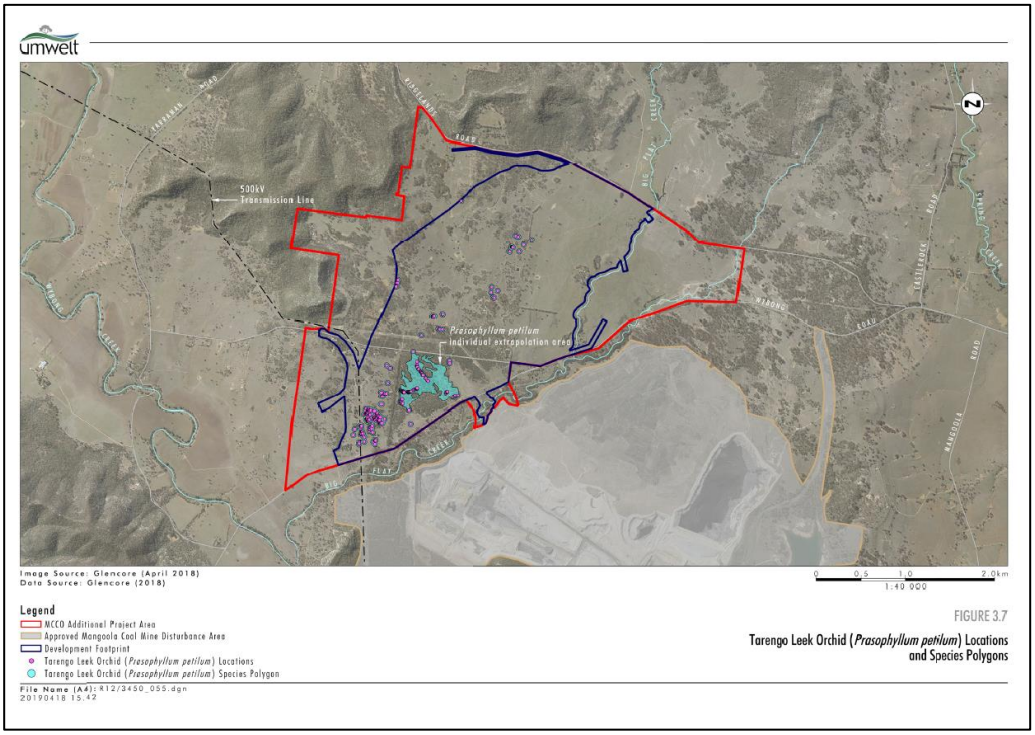

Figure 4: Figure 3.7 of the BAR.

47. The minimal survey effort that was undertaken within the *Prasophyllum petilum* Individual Extrapolation Area (Figure 3.7 BAR) (**Figure 5**) indicates significantly higher densities than four individuals per hectare. However, the data used to extrapolate the population size was not provided, in particular the number of individuals recorded along the 'transect' and the area that was covered by the 'transect'.

48. As stated in the Expert Report '*Prasophyllum detection is considerably more difficult than Diuris due to the small stature and insignificant flowers of this species when compared to Diuris, and consequently I suspect that many Prasophyllum individuals were overlooked during these targeted surveys (2010-2015)*' (Bell 2019). Therefore, based on the single 'transect' that was undertaken, the predicted density cannot be considered an accurate reflection of the number of individuals within this location.

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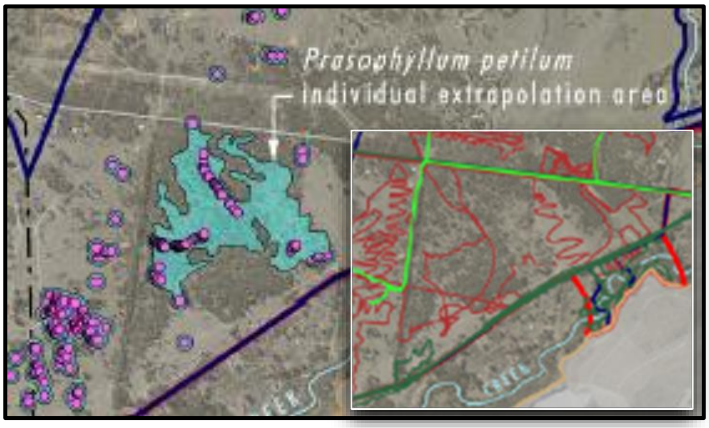

