



LANDMARK

Ecological Services Pty Ltd

PO Box 100 Suffolk Park NSW 2481 Australia | ABN 29 064 548 876
landmark@landmarkonline.com.au | (02) 66854430

DAVID MILLEDGE | DIRECTOR
david.milledge@landmarkonline.com.au

Report on the adequacy of the Environmental Impact Statement for the Narrabri Gas Project in assessing and mitigating impacts on the vertebrate fauna of the Project Area

David Milledge

16 May 2017

1. I have been asked by EDO NSW, on behalf of the North West Alliance, to prepare a report based on a review of the Environmental Impact Statement (EIS) for the Narrabri Gas Project (Project) in relation to likely impacts on the vertebrate fauna of the Project Area and on the adequacy of the EIS in assessing and mitigating these impacts.
2. In this regard I have been provided with a copy of Division 2, Part 31 of the *Uniform Civil Procedure Rules 2005* and the *Expert Witness Code of Conduct* (Code of Conduct) in Schedule 7 of those rules. I have read the Code of Conduct and have adhered to those rules in preparing this report.
3. Also in preparing this report, I have read the following documents that comprise part of the EIS for the Project:
 - a) Executive Summary
 - b) Chapter 15 - Terrestrial ecology
 - c) Chapter 29 - Cumulative impact
 - d) Chapter 30 - Environmental management and monitoring
 - e) Appendix C - Field Development Protocol
 - f) Appendix J1 - Ecological impact assessment) Appendix J2 - Biodiversity assessment report
 - i) Appendix V - Rehabilitation strategy
4. I have had considerable field experience in the Pilliga forests and woodlands and associated habitats, including the EIS Project Area, having conducted a survey for large forest owls at 500 sites throughout the Pilliga in 2001. This survey demonstrated that the area supported the most significant population

of the Barking Owl *Ninox connivens* in NSW, a species listed as Vulnerable on the Schedules of the NSW *Threatened Species Conservation (TSC) Act 1995*.

5. I also took part in a comprehensive targeted survey of Threatened fauna species in the majority of the Project Area in 2011, when 20 Threatened species (*TSC Act 1995*) were recorded. These included the South-eastern Long-eared Bat *Nyctophilus corbeni* and Pilliga Mouse *Pseudomys pilligaensis*, both also listed as Vulnerable under the Commonwealth's *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*.
6. The results of the large forest owl survey have been published in Milledge (2002), Milledge (2004) and Milledge (2009).
7. Results of the targeted Threatened fauna survey in the Project Area have been published in NICE and CUCCLG (2012), and in Paull *et al.* (2014) in relation to the Pilliga Mouse.

Overall appropriateness and adequacy of the assessment of impacts on vertebrate fauna

8. A review of the EIS assessment of impacts on vertebrate fauna (Appendix J1, summarised in Chapter 15) shows that the EIS has not appropriately and adequately assessed potential impacts on vertebrate species and on key Threatened species in particular, despite a substantial amount of field survey effort. This is due to a number of factors, consisting of:
 - a) a failure to acknowledge the overall significance of the Pilliga forests and woodlands for biodiversity conservation and of the importance of the Project Area in this context;
 - b) a failure to acknowledge the high level of environmental stress already operating on the Pilliga forests and woodlands, and to take into account the potential additional impacts of climate change;
 - c) a failure to obtain a sufficient number of records of most key Threatened species, precluding the identification of important local populations of these species in the Project Area, that are necessary to implement effective protective measures;
 - d) a failure to acknowledge the likely high level of impact on vertebrate fauna from the Project, particularly from indirect and cumulative impacts, together with the dismissal of the potential for a likely significant effect on key Threatened species.

Significance of the Pilliga forests for biodiversity conservation and of the importance of the Project Area in this context

9. The Pilliga forests and woodlands represent the largest, relatively intact, unfragmented block of dry sclerophyll forest and woodland in eastern Australia. As such they provide a crucial refuge for biodiversity in a landscape

largely cleared for agriculture (NICE and CUCCLG 2012, Lunney *et al. submitted 2017*).

