Planning and Assessment

Department of Planning, Industry and Environment

Locked Bag 5022

Parramatta NSW 2124

28 April 2020

Dear Sir/Madam

Submission on Angus Place Mine Extension Project, State Significant Development 5602, EPBC Act Referral 2013/6889

We would like to thank the NSW Department of Planning, Industry and Environment and the Commonwealth Department of Agriculture, Water and the Environment for consulting the public on the Amendment Report on the Angus Place Mine Extension Project.

We are community members who participate in the public consultation process on projects that are referred to the Commonwealth Government under s 68 of the EPBC Act.

The Amendment Report relates to the proposal to extend the existing Angus Place Colliery mine life (**Proposed Action**) by Centennial Angus Place Pty Limited (**Centennial**).

We submit that the Commonwealth Minister for the Environment should not approve the Proposed Action under s 133 the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**) on grounds of unacceptable impacts to listed threatened species.

This submission addresses the following matters raised by the Supplement to the Director-General's Requirement for the Proposed Action under the accredited NSW State Significant Development assessment process.

Table 1: Director General's Requirements addressed in this submission

	Category	Specific Requirements
1.	Description of the existing environment	3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to: a. surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and Assessment Guidelines (2009), available at: and the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC)

	Category	Specific Requirements
		species-specific survey guidelines for nationally threatened species; b. a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal.
2.	Description of the relevant impacts of the controlled action	4. An assessment of all relevant impacts with reference to the EPBC Act Policy Statement 1.1 Significant lmpact Guidelines Matters of National Environmental Significance (2009) and species specific guidelines as relevant that the controlled action has, will have or is likely to have. lnformation must include: a. a description of the relevant impacts of the action on matters of national environmental significance; b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts; c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; d. analysis of the significance of the relevant impacts; e. any technical data and other information used or needed to make a detailed assessment of the relevant impacts. 5. Where there is a potential habitat for EPBC Act listed species (see Appendix A), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person'. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the: a. population of the species at the site; b. area of occupancy of the species; c. habitat critical to the survival of the species; d. breeding cycle of the population; and e. availability or quality of habitat for the species.

	Category	Specific Requirements
		If an endangered ecological community or threatened species listed at Appendix A is not believed to be present on the proposed site, detailed information must be included in the Environmental Impact Assessment to demonstrate that this community will not be impacted.

Our submission makes the following key points:

- Centennial and its consultant the RPS Group (**RPS**) had an obligation to ensure that surveys for the Blue Mountains Water Skink, the Large-eared Pied Bat and the Koala were carried out in accordance with best practice standards and Commonwealth survey guidelines.

- The failure by Centennial and RPS to conduct appropriate surveys as the likely or known presence of Blue Mountains Water Skink, the Large-eared Pied Bat and the Koala, should result in species presence being presumed for the site.

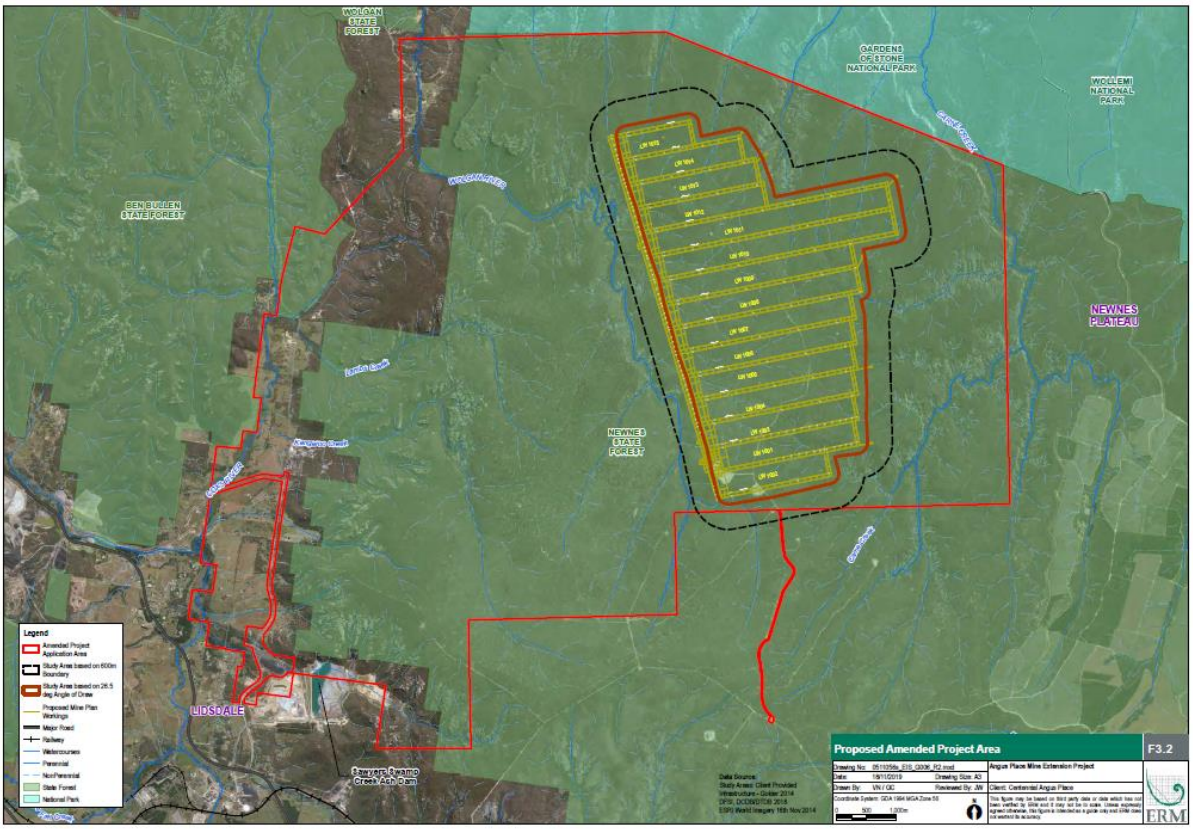
- The Proposed Action is likely to have a significant impact on the Blue Mountains Water Skink and Temperate Highland Peat Swamp on Sandstone (**THPSS**) because of bedrock fracturing and swamp cracking on Tri Star and Twin Gully Swamps.

- The impact area within the 26.5° angle of draw of the Proposed Action (**Subsidence Area**) comprises habitat critical to the survival of the koala.

- The Proposed Action is likely to have a significant impact on the local koala population of the Blue Mountains because of impacts to riparian areas, damage to critical habitat and cumulative impacts from the 2019-2020 Gospers Mountain bushfire.