Figure 5: Cropped extract of Figure 3.7 of the BAR overlain by cropped extract of Figure 2.3 of the BAR (Umwelt 2019a)

50. Therefore, the approach taken by the Applicant's Consultant in extrapolating the density of *Prasophyllum petilum* within the Tarengo Leek Orchid (*Prasophyllum petilum*) Species Polygon (Figure 3.7 of the BAR) (**Figure 4**) is inconsistent with *The NSW Guide to Surveying Threatened Plants* (OEH 2016). This is due to the inappropriate survey method and limited effort applied, the confidence not being detailed as per the requirements of *The NSW Guide to Surveying Threatened Plants* (OEH 2016), and the extent of the Tarengo Leek Orchid (*Prasophyllum petilum*) Species Polygon not being adequately justified.

51. Therefore, the BAR provides an inaccurate assessment of the number of individuals and the MCCO project would likely result in a greater impact than has been represented by the applicant or assessed by the regulator.

Potential Number of Individual Orchids on Development Footprint

52. Due to poor conditions for surveys in 2017-2018, the BCD approved an expert, Dr Stephen Bell, to prepare an expert report titled *Expert Report - Expected Presence of Threatened Terrestrial Orchids (Diuris tricolor & Prasophyllum petilum): Mangoola Coal Continued Operations Project* (Expert Report) (Bell 2019) to determine what number of individuals of *Diuris tricolor* and *Prasophyllum petilum* potentially occur on the proposed MCCO offset sites.

53. The Expert Report determined a range in densities (Table 7 of Bell 2019) for both *Diuris tricolor* (Minimum density 2 (low quality habitat), Median density 26.5 (Med-High quality habitat) individuals per hectare) and *Prasophyllum petilum* (Minimum density 2 (low quality habitat), Median density 2 (Med-High quality habitat) individuals per hectare). The Applicant's Expert considered that both moderate to good and Med-High quality habitat contained the same density of orchids.

54. Applying these densities to the 492.74 hectares of potential habitat within the Development Footprint as per the TBPDC, the Development Footprint potentially contains between 986 and 13,058 individuals of *Diuris tricolor* and 986 individuals of *Prasophyllum petilum*. Based on this analysis, the number recorded within the Development Footprint (1326 individuals of *Diuris tricolor* and of 691 *Prasophyllum petilum*) is below the minimum predicted density determined by the Applicant's Expert.

55. Regarding the high and medium quality habitat densities determined by the Applicant's Expert, the Expert Report stated that '*I expect these numbers to be an under-estimate of the true population size due to difficulties of detection (particularly for Prasophyllum), separation distances between survey transects, the staged nature of flowering across each season, and variation in climate (principally winter rainfall) from year to year*' (Point 7.4 Bell 2019).

Conclusion

56. The Applicant should undertake additional surveys for threatened flora to ensure all species were surveyed consistently with the relevant guidelines using appropriate methods, applying an appropriate level of effort, at appropriate times, and during appropriate conditions for maximising the detectability of target species.

Diuris tricolor population Size

57. There is considerable discrepancy between the number of *Diuris tricolor* recorded And therefore assessed as part of the existing Mangoola Coal Project (PA 06_0014) (two individuals) versus the indeterminate number (a high number based on the figures provided) recorded by the Applicant within the Mangoola Coal Project Disturbance Footprint in

subsequent post approval surveys. There is also a considerable difference in the number of *Diuris tricolor* records on the DPIE Bionet Atlas compared to the number recorded by MCCO's Consultants. The provision of these records is a condition of the respective licenses where work is done pursuant to the license with this data being critical for the assessment and subsequent review of the assessment of the cumulative impact of this and other projects by regulatory authorities.