10. They comprise part of one of 15 National Biodiversity Hotspots recognised by the Commonwealth (Australian Government Department of Environment and Energy website, accessed 14 May 2017) and a globally significant Important Bird Area (now termed Key Biodiversity Area, Birdlife Australia website, accessed 14 May 2017).
11. The Pilliga forests and woodlands also constitute a stronghold for numerous declining woodland bird species (e.g. Birds Australia 2005) as well as many other Threatened vertebrates (NICE and CUCCLG 2012, Milledge 2013) and constitute part of the eastern Australian bird migration system, providing seasonal foraging and movement habitat (NICE and CUCCLG. 2012, Milledge 2013).
12. These attributes have been virtually ignored in the EIS and do not appear to have been considered as background or context (Chapter 15, Appendices J1 and J2) in assessing the biodiversity significance of the area, the potential for significant impacts and the mitigation of such impacts.
13. The Project Area falls mainly within a landscape unit known as the Pilliga Outwash Province (Provinces of the Brigalow Belt South Bioregion, NSW EPA Forests Agreement, Western Regional Assessment, website accessed 14 May 2017). This Province has generally higher soil nutrient status, increased plant productivity, and a higher vertebrate carrying capacity than the adjoining Pilliga Province (Milledge 2004), which encompasses the greater proportion of the Pilliga forests and woodlands.
14. Much of the National Park and Nature Reserve estate in the Pilliga lies in the eastern and southern sections within the Pilliga Province with its poorer soils and higher incidence of wildfire (Milledge 2004). These reserves provide relatively poor quality habitat for vertebrate fauna compared with conservation areas in the Outwash Province, which although containing more productive soils, comprise Community Conservation Areas that provide lower levels of protection. This is because they are subject to a range of activities excluded from National Parks and Nature Reserves that diminish their biodiversity conservation values.
15. Consequently it is inaccurate to imply that the approximately 50% of the Pilliga allocated to conservation (EIS Executive Summary, What is proposed?; Chapter 15, s.15.2.1) is of equal value in this regard.
16. The lack of consideration and acknowledgement of these attributes and values refutes the claim that the Project Area has been evaluated in the wider Pilliga context (EIS Chapter 15, s.15.1) and that the "ecology of the project area is well understood" (EIS Executive Summary, Terrestrial and aquatic ecology).

17. Although the "high ecological and landscape value" of the Pilliga forests and woodlands is noted (EIS Chapter 15, s15.2.1) and that the area comprises a "unique biological, geological and geographic unit" (EIS Appendix J1, s4.11.3), this is not carried through to any analyses or mitigation measures. Neglecting consideration of the specific ecological values of the Project Area in a regional and national context have contributed to the inappropriateness and inadequacy of the impact assessment and to the lack of identification of particular areas requiring the application of precise protection and mitigation measures.

High level of environmental stress already operating on the Pilliga forests and woodlands, and the potential additional impacts of climate change

18. The Pilliga forests and woodlands have been subject to severe environmental stress over the past few decades, including prolonged drought, extreme temperatures, wildfire and losses of significant fauna habitat elements (Lunney *et al. submitted 2017*, Niche Environment and Heritage 2004, Parnaby *et al.* 2010, Milledge 2004).
19. This situation should have been taken into account in assessing the impact of the Project, particularly in relation to cumulative impacts. However, as with the Pilliga's overall biodiversity conservation significance and the Project Area's values in the wider Pilliga context, it has generally been overlooked.
20. The failure to detect any live Koalas *Phascolarctos cinereus* in the Project Area over the four year survey period (EIS Chapter 15, Appendix J1) in areas where the species had previously been recorded (NICE and CUCCLG 2012, Niche Environment and Heritage 2014) should have raised concern and served to inform the impact assessment process.
21. The status of the formerly extensive and healthy Koala population in the Pilliga forests and woodlands, now considered to be on an extinction trajectory (Lunney *et al. submitted 2017*), is an indication of the level of environmental stress currently impacting the Pilliga's ecosystems.
22. The potential for even greater detrimental impacts on these systems posed by anthropogenic climate change has similarly received little consideration in the EIS's assessment of the Project's impacts, again particularly with respect to cumulative impacts. Predictions for climate changes in the Pilliga area include frequent extended extreme temperatures, altered rainfall with longer periods of drought and increased fire frequency and intensity (Lunney *et al. submitted 2017*, Niche Environment and Heritage 2014).
23. These effects, although discussed in the supporting documents in the EIS (Appendix J1), have not been adequately considered, particularly in identifying refuges and designing specific measures to mitigate impacts likely to be exacerbated as the climate changes.