1.Project Background

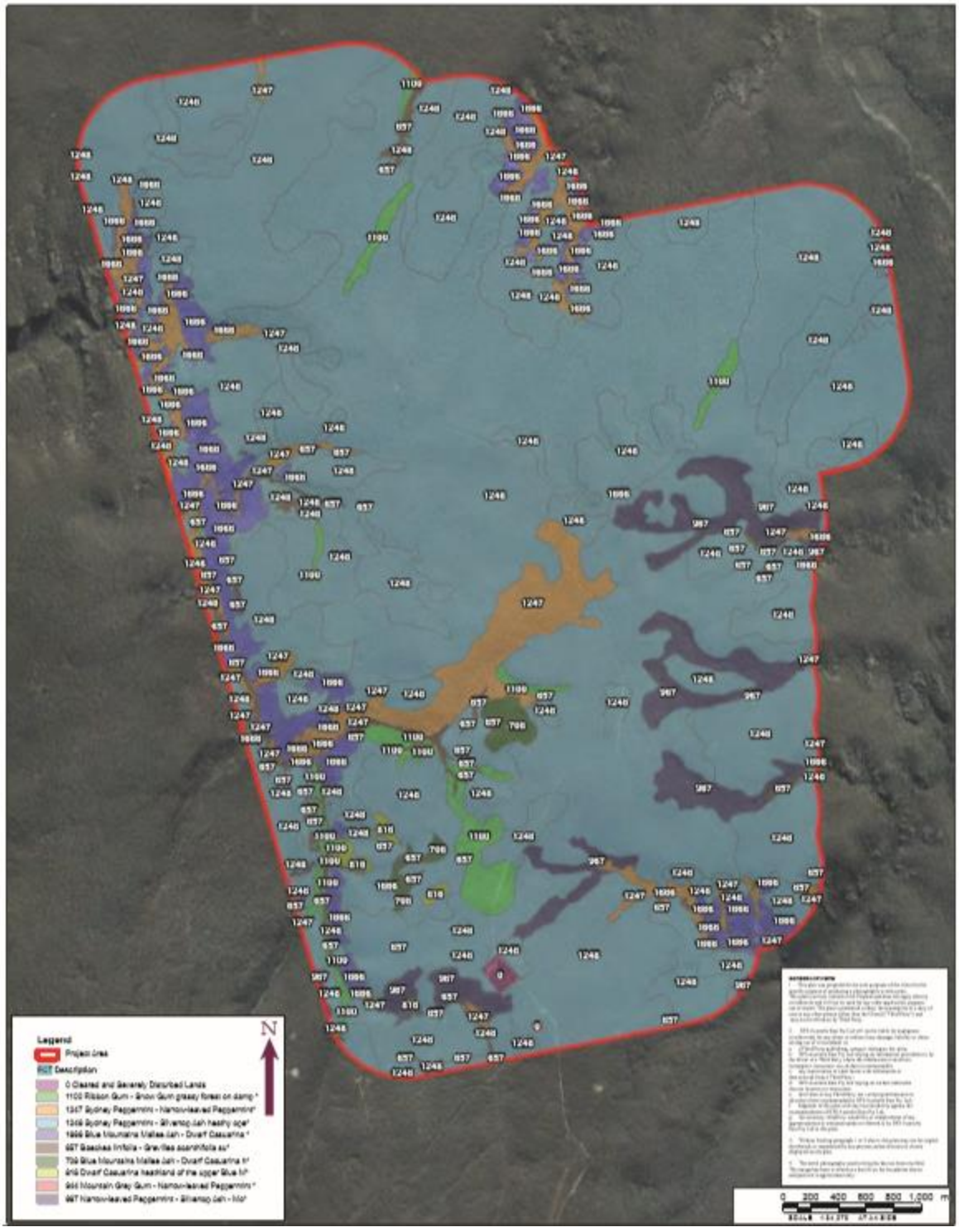
1. The Extension of Mining Area (**Extension Area**) of the Proposed Action is primarily within Newnes State Forest (see Extension Area outlined in red in Map 1 below). It is adjacent to the Gardens of Stone National Park and in close proximity to Ben Bullen State Forest, Wolgan State forest and Wollemi National Park.



Map 1: Proposed Amended Extension Area[1]

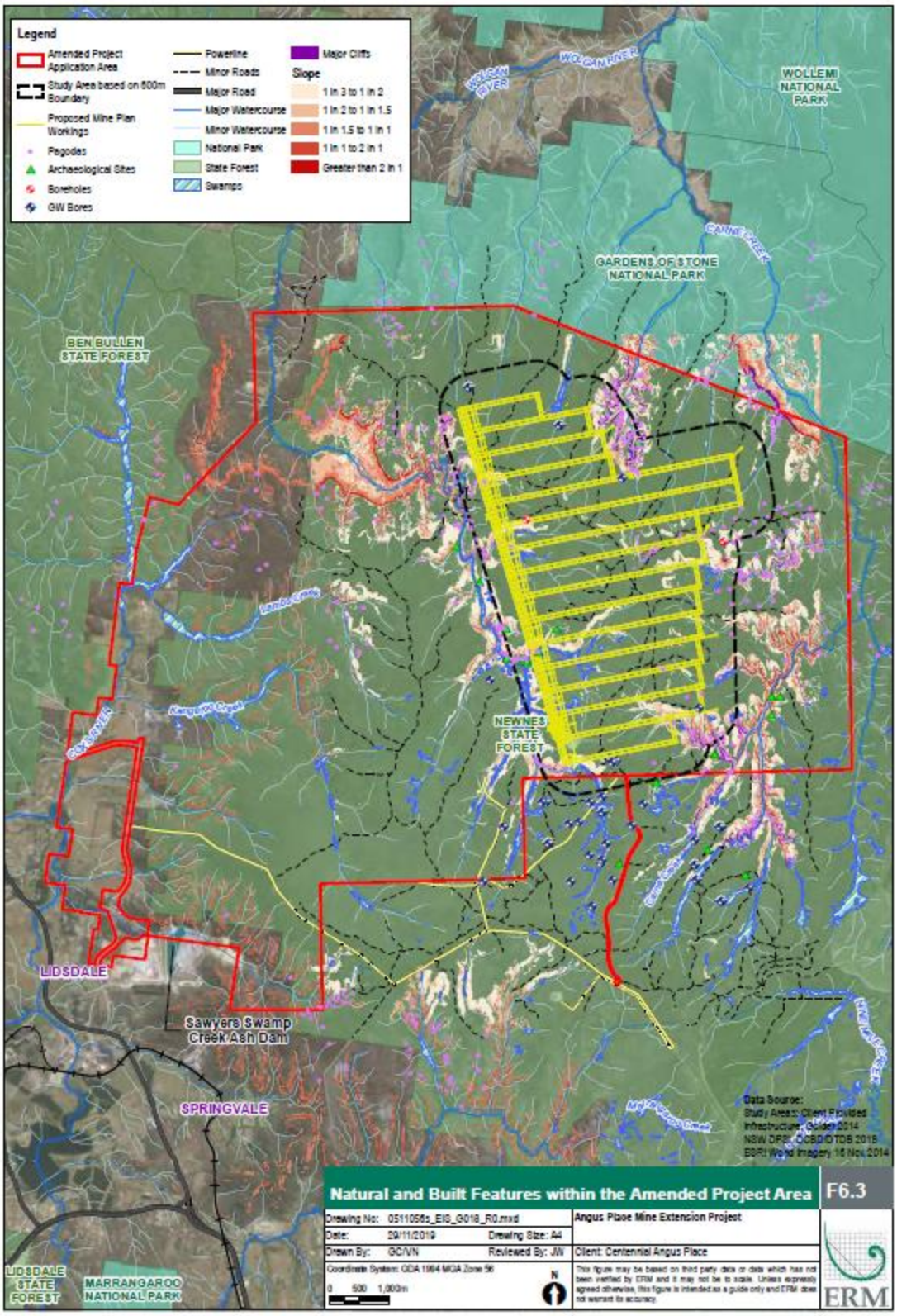
2. Most of the Extension Area contains extensive vegetation (see Map 2 below) and watercourses (see Maps 3, 4 and 5 below). It is a rich, biodiverse area with more than 30 threatened flora species and 56 threatened fauna species listed as occurring and potentially occurring in the area.[2] Of particular conservation significance are several areas of THPSS, which are listed as endangered under the EPBC Act (Map 5).

[1] Centennial Coal, 'Angus Place Mine Extension Project: Amended Report" (6 December 2019) 12.
[2] Centennial Coal, 'Angus Place Mine Extension Project EIS" (7 April 2014) Appendix H 30-32.