58. I undertook a review of existing assessments for the existing Mangoola Coal Project (PA 06_0014) (Mangoola Coal project). As part of this review, I established that there is considerable discrepancy between the population size of *Diuris tricolor* that was assessed as part of the original Mangoola Coal Project application and the various population sizes quoted within subsequent reports and assessments for the Mangoola Coal Project.

    a. The original Mangoola Coal Project 2006 application recorded two individuals and 934 ha of potential habitat within the Development Footprint and assessed the impact accordingly.
    b. The 2016 MOD 4 was the next application for which the Applicant was required to address biodiversity loss and it identified an additional '*two occurrences*' within the proposed modification area and '*within the approved project disturbance area, there are a number of other recorded occurrences of this species*' though no exact numbers were provided. Based on the figure provided (Figure 3.2 Umwelt 2010), it was much more than the 2 individuals identified in the original assessment.
    c. The 2018 Mangoola Coal Translocation Plan (Glencore 2018) states that 20,911 *Diuris tricolour* have been located within the Approved Project Disturbance Area and Biodiversity Offset Areas and Corridors (Bell 2016), and that 1,360 individuals have been translocated from the disturbance areas.
    d. Figure 9 of the Expert report (Bell 2019) (**Figure 6**) displays the records of *Diuris tricolor* and *Prasophyllum petilum* based on surveys between 2009 and 2017 further indicating that considerably more than 2 individuals of *Diuris tricolor* are/were present within the existing Mangoola Coal Project Development Footprint.

59. Therefore, it is unclear what number of *Diuris tricolor* and *Prasophyllum petilum* have and will be impacted upon by the existing Mangoola Coal Project and the proposed MCCO Project were it to be approved.

60.

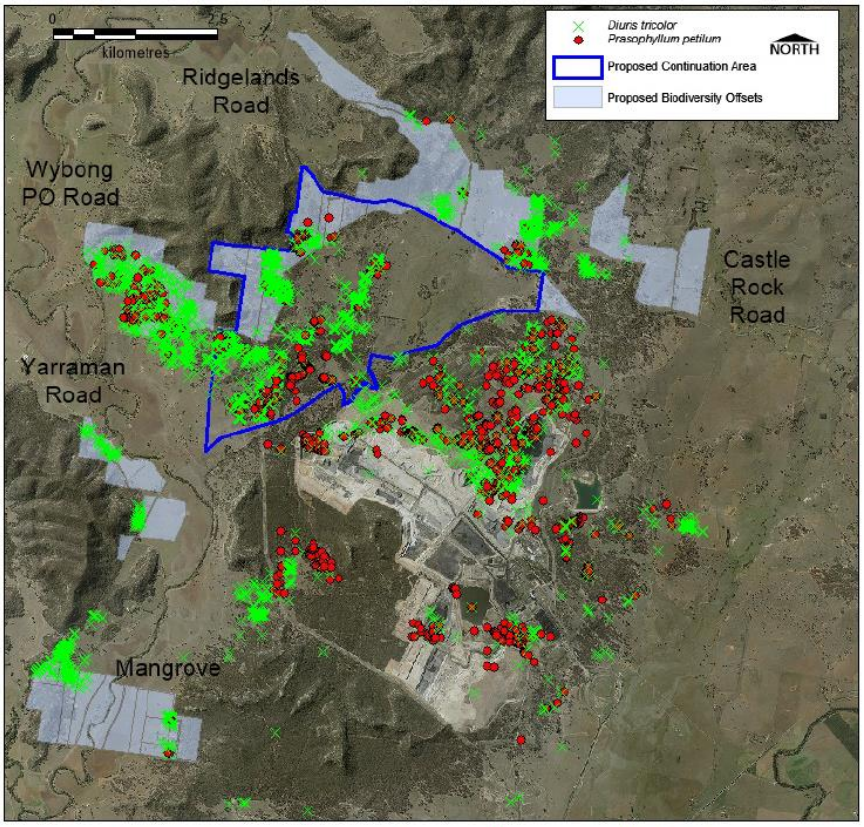

Figure 9 Distribution of *Diuris* and *Prasophyllum* across the proposed offset and continuation areas, 2009 – 2017.

Figure 6: Figure 9 of the Expert report (Bell 2019)

61. There also appears to be discrepancy between the number of individuals recorded by the Applicants Consultant and Expert and the number provided to DPIEs BioNet Atlas. There are 3,540 records comprising approximately 8,600 individuals on the DPIE BioNet Atlas (accessed July 2020) compared to the '*20,911 Diuris tricolour that have been located within the Approved Project Disturbance Area and Biodiversity Offset Areas and Corridors*' (Bell 2016).