Lack of a sufficient number of records of most key Threatened species to enable identification of important local populations of these species in order to implement protective measures

24. An examination of the locations and numbers of individuals of most key Threatened species (species with significant populations in the Pilliga forests and woodlands) detected in the Project Area over the four year survey period (EIS Appendix J1, Figs 20, 21; Appendix C) indicates that the field surveys failed to obtain a sufficient number of records of these species to adequately inform the assessment and mitigation of impacts likely from the Project.
25. Examples of the low numbers of locations and individuals of such Threatened species that were obtained in the Project Area comprise:
 - a) no records of the Pale-headed Snake *Hoplocephalus bitorquatus* from the State Forests (the main area of forest and woodland in the Project Area) and only four locations outside these Forests;
 - b) no records of the Barking Owl from the State Forests and only four locations outside State Forests;
 - c) only one location for the Eastern Pygmy-possum *Cercartetus nanus* within the Project Area and one outside;
 - d) only one location for the Squirrel Glider in the Project Area;
 - e) only four locations in the Project Area for the South-eastern Long-eared Bat with only four to five individuals captured;
 - f) only three locations in the Project Area for the Pilliga Mouse with only five individuals captured.
26. These results, from surveys conducted over four years contrast markedly with those obtained by NICE and CUCCLG (2012) in and closely adjacent to the Project Area over only approximately 10 days, when for example, 21 individuals of the South-eastern Long-eared Bat and 25 individuals of the Pilliga Mouse were captured at 8 and 7 separate locations respectively.
27. Perhaps the low number of records of these Threatened species from EIS field surveys reflected the environmental stresses experienced in the Pilliga prior to and during the survey period (paras 18-23 above), or perhaps they also reflected additional impacts operating as a result of previous and on-going gas mining exploration activities. However, the NICE and CUCCLG (2012) surveys were undertaken within the same period with sharply contrasting results (para 26 above).
28. Whatever the reasons for these low numbers, such a paucity of information has resulted in an inability to accurately demonstrate the occurrence of important populations of key Threatened species in the Project area,

preventing an adequate assessment of potential impacts and severely restricting the ability to formulate effective mitigation measures.

29. The identification of specific habitats and habitat elements being used by the key Threatened species is required prior to planning the locations for siting gas wells and well pads to facilitate avoidance and buffering of these attributes.
30. For example, the locations of hollow-bearing trees used by the hollow-dependent Pale-headed Snake, Barking Owl, Eastern Pygmy-possum, Squirrel Glider, Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris* and South-eastern Long-eared Bat in the Project Area should have been determined to enable protection measures to have been precisely applied.
31. In addition, the paucity of survey records of key Threatened species is also likely to have compromised the modelling of their habitats (EIS Appendices J1, J2), as indicated by the use of only five Pilliga Mouse captures at three sites to inform derivation of the Pilliga Mouse habitat model (EIS Appendix J1, F5).

Likely high level of impact from the Project and particularly from indirect and cumulative impacts, and dismissal of potential for a likely significant effect

32. It is difficult to accept, as the EIS has found, that there would not be a major significant adverse effect on the vertebrate fauna, including a number of Threatened species (EIS Executive Summary, Terrestrial and aquatic ecology), from the installation and operation of up to 850 gas wells on up to 250 well pads over a 20 year period as proposed by the Project.
33. The installation and operation of these pads and wells will result in the following detrimental impacts over approximately 15% of the higher quality vertebrate habitat in the Pilliga forests and woodlands:
 - a) increased fragmentation of a landscape already under severe environmental stress;
 - b) the creation of wide, effectively permanent barriers to vertebrate movement resulting from construction of linear corridors and bushfire asset protection zones; these will have an associated effect of increased exposure of vulnerable species to predation from introduced vertebrates including the Red Fox *Vulpes vulpes*, Feral Cat *Felis catus* and Feral Pig *Sus scrofa*;
 - c) increased sedimentation of already silted up, ephemeral waterways and the reduced availability of surface water essential to the maintenance of many vertebrate populations;
 - d) increased disturbance from an exponential increase in vehicle movements, dust, noise and lighting associated with gas mining operations;