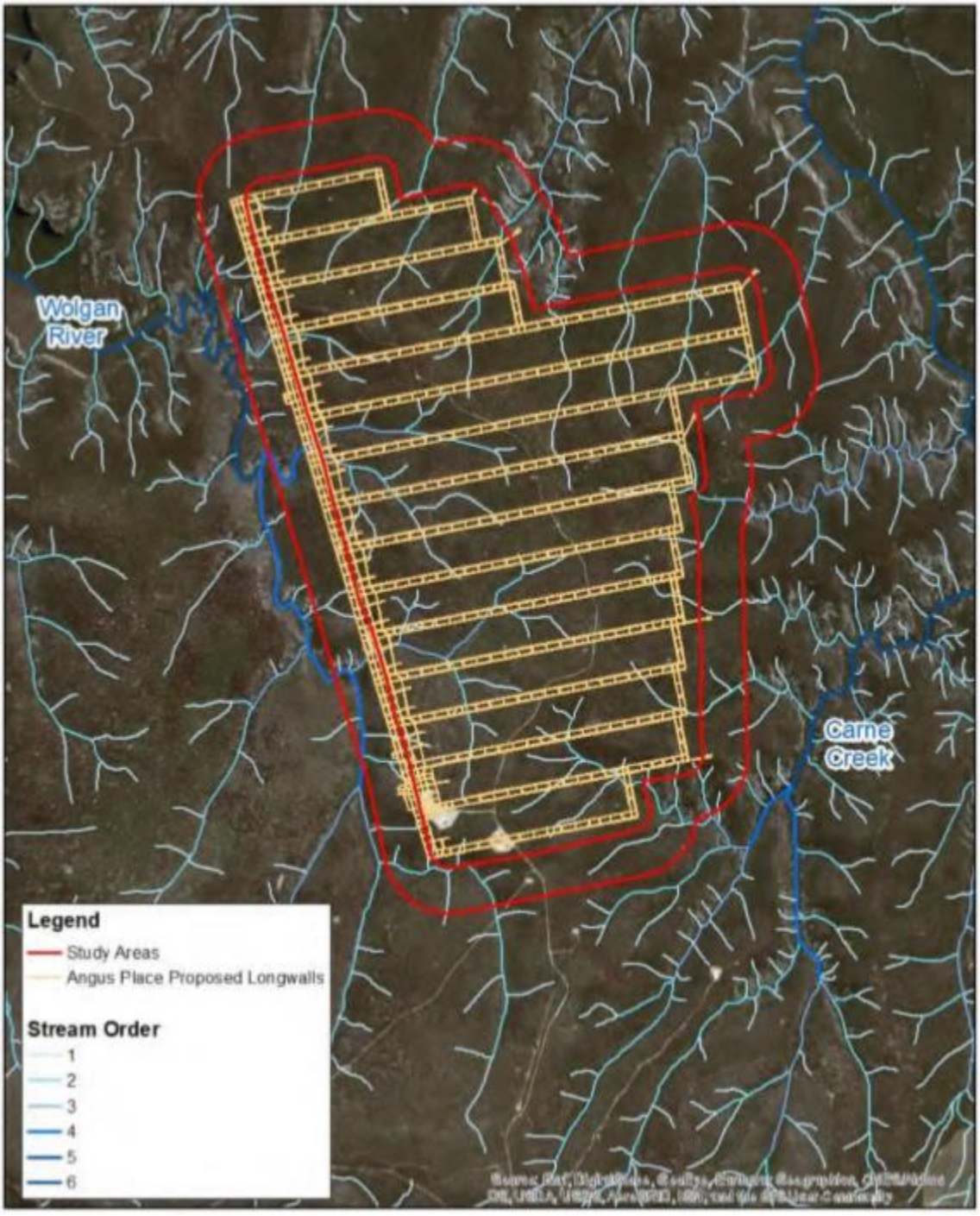
Map 2: Extension Area Vegetation Mapping[3]

[3] Ibid, above n2, 28.



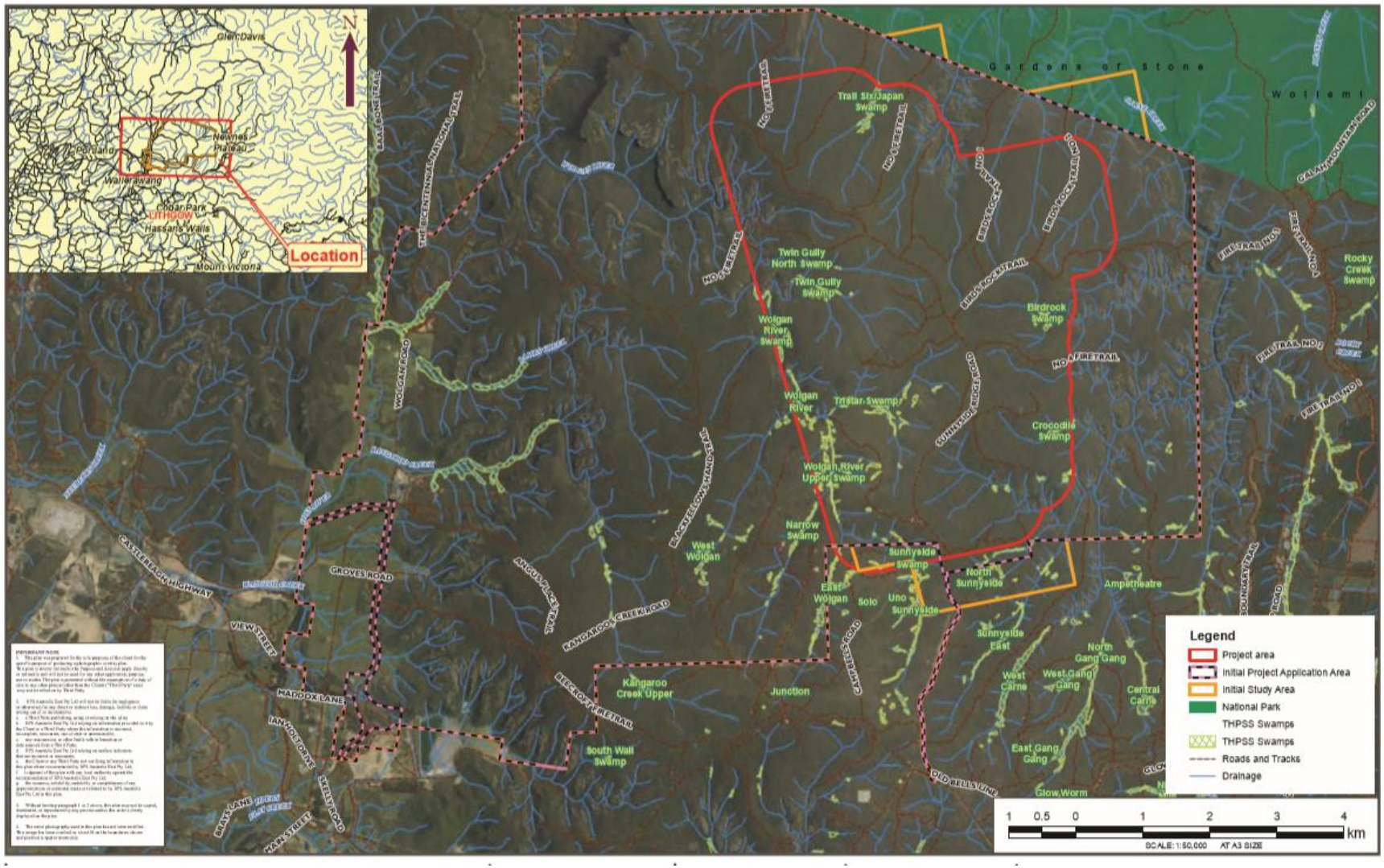
Map 3 Natural and Built features in Extension Area[4]

[4]Ibid, above n1, 36.