62. It is a condition of both Applicant's Consultant's and Expert's scientific licenses to provide ecological data to BioNet Atlas if surveys were pursuant to their scientific licenses. The Applicant's Consultant and Expert need to ensure they have provided all of their records to BioNet Atlas. Deficiencies in this data impedes the ability for this and future developments to adequately assess cumulative impacts to this Endangered Population and at the same time limits the ability of regulatory authorities to review the adequacy of these assessments.

Adequacy of Cumulative Impact Assessment

63. The BAR and EIS do not adequately address the cumulative impacts of the proposal on biodiversity (section 4.4.6 of the BAR). The cumulative impacts of the Mangoola Coal Project (Part 3A) and the MCCO Project on the *Diuris tricolor* Endangered Population will result in a significant percentage loss (30%) of the Scientific Committee Final Determination predicted area of habitat for this species. The cumulative impact to *Diuris tricolor* cannot be addressed through mitigation measures or the provision of offsets as these measures do not reduce the total area of known and potential habitat being directly impacted upon as a result of these projects.

64. The Reissued SEARs dated 15th February 2019 state that the EIS must include '*an assessment of the likely impacts for all stages of the development, including any cumulative impacts taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice*' and '*the reasons why the development should be approved, having regard to: the biophysical, economic and social impacts of the project, including the principles of ecologically sustainable development*'(my emphasis).

65. The Department of Planning, Industry and Environment – Division of Resources and Geoscience (DRG) recommended that '*continued consultation should be undertaken with…the neighbouring mines such as Mt Pleasant and Mt Arthur regarding the potential for cumulative impacts associated with the project* (my emphasis)'.

66. Ecological Sustainable Development (ESD) (as defined in 6(2) of the *Protection of the Environment Act 1991*) has key principles including the precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity, and the accurate assessment of loss to inform improved valuation, pricing and incentive mechanisms.

67. As per Section 8.3.1.8.(c) of the FBA, the Applicant's Consultant is required to describe and document the reasonable measures and strategies that the proponent has taken or proposes to take to avoid and minimise the direct and cumulative adverse impacts of the MCCO Project on biodiversity values during the construction phase and at the operation phase.

68. Where the MCCO EIS (Umwelt 2019b) did address ESD, it was only in a general sense and did not directly discuss or critically evaluate the cumulative impact of Mangoola Mine and the proposed Project to *Diuris tricolor* or any other specific threatened species.

69. The RTS provides further brief consideration of the cumulative impact of the proposal but not in relation to biodiversity.

70. In response to the Department of Planning, Industry and Environment – Division of Resources and Geoscience comment, the Applicant stated that '*As part of the existing operations at Mangoola Coal Mine, engagement is undertaken with the existing coal mining operations of Mount Pleasant (approximately 9 km north-east), Bengalla (approximately 8.5 km east) and Mount Arthur Coal (approximately 9.5 km south-east) as required. Given the significant distance that the existing Mangoola Coal Mine and the proposed MCCO Project are located from these other mining operations no significant cumulative impacts are predicted as confirmed by the studies completed for the Project EIS*' (Umwelt 2019c).

71. The NSW Scientific Committee Final Determination for the *Diuris tricolor* Endangered Population Listing states that '*The area of occupancy of the population is less than 50 km2* (5,000 ha) *in the Muswellbrook LGA. Therefore, the geographic distribution of the population is estimated to be highly restricted*'. It also states that '*in the opinion of the Scientific Committee it is facing a very high risk of extinction in New South Wales in the near future*' (NSW Scientific Committee 2007).

72. The Applicant is proposing to remove at least 1,326 individuals of *Diuris tricolor* which is potentially a significant under-assessment of the true numbers on the Development Footprint. In regard to the total area of potential habitat on the Development Footprint, the '*BCD regards vegetation zones 1 to 9 as known or potential habitat within the proposed impact area, totalling 567.81 hectares*' (BCD 2019). The TBPDC identifies PCT 1603 as being potential habitat for *Prasophyllum petilum* and *Diuris tricolor*. 492.74 hectares of this PCT occur within the Development Footprint (Umwelt 2019a).

73. The existing Mangoola Coal Project will result in the removal of an indeterminate number of individuals of *Diuris tricolor*. The Anvil Hill Project (Mangoola Coal Project) Environmental

Assessment (Umwelt 2006) determined that 934 hectares of *Diuris tricolor* habitat occurred within the Development Footprint (4.4.1.2 Umwelt 2006).