- e) continuing detrimental impacts on high value riparian habitat crucial for vertebrate refuges and movements;
- f) increased adverse impacts on vertebrate habitats from pest vertebrate species such as the Feral Pig and Feral Goat *Capra hircus*;
- g) cumulative impacts resulting from the exacerbation of perturbations already operating in the Project Area due to now intensive forestry operations (Niche Environment and Heritage 2014) and climate change, particularly the loss of hollow-bearing trees (Parnaby *et al.* 2010), vegetation loss and increased fire frequency (Lunney *et al. submitted 2017*).
34. The statement that the Project would not have a significant impact on Threatened vertebrate species (EIS Executive Summary, Terrestrial and aquatic ecology) is based primarily on the claim that it would only impact on a very small area of habitat, and on largely untested mitigation measures intended to alleviate the direct and indirect impacts listed above (para 33).
35. Mitigation measures relied on to reduce these impacts include the employment of an "Ecological Scouting Framework" (EIS Executive Summary, Chapter 15, Appendix J1), but this appears untested and should have been developed and validated prior to the field surveys to demonstrate its usefulness. Further, its effectiveness is likely to be highly compromised as the "avoidance, management and mitigation measures" proposed to protect the values it might identify will only be implemented "where practicable" (EIS Executive Summary, Terrestrial and aquatic ecology).
36. Another mitigation measure is the proposed progressive rehabilitation of well pads (EIS Executive Summary, How will the project be developed?, Fig. ES 2) but the benefits of this measure have not been demonstrated, despite the rehabilitation of exploration well pads having been underway for at least two years (EIS Executive Summary, Fig. ES 2).
37. It could also have been expected that permanent monitoring plots would have been established to gauge the effectiveness of proposed mitigation measures. These should have initially been installed to collect baseline data and allow for adaptive management, and to engender confidence in the mitigation measures proposed, but such plots do not appear to have been established.
38. Similarly, vertebrate pest control programs could also have been established to inform this proposed mitigation measure, as pest animal impacts have been ongoing during the past years of exploration activities in the Project Area (NICE and CUCCLG 2012), but again this does not appear to have been trialled.
39. **In summary, the EIS does not provide an appropriate and adequate assessment of the likely impacts of the proposed Project on vertebrate fauna, and particularly on Threatened species (TSC Act 1995, EPBC Act 1999), or of adequate mitigation of these impacts.**

References

Birds Australia 2005. The State of Australia's Birds 2005. Woodlands and Birds. Suppl. to *Wingspan* 15, No. 4, December 2005. Birds Australia, Hawthorn East, Vic.

Lunney, D., Predavec, M., Sonawane, I., Kavanagh, K., Barrott-Brown, G., Phillips, S., Callaghan, J., Mitchell, D., Parnaby, H., Paull, D., Shannon, I., Ellis, M., Price, O. and Milledge, D. (submitted 2017). The remaining koalas (*Phascolarctos cinereus*) of the Pilliga forests, northwest NSW: refugial persistence or a population on the road to extinction? *Pacific Conservation Biology*.

Milledge, D.R. 2002. A survey of large owls in the cypress pine-ironbark forests and woodlands of central western NSW. Unpubl. report to Western Directorate, NSW National Parks and Wildlife Service. Landmark Ecological Services Pty Ltd, Suffolk Park, NSW.

Milledge, D.R. 2004. Large owl territories as a planning tool for vertebrate fauna conservation in the forests and woodlands of eastern Australia. Pp 493-507 in *Conservation of Australia's Forest Fauna* (second edition), ed. by D. Lunney. Royal Zoological Society of NSW, Mosman, NSW.

Milledge, D. 2009. Large owl territories and conservation planning. *Wingspan* 19: 28-29.

Milledge, D. 2013. Submission to NSW Department of Planning and Infrastructure on proposed Bibblewindi Gas Exploration Pilot Expansion, SSD 13_5934. Unpubl. report. David Milledge, Broken Head, NSW.

NICE and CUCCLG. 2012. Ed. D.R. Milledge. National significance: The ecological values of Pilliga East Forest and the threats posed by coal seam gas mining 2011-2012. Report to Northern Inland Council for the Environment and the Coonabarabran and Upper Castlereagh Catchment and Landcare Group. Northern Inland Council for the Environment and The Wilderness Society, Coonabarabran and Sydney, NSW.

Niche Environment and Heritage 2014. Koala refuges in the Pilliga forests. Unpubl. report. Niche Environment and Heritage, Parramatta, NSW.

Parnaby, H., Lunney, D., Shannon, I. and Fleming, M. 2010. Collapse rate of hollow-bearing trees following low-intensity prescription burns in the Pilliga forests, New South Wales. *Pacific Cons. Biol.* 16, 209-220.

Paull, D.C., Milledge, D., Spark, P., Townley, S. and Taylor, K. 2014. Identification of important habitat for the Pilliga Mouse *Pseudomys pilligaensis*. *Aust. Zool.* 37:15-22.