Map 4: Aquatic Ecology Study Area (outdoor 600 m Buffer from the Proposed Longwalls) overlaid with Watercourses and their Stream Order. The inner buffer is the MSEC 2019 Study Area based on the 26.5º angle of draw.[5]

[5] Centennial Coal, 'Angus Place Mine Extension Project EIS" (7 April 2014) Appendix J 10.



Map 5: Extension Area overlaid with THPSS mapping[6]

[6] Ibid, above n2, 13.

2.Surveys

2.1 Requirement to conduct surveys

3. The Commonwealth Department of Agriculture, Water and the Environment's survey guidelines provide that "biological surveys are usually an essential component of significant impact assessment, and should be conducted on the site of the proposed action prior to referral."[7] A proponent may depart from the Commonwealth survey guidelines if "an evidence-based rationale for an alternative approach has been provided."[8]

4. The requirement to conduct biological surveys is a fundamental component of the accredited assessment process under the EPBC Act. This requirement is comprised of two parts: (1) where there is potential habitat for EPBC Act listed threatened species, surveys must be undertaken[9] and (2) surveys must be conducted in accordance with "accepted methodology".[10]

5. In the present matter, the following Commonwealth guidelines set out species-specific survey methodology for determining EPBC Act listed species presence/absence:

    a. Survey Guidelines for Australia's Threatened Reptiles;[11]

    b. Survey Guidelines for Australia's Threatened Bats;[12] and

    c. EPBC Act Referral Guidelines for the Vulnerable Koala.[13]

2.2 Habitat for the Blue Mountains Water Skink

6. Habitat for the Blue Mountains Water Skink is present in the Extension Area in particular within the Subsidence Area because of the presence of THPSS in the area, which include Blue Mountain Sedge Swamps and Newnes Plateau Shrub Swamps.[14]

7. The Conservation Advice for the Blue Mountains Water Skink provides:

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[7] Commonwealth of Australia, Survey Guidelines for Australia's Threatened Mammals (2011) 1.
[8] Ibid.
[9] Department of Planning and Infrastructure, 'Angus Place Mine Extension Project (SSD-5602) Supplement to the Director-General's Requirements' para 5.
[10] Ibid para 3.
[11] Commonwealth of Australia, Survey Guidelines for Australia's Threatened Reptiles (2011).
[12] Commonwealth of Australia, Survey Guidelines for Australia's Threatened Bats (2010).
[13] Commonwealth of Australia, EPBC Act Referral Guidelines for the Vulnerable Koala (2014) 16.
[14] Conservation Advice for Temperate Highland Peat Swamps on Sandstone (2005). See also Department of Agriculture, Water and the Environment, Nationally threatened species and ecological communities information sheet: Temperate Highland Peat Swamps on Sandstone (2005) 1.

"The Blue Mountains water skink occurs in the mid to upper Blue Mountains (from 560 m above sea level upwards) of New South Wales between Hazelbrook in the east and Newnes in the west (Keith & Benson 1988, and Benson & Keith 1990 cited in NSW NPWS 2001; NSW OEH 2012).

The species inhabits permanently wet sandy-peat swamps found on the slopes of narrow valleys, or in low-lying areas of flat or undulating plateaux that are primarily restricted to the high, dissected Narrabeen group sandstone plateau. Such swamps occur where groundwater perches in permeable sandstone and derived sandy soils above basins of impermeable rock (Holland 1972 cited in NSW NPWS 2001).

A number of vegetation types occurring in the Blue Mountains represent suitable habitat for the Blue Mountains water skink and are indicative of the species potential distribution. Blue Mountains Sedge Swamps and Newnes Plateau Shrub Swamps are likely to comprise the majority of the species potential habitat, although Boyd Plateau Bogs and Cox's River Swamps also represent potential habitat for the species (NSW NPWS 2001). Blue Mountains Sedge Swamps extend from the lower Blue Mountains on the eastern side through to the upper Blue Mountains where they are most numerous. The abundance of Blue Mountains Sedge Swamps increase significantly at around 500 - 600 m (Keith & Benson 1988 cited in NSW NPWS 2001). Newnes Plateau Shrub Swamps are largely restricted to the Newnes area. The Blue Mountains Sedge Swamps and Newnes Plateau Shrub Swamps ecological communities are synonymous with the Temperate Highland Peat Swamps on Sandstone ecological community which is listed as Endangered under the EPBC Act. Boyd Plateau Bogs are generally restricted to the Boyd Plateau, while Cox's River Swamps are present in small numbers on the western side of the Blue Mountains and are usually found on flats in the deeper valleys (NSW NPWS 2001)." [15]

8. The availability of suitable habitat for the Blue Mountain Water Skink in the Extension Area was acknowledged by RPS as follows:

"Habitats within the Study Area include dense low shrubby swamp vegetation along the drainage lines, eucalypt forest and woodland vegetation on the slopes and ridges and dry rocky heath along cliffs. These habitats support a variety of fauna species, including threatened fauna. In total, 111 fauna species were identified across the Study Area, including 23 threatened fauna species listed under the TSC and/or EPBC Acts. Of these 23 species, nine were recorded within the Study Area by RPS and an additional 14 have previously been recorded from fauna monitoring.

The enhanced protection from predators offered by the dense vegetation of shrub swamps and, to a lesser extent, the hanging swamps, provides habitat for small mammals and birds, including more reserved species, which forage in the dense shrubs and undergrowth. Shrub swamps provide potential habitat for specialist threatened fauna species, including the Giant Dragonfly (Petalura gigantea) and Blue Mountains Water Skink (Eulamprus leuraensis)."

9. RPS also stated that all Newnes Plateau Shrub Swamps in the Extension Area were potential habitat for the Blue Mountains Water Skinks. It said:

[15] Conservation Advice for the Blue Mountains Water Skink (Eulamprus leuraensis) (2013) 2.

" *Given the species' preference for shrub swamps on the Newnes Plateau, all areas of MU 50 – Newnes Plateau Shrub Swamp are considered to provide critical habitat for this species. Despite no records existing for the species within hanging swamps on the Newnes Plateau, these swamps (MU 51 – Newnes Plateau Hanging Swamp) are still considered to provide potential habitat*."

10. Given that there are currently only 30 identified populations of the Blue Mountain Water Skink and, of these, 8 populations occur within Newnes State Forest,[16] it was important for appropriate surveys to be conducted to confirm the presence of any populations in the Subsidence Area.

2.3 Surveys for the Blue Mountains Water Skink

11. The Commonwealth Survey Guidelines for Australia's Threatened Reptiles provides that the following methodology and effort should be used to survey for the Blue Mountains Water Skink:

> *"Survey methods: The most comprehensive field research has been done by LeBreton (1994, 1996). In the first survey, pitfall traps were used consisting of two or three 10-litre buckets buried flush with the ground, with moist vegetation placed in the bottom of each trap to provide shelter from exposure and predators. A fence of 50 centimetre high plastic was placed between and over the buckets. In the second survey, no fences were used and this was still deemed suitable for detecting the presence of the species. Appropriate survey methodology for detecting the presence of the Blue Mountains water skink would be targeted pitfall trapping in December to February when the species is most likely to be active, using a line of three 10 litre buckets each approximately 5 metres apart (although other pitfall trap arrays could be trialled). No drift fence would be required."*[17]

12. In contrast, the methodology used by RPS was described as follows:

> "*3.4.4 Blue Mountains Water Skink surveys*
>
> *Surveys were performed in March 2019 to determine the presence/absence of Blue Mountains Water Skinks (BMWS within the Project Area. Swamp vegetation comprising potential BMWS was mapped using high resolution imagery (7cm pixel resolution) and subsequently reviewed to identify high value habitat as described for this species in RPS (2019b). Sample sites were identified from this mapping for field investigation as shown in Figure 7. Each sample site comprised a linear funnel trap array comprising five traps with inter-trap distances of five metres, this being generally consistent with the method described in SEWPaC (2011). Small water containers were placed in each trap to provide a refuge for caught BMWS, thereby preventing ant attack. Trapping occurred over five consecutive days in suitable conditions (e.g. ambient daytime temperatures exceeding 20 degrees Celsius with minimal incidence of wind and rainfall). Traps were checked daily with caught animals measured and weighed. A GPS location was recorded for each*

[16] Department of the Environment (2020). *Eulamprus leuraensis* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.
[17] Centennial Coal, 'Angus Place Mine Extension Project: Amended Report" (6 December 2019) Appendix I 31.