74. The DPIE BioNet Atlas (accessed July 2020) contains approximately 8,600 individual records of *Diuris tricolor*.

75. Based on the above data, the combined Mangoola Coal projects will result in a cumulative impact of 1,501.81 hectares or 30% of predicted habitat for *Diuris tricolor.* This cumulative impact does not include other existing or outstanding development approvals that have impacted this species.

76. For example, the Bayswater Power Station Upgrade (SSD-9697) has identified 160 hectares of potential *Diuris tricolor* habitat being directly impacted upon and the Maxwell Underground Coal Mine Project (SSD-9526) has been identified as directly impacting upon 153.5 hectares of *Diuris tricolor* potential habitat. When combining these areas of impact of Mangoola Coal it equates to a total loss of 1,815.31 hectares or 36% of predicted habitat of *Diuris tricolor*.

77. Due to the MCCO Project being assessed under the FBA, the Applicant will be required to provide 'offsets' for the impact to *Diuris tricolor* as well as the other relevant biodiversity values recorded, consistent with the *NSW Biodiversity Offsets Policy for Major Projects.* However, it is important to note that these offsets will not create new habitat or individuals of *Diuris tricolor* but will only result in the conservation of existing habitat and a predicted number of individuals. Therefore, offsetting is an inadequate remedy for the cumulative impact on the species.

78. The total area of habitat will be reduced as a result of both of the Mangoola Coal and MCCO Projects which would place the species at greater risk from natural disasters like wildfire due to the reduction of the total area of potential habitat and therefore the area and geographical distribution of refugia for this species.

79. Based on the information available the cumulative impact to *Diuris tricolor* habitat is significant and will increase the likelihood of the extinction of this species as the proposed mitigation and offset measures do not adequately address the cumulative impact to this Endangered Population.

80. To be able to understand and, therefore, assess the proposal's cumulative impact to *Diuris tricolor*, the population within the Development Footprint would need to be adequately surveyed and the number within the existing Mangoola Coal Project approved Development Footprint would need to be quantified. Following this, cumulative impacts to each species must be addressed consistent with the SEARs, the FBA (Section 8.3.1.8) and the principles of ESD. This would apply to all threatened species recorded within the Development Footprint.

Adequacy of Threatened Fauna Species Surveys

81. The targeted herpetological surveys undertaken for the MCCO Project are not consistent with *The Threatened Species Survey and assessment: Guidelines for developments and activities (working draft)* (DEC 2004). Therefore, the surveys conducted cannot be considered as adequate, in particular, for the *Biodiversity Conservation Act* and *Environmental Protection Biodiversity Conservation Act* listed threatened species *Delma impar* and *Aprasia parapulchella*. The BAR failed to discuss or even consider the potential presence of *Delma impar* despite there being records of this species within the locality on the Department of Planning Industry and Environment (DPIE) BioNet database that predate the submission of the development application. In addition, the DPIE Threatened Biodiversity Profile Data Collection (TBPDC) identifies much of the vegetation that occurs on the Development Footprint as being potential habitat for both these reptile species.

82. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act* (DSEWPaC 2011) details survey methods for each reptile species. For *Aprasia parapulchella* it states that *'searches restricted to an area of relatively homogeneous habitat within each site and a search beneath all rocks that can be turned is made*'. However, for *Delma impar* it states that surveys need to be undertaken *'In areas with surface rock, artificial shelter site surveys or rock turning should be the primary technique (with supplementary techniques employed as appropriate). However, rock turning can be detrimental to striped legless lizard populations, especially when undertaken regularly. Therefore, this method should be used only when other methods are unavailable'* and that *'rock-turning and hand collection are only considered useful as an adjunct to pitfall trapping or artificial shelter site surveys'.*

83. The Threatened Species Survey and assessment: Guidelines for developments and activities (working draft) (DEC 2004) states that '*a range of sampling techniques is necessary for reptiles as no one technique will capture all species (Schulz and de Oliveira 1995). Techniques include pitfall trapping, active searching and spotlighting on foot*'. In regard to survey effort, the guideline state that for every 100ha a 30-minute search on two separate days targeting specific habitat, 24 pitfall trap nights, preferably using six traps for a minimum of four consecutive nights, and 30-minute search on two separate nights targeting specific habitat is required.