BMWS caught during the sampling location. Incidental observations were also recorded."[18]

13. Linear funnel traps are suitable for detecting the presence of certain reptiles such as snakes, but are not suitable for detecting the Blue Mountain Water Skink. There was a significant disparity between the equipment used by RPS (see, for example a photo of linear funnel traps in Figure 1 below) and what was required by the Survey Guidelines (see Figure 2 below). No evidence-based rationale was provided by RPS for its departure in methodology.

Figure 1: Examples of linear funnel traps for reptiles[19]

Figure 2: Example of bucket used to catch skinks[20]

[18] Ibid.

[19] < https://terrestrialecosystems.com/funnel-traps-order-form/?xhxcclop=315351>

[20] <https://lemonbayconservancy.org/the-mysterious-blue-tailed-skink/>

14. The survey conducted by RPS for the Blue Mountains Water Skink was also below acceptable standards for the following reasons:

a. It was not conducted at an appropriate time of year.

The Survey Guidelines provide that *"for any proposal, the timing of fieldwork is critical to the surveying and reporting process. Careful consideration of the necessary lead-time is required, as it may be necessary to undertake surveys at specific times of the year depending on the ecology of the species in the subject area. Surveys over multiple years may be required where a single year's data is not adequate to detect the species or to address the environmental factors. There may also be a time lag due to the availability of appropriate faunistic expertise. If it is not possible to survey for target taxa that have been previously recorded in the general location of the study area during the appropriate time of day or season, it should be assumed that these taxa do occur in the study area if suitable habitat exists (NSW DEC 2004)."*[21]

In contrast, the RPS survey was conducted in March 2020, which is outside the survey window of December – February 2020.

b. There was no temporal replication of the survey.

The Survey Guidelines provide: *"Temporal replication may be necessary to detect populations that fluctuate in abundance, occurrence or detectability with time, especially when these fluctuations are unpredictable. Regular sampling during and throughout the time of year when the taxa are most likely to occur at the study area is desirable. Some locations may be occupied by target taxa/taxon in some years but not others, depending on environmental conditions."*[22]

In contrast, the RPS Survey was only conducted once, over five days, without any temporal replication during the time of year when the Blue Mountains Water Skink was most likely to occur on the site.

2.4 Suitable habitat for the Large-eared Pied Bat

15. Foraging and roosting habitat for the Large-eared Pied Bat is present in the Extension Area because of the presence of caves and overhangs. The NSW Office of Environment and Heritage published the following relevant information on the species:

"***Habitat and ecology***

- *Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years.*

[21] Ibid, above n11, 7.
[22] Ibid, above n11, 9.

- *Found in well-timbered areas containing gullies.*

- *The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.*

- *Likely to hibernate through the coolest months.*

- *It is uncertain whether mating occurs early in winter or in spring."*[23]

16. The availability of critical breeding and foraging habitat for the Large-eared Pied Bat in the Extension Area was acknowledged by RPS as follows:

    "*On-site Habitat*

    Critical breeding habitat for this species within the Study Area is considered to occur amongst the caves and overhangs found within the Pagoda Rock Sparse Shrubland community (MU43). Critical foraging habitat is also considered to occur in remnant vegetation communities located along the valley floor in the western portion of the Study Area. These communities include areas of MU 15, 19, 20, 21, 32, 33, 35 and 37. All other areas of forest and woodland communities across the Study Area are considered to provide potential foraging habitat for the species."

17. Map 3 above shows that the Subsidence Area contains cliffs and pagodas that are potential breeding habitat for the Large-eared Pied Bat. For this reason, appropriate surveys should have been conducted by RPS to confirm the presence of any roosts in the Subsidence Area.

2.5 Surveys for the Large-eared Pied Bat

18. The Commonwealth Survey Guidelines for Australia's Threatened Reptiles provides that the following methodology and effort should be used to survey for the Large-eared Pied Bat:

    "***Recommended survey approach***

    The use of electronic bat detectors is the best means of non-invasive survey, and the most efficient in terms of data collection and area coverage. Trapping with harp traps and mistnets, and roost searches in caves, mines, rock overhangs, culverts and crevices could be undertaken to confirm presence or roosting.

    Recommended acoustic detection devices include the Anabat ZCA system (recording to CF card), though other frequency-division and time expansion detectors connected to digital recorders could be used.

    1. Prior to the survey. Determine the potential for rocky outcrops, caves and mines to occur in the area by examining topographic and geological maps, and contacting state

[23] https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10157

government mines and forestry departments, Queensland Parks and Wildlife Service, caving groups, bat researchers and local councils. Where appropriate, information on caves and mines may be obtained from local residents.

2. Passive acoustic detection. A range of potential roost habitats can be examined by passive detection with unattended recorders placed in the vicinity of mines, caves and rocky outcrop, and also in foraging sites such as vegetation corridors and flyways, sandstone gorges, over watercourses, isolated waterholes and in representative vegetation types. Quality search-phase echolocation calls are diagnostic but these may not be recorded from bats emerging from underground roosts if bat detectors are placed at the entrance. Unattended detectors should be left overnight at multiple locations.

3. Active acoustic detection. For larger project areas, walking or driving transects using hand-held detectors may be used in conjunction with unattended detectors. Transects should begin at dusk.

4. Roost searches. Where no known roost sites have been identified in the planning stage, several hours may be required to conduct ground-based surveys for caves, mines, rock overhangs and crevices. For large project areas in gorge country, ground-based searching could be expected to take several days.

Daytime entry of subterranean structures such as culverts, mines and caves should be undertaken carefully to avoid risking the safety of personnel and disturbance to resting bats. Identification can be made from capture within roosts. Disturbance resulting from capture of bats should be compensated by the collection of unambiguous and verifiable evidence of occupancy – in the form of photographs of the distinctive pelage, and external measurements.

5. Trapping. Success with trapping is most efficient in the vicinity of potential roosts. Harp traps and mistnets are useful for detecting this species, and can be set overnight in forest flyways, near scarps and cliffs and in riparian zones. Captured individuals should be released only at night, or into roosts during the day if these are known, and bats should be held for the minimum amount of time after being removed from traps and nets. If bats are cleared from harp traps in the early morning, they should be kept at room temperature until the following night. Reference calls should be recorded from individuals released after trapping so that identification information is available for verification."[24]

19. RPS used bat echolocation call recording and harp traps to survey for bats in the Subsidence Area. It described its methodology as follows:

"*2.5.6 Bat Echolocation Call Recording*

Microbat echolocation calls were recorded using Anabat II Detector and CF ZCAIM units set to remotely record for the entire night (6pm to 6am). Anabats were placed at 12 separate sites within the Study Area with each survey location sampled for four consecutive nights. The location of each Anabat site was selected based on the likelihood that it would provide potential foraging sites and flyways for microbats. The location of each Anabat survey site is shown in Figure 4.

[24]Ibid, above n12, 35-36.

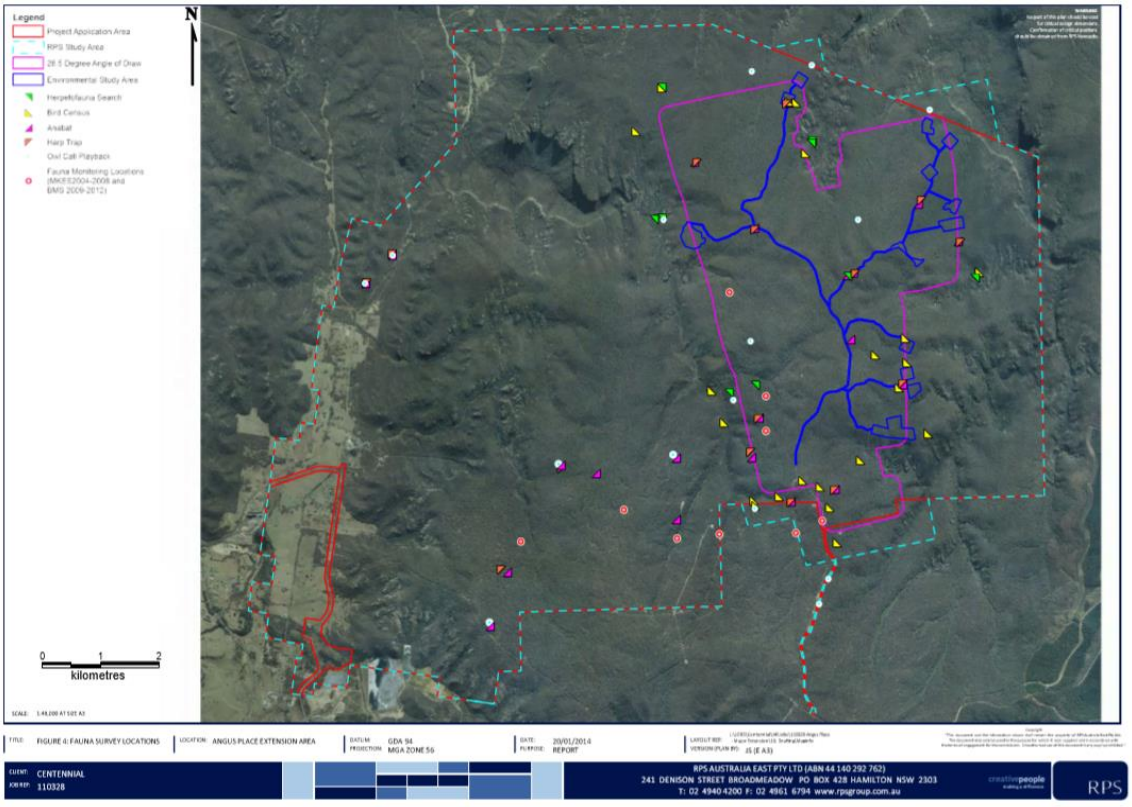
Bat call analysis was undertaken by Anna McConville who is experienced in the analysis of bat echolocation calls. Each call sequence ('pass') was assigned to one of three categories, according to the confidence with which an identification could be made, being:

- *Definite - Pass identified to species level and could not be confused with another species;*
- *Probable - Pass identified to species level and there is a low chance of confusion with another species; or*
- *Possible - Pass identified to species level, but short duration or poor quality of the pass increases the chance of confusion with another species.*

2.5.7 Bat Trapping – Harp Traps

Harp Traps were utilised at ten of the 13 trap line locations across the Study Area. Harp Traps are designed to catch microbats, allowing for visual identification of species occurring within the Study Area as well as to allow for the identification of species that are not detectable utilising ultrasonic recording devises. Any microbats caught were identified and released on the same night of capture."

20. The location of the Anabats and Harp Traps are depicted as orange and pink triangles in Map 6 below.



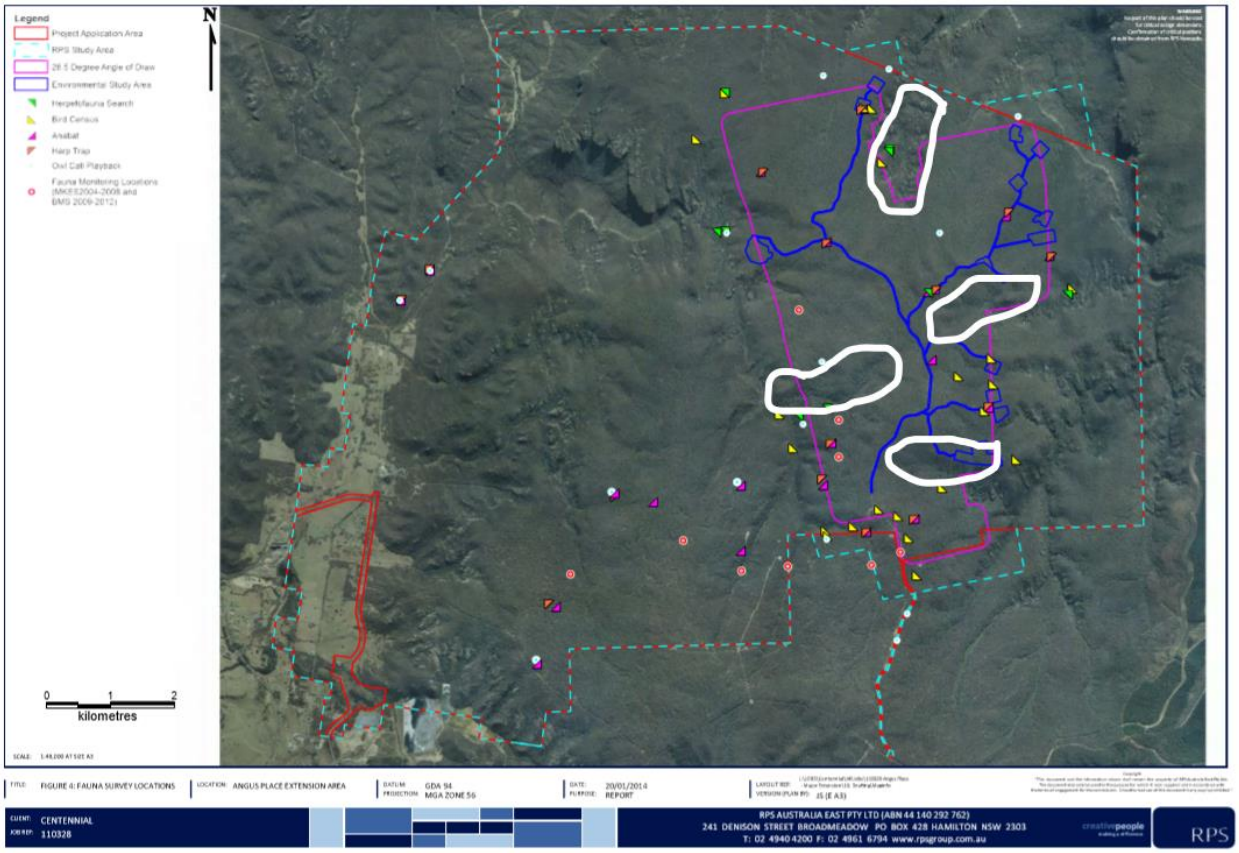
Map 6: Location of surveys conducted by RPS in 2014.

21. Given the availability of suitable roosting habitat for the Large-eared Pied Bat within the Subsidence Area, RPS should also have conducted roost searches as part of its survey.

22. At the very minimum, some of the Anabats and harp traps should have been placed within the vicinity of potential roosts. Instead, the sites selected by RPS were located only at potential foraging sites. These sites appear to have been at low elevations near riparian areas.

23. The location of surveys is a critical factor that affects a survey's ability to effectively detect threatened species in an area. However, no description was provided by RPS of how the Anabat and harp trap survey locations were determined and whether they maximized the chances of detecting <u>both</u> foraging and breeding areas, which were fundamental to the survey's design.