84. The Threatened Biodiversity Profile Data Collection (TBPDC) identifies Plant Community Types (PCT) 1602 and 1603 as being potential habitat for *Delma impar* and *Aprasia parapulchella*, 499 hectares of these PCTs occur in the Development Footprint. The TBPDC also lists 'cow pats' as habitat for *Delma impar*.

85. Appendix B of the BAR states that '*targeted searches for pink-tailed worm lizard were undertaken in February 2013 at six locations (refer to Figure 2.5.). The searches targeted areas of potential habitat within the UHSA project area. A total of 7.25 person hours of pink-tailed worm-lizard searches were undertaken. The searches involved traversing rocky areas and looking under rocks'*.

86. Therefore, the herpetological survey method and effort are not consistent with *Threatened Species Survey and assessment: Guidelines for developments and activities (working draft)* (DEC 2004) or the EPBC Act 1999 *Survey guidelines for Australia's threatened reptiles* (DSEWPaC 2011).

87. There was no mention of the potential presence of *Delma impar* within the BAR and therefore no targeted surveys for this species were undertaken as indicated above. There is no mention or discussion about the likely presence of *Delma impar* anywhere within the BAR even though there are 34 historic and contemporary *Delma impar* records in the Muswellbrook Local Government Area with the oldest record being from the Muswellbrook Common in October 2013 (approx. 19km East of the Development Footprint).

88. The BAR states that *Aprasia parapulchella* has only been recorded 'approximately 70km west of the Development Footprint' (my emphasis) when determining the likelihood of occurrence. However, there are a number of records that predate the submission date of the MCCO project application with a 2014 record approximately 75km to the South East of the Development Footprint, in addition the Maxwell Mine State Significant development applications recorded *Aprasia parapulchella* approximately 20km to the South East of the Development Footprint with the records added to the BioNet Atlas in 2018 which would therefore make the MCCO project well within this specie's range.

89. It should be noted that the contemporary *Biodiversity Conservation Act* 2016 (BC Act) does not allow for the use of surveys greater than 5 years of age (OEH 2018), reflecting current best practice in ecological assessment. Based on the submission date of the MCCO EIS and the dates surveys were undertaken (Table 2.3 of the BAR), the majority of Species

Credit fauna surveys, in particular the herpetological surveys, would be greater than 5 years of age and would not be able to satisfy the survey effort required by the BC Act.

90. I acknowledge that the BCD (DPIE) allowed the use of the FBA based on the work done for the project under the Upper Hunter Strategic Assessment (DPI 2012). However, any additional species listings or records within the locality since previous surveys were undertaken should have been addressed, for example the numerous *Delma impar* (dating back to 2013) and the *Aprasia parapulchella* observed and subsequently recorded on BioNet Atlas which the BAR failed to acknowledge.

91. The Request for Additional Information (DPIE 2020) made in July 2020 regarding MNES matters requested that MCCO '*please identify all of the EPBC Act listed threatened species that occur on, or in the vicinity of the Project site (as per the Environmental Reporting Tool), and state whether these species require any further consideration*'.

92. Even though there are records on BioNet Atlas within the locality and much of the Development Footprint is identified as being potential habitat in the TBPDC, the Applicant states, in its response to DPIE, that for *Aprasia parapulchella* no further consideration was required as its presence is '*Unlikely - not recorded within the MCCO Additional Project Area. Known distribution in NSW is in the Central and Southern Tablelands and the South Western Slopes but highly isolated from each other*' (Umwelt 2020).

93. Also, the Applicant states that for *Delma impar* no further consideration was required as its presence is '*Unlikely - not recorded within the MCCO Additional Project Area. The striped legless lizard is a grassland specialist, found only in areas of high quality native grassland and nearby grassy woodland and exotic pasture*' (Umwelt 2020).

94. Any additional species listings or records within the locality since previous surveys were undertaken should have been addressed adequately by the Applicant. Additional threatened fauna surveys (herpetological surveys in particular) consistent with the relevant policies and guidelines will need to be undertaken by the Applicant.