24. We refer to Map 3 above, which shows cliffs, pagodas and areas of higher elevation within the Subsidence Area. We have overlaid these areas in Map 7 below to show the complete absence of surveys by RPS in these areas.



Map 7: Potential breeding habitat for the Large-eared Pied Bat within the Subsidence Area.

2.5 Conclusion

25. It is submitted that the lack of adequate and appropriate surveys for the Blue Mountains Water Skink and the Large-eared Pied Bat should lead to:

c. The NSW Department of Planning, Industry and the Environment reporting that **Requirements** 1(a) and 5 of the Director-General's Supplementary Requirements were not met by Centennial under the accredited assessment scheme; and

d. The Commonwealth Minister for the Environment assuming that both these species are present in the Extension Area, including the Subsidence Area, for the purposes of assessing significant impact to these species.

3. Subsidence Impacts

3.1 Context – Longwall mining

26. In longwall mining, large rectangular panels of coal are extracted beneath the ground. Strips of coal, typically 3 m thick, are shaved from the longwall face using a shearer, under the protection of hydraulic supports.

27. As the longwall face progresses through the seam in a snake-like motion, the overlying roof strata bends or sags into the void and the subsidence process of the overburden strata commences (see Figure 3 below).

28. The collapsed roof strata is made of loose blocks and can contain large voids depending on the loading and compaction that follows. Immediately above the mined void and the collapsed zone, the strata can remain relatively intact and bends into the void.

29. This results in the formation of new vertical factures, the opening up of existing natural vertical fractures and bed separation. The strata layers above bend and shear with the amount of strata sagging, fracturing and bed-separation reducing towards the surface. The fracture zone commonly forms an arch over the extracted panel (see Figure 4 below).[25]

[25] Subsidence from coal mining activities, Background review, Commonwealth of Australia 2014.

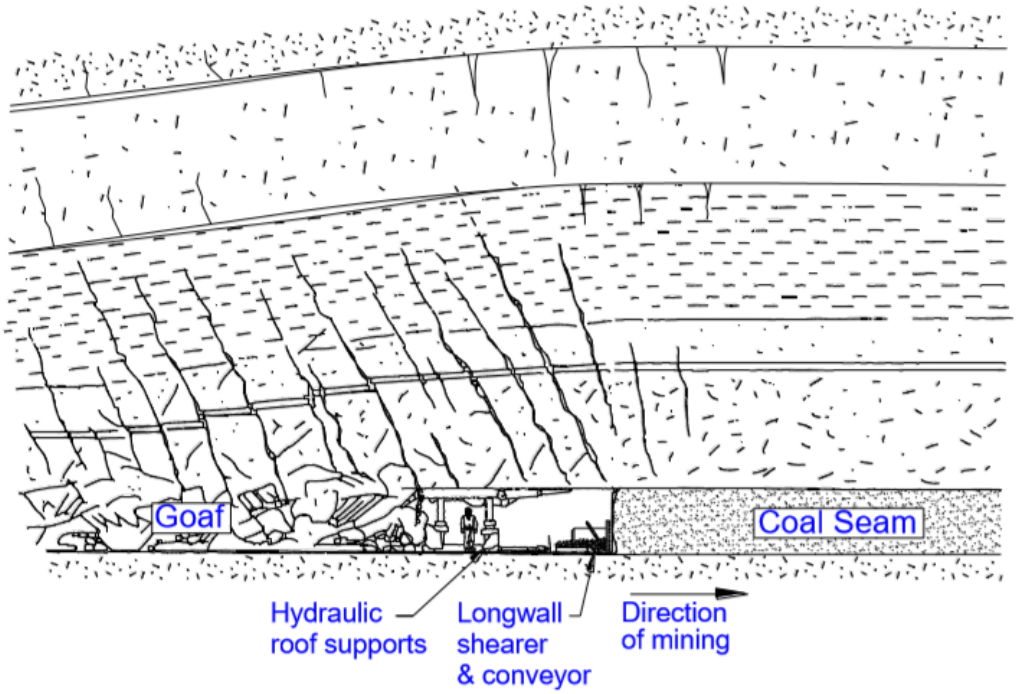


Figure 3: Cross section along the length of a typical longwall at the coal face[26]

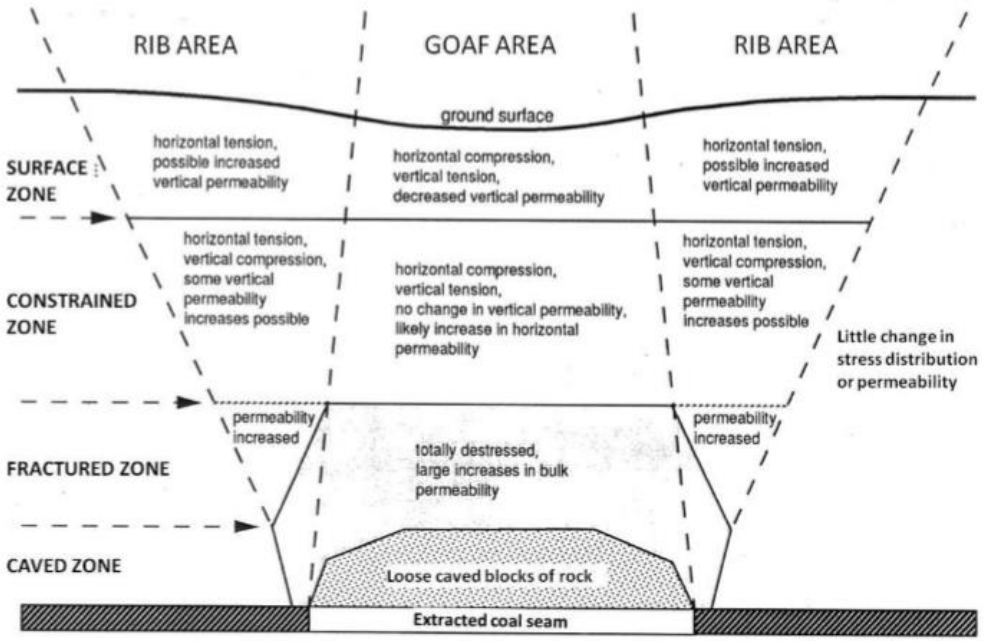


Figure 4: Caving, fracturing and subsidence above a longwall panel[27]

[26] MSEC 2007, Introduction to longwall mining and subsidence, Unpublished report by Mine Subsidence Engineering Consultants (MSEC), Chatswood New South Wales, August 2007.
[27] Ibid, above n25, 26.

30. Because longwall mining carries the greatest risk of impacts from subsidence compared to other methods of mining, it is often not used in areas with sensitive environmental receivers and infrastructure features. For example, Centennial Coal's Awaba and Clarence mines use bord-and-pillar mining because of many cliff lines, creeks and aquifers that require protection.[28] Further, Centennial Coal's current proposal to extend its operations at Newstan Colliery ((Referral 2019/8528) also involves bord-and-pillar first and second workings because of features such as the Eraring Power Station, the Eraring Ash Dam Wall, a 132 kv transmission substation and the Northern Railway.

3.2 Context – the NSW Western Coalfield

31. Longwall mining has had a long and troubled history in the NSW Western Coalfield, where this project has been proposed.