Use of the FBA

95. For the purposes of this report, I have assumed that the use of the FBA to assess the impact of the proposal was allowed by the BCD as stated by the Applicant. I also assume this was due to the project having 'substantially commenced' as per the *Biodiversity Conservation (Savings and Transitional) Regulation* 2017 due to the effort that had been applied as part of the Upper Hunter Strategic Assessment (DPI 2014).

96. The justification and request for the project to be assessed under the Framework for Biodiversity Assessment was detailed in the request for SEARs (Umwelt 2017). However, the EIS does not appear to provide details on the BCD's determination of approval for the use of the FBA only stating that they did so, in addition this determination, if required, does not appear to be publicly available on the DPIE Major Projects website and available for viewing by the public.

Conclusion

97. The ecological impact assessment for the MCCO Project inadequate. The evaluation of the ecological values by the Applicant's Consultant was not undertaken consistent with the relevant legislation, methodology, and subsequent guidelines. Therefore, this also makes the impact assessment of the MCCO Project inconsistent with the relevant legislation, methodology, and subsequent guidelines and as detailed below further work by the Applicant is required to ensure the impact assessment is adequate.

98. Notwithstanding the above, based on the available information the cumulative impact to *Diuris tricolor* habitat is significant and will increase the likelihood of the extinction of this species. The proposed mitigation and offset measures do not adequately address the cumulative impact to this Endangered Population as the MCCO Project in conjunction with existing Mangoola Coal Project alone will result in the complete removal of approximately 30% of the predicted habitat for this species.

99. The four plots within Zone 6 that were undertaken in July need to be undertaken again at an appropriate time of year that maximises the detectability of native species in particular groundcover (other) and they should be stratified randomly in vegetation representative of the condition state of Zone 6 as per Section 5.3.2 of the FBA. This plot data will then need to be used to re-run the BBCC.

100. The Applicant must undertake additional surveys for threatened flora to ensure all species were surveyed consistently with the relevant guidelines using appropriate methods, applying an appropriate level of effort, at appropriate times, and during appropriate conditions for maximising the detectability of target species.

101. The Applicant's Consultant and their Expert need to ensure they have provided all of their records to BioNet Atlas. Deficiencies in this data impedes the ability for this and future developments to adequately assess cumulative impacts to this Endangered Population and at the same time limits the ability of regulatory authorities to review the adequacy of these assessments.

102. To be able to understand and, therefore, assess the proposal's cumulative impact to *Diuris tricolor*, the population within the Development Footprint would need to be adequately surveyed and the number within the existing Mangoola Coal Project approved Development Footprint would need to be quantified. Following this, cumulative impacts to each species must be addressed consistent with the SEARs, the FBA (Section 8.3.1.8) and the principles of ESD. This would apply to all threatened species recorded within the Development Footprint.

103. Any additional species listings or records within the locality since previous surveys were undertaken should have been addressed adequately by the Applicant. Additional threatened fauna surveys (herpetological surveys in particular) consistent with the relevant policies and guidelines will need to be undertaken by the Applicant.

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Appendix A - Expert’s Code of Conduct

Expert witness code of conduct

(Uniform Civil Procedure Rules 2005 (NSW) Schedule 7)

(Rule 31.23)

1. Application of code

This code of conduct applies to any Expert witness engaged or appointed:

(a) to provide an Expert's report for use as evidence in proceedings or proposed proceedings, or

(b) to give opinion evidence in proceedings or proposed proceedings.

2. General duties to the Court

An Expert witness is not an advocate for a party and has a paramount duty, overriding any duty to the proceedings or other person retaining the Expert witness, to assist the court impartially on matters relevant to the area of Expertise of the witness.

3. Content of report

Every report prepared by an Expert witness for use in court must clearly state the opinion or opinions of the Expert and must state, specify or provide:

(a) the name and address of the Expert, and

(b) an acknowledgement that the Expert has read this code and agrees to be bound by it, and

(c) the qualifications of the Expert to prepare the report, and

(d) the assumptions and material facts on which each opinion expressed in the report is based (a letter of instructions may be annexed), and

(e) the reasons for and any literature or other materials utilised in support of each such opinion, and

(f) (if applicable) that a particular question, issue or matter falls outside the Expert's field of Expertise, and

(g) any examinations, tests or other investigations on which the Expert has relied, identifying the person who carried them out and that person's qualifications, and

(h) the extent to which any opinion which the Expert has expressed involves the acceptance of another person's opinion, the identification of that other person and the opinion expressed by that other person, and

(i) a declaration that the Expert has made all the inquiries which the Expert believes are desirable and appropriate (save for any matters identified explicitly in the report), and that no matters of significance which the Expert regards as relevant have, to the knowledge of the Expert, been withheld from the court, and

(j) any qualification of an opinion expressed in the report without which the report is or may be incomplete or inaccurate, and

(k) whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason, and

(l) where the report is lengthy or complex, a brief summary of the report at the beginning of the report.

4. Supplementary report following change of opinion

(1) Where an Expert witness has provided to a party (or that party's legal representative) a report for use in court, and the Expert thereafter changes his or her opinion on a material matter, the Expert must forthwith provide to the party (or that party's legal representative) a supplementary report which must state, specify or provide the information referred to in clause 3(a), (d), (e), (g), (h), (i), (j), (k) and (l), and if applicable, clause 3(f).

(2) In any subsequent report (whether prepared in accordance with subclause (1) or not), the Expert may refer to material contained in the earlier report without repeating it.

5. Duty to comply with the court's directions

If directed to do so by the court, an Expert witness must:

(a) confer with any other Expert witness, and

(b) provide the court with a joint report specifying (as the case requires) matters agreed and matters not agreed and the reasons for the Experts not agreeing, and

(c) abide in a timely way by any direction of the court.

6. Conferences of Experts

Each Expert witness must:

(a) exercise his or her independent judgment in relation to every conference in which the Expert participates pursuant to a direction of the court and in relation to each report thereafter provided, and must not act on any instruction or request to withhold or avoid agreement, and

(b) endeavour to reach agreement with the other Expert witness (or witnesses) on any issue in dispute between them, or failing agreement, endeavour to identify and clarify the basis of disagreement on the issues which are in dispute.

Appendix B – Instructions

From: Fiona Plesman

Sent: Friday, 23 October 2020 11:44 AM

To: Ziggy Andersons; Sharon Pope

Cc: Anthony Willis; Derek Finnigan

Subject: Mangoola Coal Continued Operations SSD 08642

Dear Ziggy

Please undertake a critical review of the Mangoola Coal Continued Operations State Significant Development Application (SSD 8642) as it relates to the assessment of the impact to terrestrial ecology. Particular consideration should be given to the assessment of the direct, indirect, and cumulative impacts to the Muswellbrook Endangered Population of *Diuris tricolor* in addition to any matters that would have a material impact on the outcome of the impact assessment.

Kind Regards,

Fiona Plesman

Muswellbrook Shire Council | Fiona Plesman| General Manager| Administration Centre

T: 02 6549 3710 **I M:** 0407 451 028 **I E:** Fiona.Plesman@muswellbrook.nsw.gov.au **I** www.muswellbrook.nsw.gov.au

Note The Muswellbrook Council Administration Centre has moved to Campbell's Corner 60-82 Bridge Street Muswellbrook NSW 2333

Appendix C – CV

ZIGGY ANDERSONS

T: 02 6549 3783 **I E:** Ziggy.Andersons@muswellbrook.nsw.gov.au
60-82 Bridge Street Muswellbrook NSW 2333

Education

2010 Bachelor of Science (Botany Major) from the University of New England 2010

Career Summary

DATES	POSITION	ORGANISATION
Oct 2019 to present	Ecologist and Sustainability Team Leader	Muswellbrook Shire Council
Jan 2019 – Oct 2019	Ecologist	Cessnock City Council
June 2018 – Jan 2019	Ecologist	MJD Environmental Pty Ltd
2016 – June 2018	Senior Project Officer	NSW Office of Environment and Heritage (OEH) and Biodiversity Conservation Trust (BCT)
2014 – 2016	Conservation Planning Officer	NSW Office of Environment and Heritage (OEH)
2012 - 2014	Senior Ecologist Project Manager then Ecology Dept Manager	RPS Pty Ltd
2012 – 2012	Regional Ecology Manager	Kleinfelder Pty Ltd
2010 – 2011	Environmental Consultant	Evergreen Vegetation Consultants (Owner operator)

Relevant Professional Development

- Biodiversity Conservation Act 2016 BAM Accredited Assessor #BAAS17103