> "*Longwall mining on the NSW Western Coalfield was inaugurated in the mid-1980s, when Angus Place Colliery came into operation. There are now four longwall mines active on the field, with another three planned. A fifth mine, Clarence Colliery, was planned for longwall operations, but now uses a miniwall and flexible conveyor train to limit subsidence impacts on overlying aquifer, cliff lines and bushland. The major subsidence issues that have arisen on the Western Coalfield are cliff instability and drainage of perched aquifers that sustain groundwater-dependent ecosystems (GDEs), especially where the longwall panels are relatively shallow.*
>
> *The cliff stability problem has been heightened by the tendency of the relatively weak sandstone overburden to break through the intact rock, as well as along joints. In addition, the sandstone has been eroded into intricate patterns by solution weathering (silicate karst), as exemplified by pagoda-like landforms in the Gardens of Stone National Park. Even though mining is not allowed in the national park, natural cliff lines elsewhere have to be preserved so far as possible. The issue has been especially acute in the case of Baal Bone Colliery and is the subject of continuing research. However, the Clarence Colliery miniwall has successfully mined under cliffs, because subsidence from its panel and pillar system of working is limited to 100 mm."*[29]

3.3 Context: Subcritical, Critical or Supercritical?

32. Extraction areas can be categorized with regard to expected subsidence as subcritical, critical or supercritical. The difference between these categories is as follows:

    a. Subcritical –This results in a ratio of panel extraction width (W) to the thickness of the overburden or cover rocks (H) that is less than the critical range. At W/H values of <0.4-0.6, the amount of surface subsidence is negligible.

    b. Critical – This results in maximum subsidence at a point directly above the centre of the panel. At W/H values of 0.6-1.6, the amount of subsidence is sensitive to variations in panel width, overburden depth and strata composition and properties.

[28] Ibid, above n25, 10.
[29] Ibid 52.

c. Supercritical – This results in a W/H ratio that is more than the critical range. At W/H greater than 1.6, the maximum subsidence is reached with S_{max} typically 55-65 percent of the mined seamed thickness.

33. The Proposed Action has the following characteristics:

a. The depths of cover above the proposed LW1001 to LW1015 are between 270 m - 450 m. The western side of the proposed mining area has lower depths. The eastern side of the proposed mining area has higher depths. The W/H ratios for the proposed longwalls, therefore, vary between 0.8 and 1.3.[30]

b. In the western part of the proposed mining area, the width-to-depth ratios typically vary between 1.0 and 1.3. This range is greater than the previously extracted longwalls at Angus Place and Springvale Collieries. The IPM for this project, was therefore reviewed based on monitoring data from collieries located elsewhere in the Western Coalfield having a similar range of width-to-depth ratios.[31]

c. In the Western Coalfield, measured subsidence for longwalls with W/H ratios between 1.2-1.3 were similar to the maximum predicted values. The reason is the longwalls are near supercritical widths and, therefore, the vertical subsidence is close to the maximum achievable for single-seam mining conditions of 60 % to 65 % of the mining height (see Fig 5 below).[32]

d. This means that for areas with W/H ratios between 1.2-1.3 in the western part of the proposed mining area, expected vertical subsidence will be close to maximum predicted values of 60%-65% of the mining height.

34. In context, the 0.8-1.3 W/H ratios that are estimated for this project are much higher than W/H ratios that are considered acceptable for sensitive areas. The IESC has stated:

> "*Sub-critical extraction is common in the Sydney Basin, NSW, where it is often required by the regulator so as to minimise surface movements near residential areas. Typical sub-critical W/H ratios in the Newcastle area range from 0.3 to 0.8. The resulting subsidence may be 10 to 50 per cent of the maximum potential subsidence (under critical or super-critical extraction).*"[33]

35. The amendments proposed by Centennial have increased the risk of subsidence in some areas of the project to maximum predicted subsidence levels, instead of 10-50% of the maximum as has been found appropriate in other sensitive environments.

36. The increase of void width in amended proposal has resulted in overall greater W/H ratios and, accordingly, greater subsidence. In particular, the maximum predicted total conventional subsidence has significantly increased. Similar increases have been projected for maximum total conventional tilt, maximum total conventional hogging curvature and maximum predicted total conventional sagging curvature (see Table 2 below).

[30] Centennial Coal, 'Angus Place Mine Extension Project: Amended Report" (6 December 2019) Appendix G 30.
[31] Ibid.
[32] Ibid.
[33] Ibid, above n25, 20.

Table 2: Comparison of maximum predicted total subsidence effects[34]

Application (Report)	Maximum predicted total conventional subsidence (mm)	Maximum predicted total conventional tilt (mm/m)	Maximum predicted total conventional hogging curvature (km^{-1})	Maximum predicted total conventional sagging curvature (km^{-1})
APMEP EIS (Report No. MSEC593)	1900	20	0.30	0.35
Amended Project Report (Report No. MSEC1042)	2250	25	0.35	0.40

37. In effect, what Centennial has proposed a project that presents a substantially higher risk to a sensitive receiving environment. The higher subsidence risk of the project increases the chances of irreversible damage being caused to matters of national environmental significance (**MNES**) that are known and likely to be present within the Subsidence Area.

3.4 Subsidence impacts to THPSS and the Blue Mountains Water Skink

38. There are two types of THPSS that are present within the Subsidence Area:

    a. Shrub swamps – These swamps develop in the bases of natural valleys and are formed from the accumulation of sediments along relatively flat sections of drainage lines. Most of the vegetation in these swamps comprise of grasses, ferns and shrubs.

    b. Hanging swamps – These swamps develop on the sides of valleys where groundwater seepage occurs from perched aquifers. These swamps are usually downslope of sandstone layers which are on top of claystone or shale layers.[35]

39. The Revised Subsidence Assessment by MSEC (**Subsidence Assessment**), which can be found in Appendix G to the Amendment Report makes the following findings regarding impacts to shrubby and hanging swamps:

    a. The impacts to shrub swamps will depend on their location. Subsidence is predicted to be about 60%-90% of maximum values near the centrelines of the longwalls and around 30%-60% of the maximum predicted impacts near the chain pillars and near the perimeter of the proposed mining area.[36]

    b. Maximum valley closure, or the reduction in horizontal distance between the valley sides, is expected to be high, with 1000 mm predicted for Tri-Star Swamp and Twin Gully Swamp, with lower but significant closure for Carne Creek Tributary Swamps of 350 mm and Wolgan River Swamps of 160- 370mm. The effects on Wolgan River Swamps are expected to be amplified because of accumulated effects from existing longwalls.

[34] Ibid 51.
[35] Ibid 86-87.
[36] Ibid 89.

c. Maximum upsidence, or the bulging upwards of the valley floor, is also expected to be high with 750mm predicted for Tri-Star Swamp and Twin Gully Swamp, followed by 260mm for Carne Creek Tributary Swamps and 100-290 mm for Wolgan River Swamps. The effects on Wolgan River Swamps are expected to be amplified because of accumulated effects from existing longwalls (see Table 3 below).

Table 3: Maximum predicted total upsidence and closure for shrub swamps[37]

Shrub swamp	Maximum predicted total upsidence (mm)	Maximum predicted total closure (mm)
Tri Star Swamp	750	1000
Twin Gully Swamp	750	1000
Japan Swamp	90	120
Wolgan River Swamps*	100 (proposed longwalls only) 290 (existing and proposed longwalls)	160 (proposed longwalls only) 370 (existing and proposed longwalls)
Carne Creek Tributary Swamps	260	350

d. High maximum predicted vertical subsidence levels for Tri Star Swamp and Twin Gully Swamp of 2250 mm and 1600 respectively (see Table 4 below).

Table 4: Maximum predicted total upsidence and closure for shrub swamps[38]

Hanging swamp	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km^{-1})	Maximum predicted total sagging curvature (km^{-1})
Tri Star Catchment	2000	13	0.16	0.20
Twin Gully Catchment	1500	8	0.12	0.20
Japan Catchment	50	1	0.02	< 0.01
Wolgan River Catchment	< 20	< 0.5	< 0.01	< 0.01
Carne Creek Catchment	170	3.5	0.12	0.01

40. Impacts from subsidence to shrubby swamps are expected both from vertical subsidence as well as tilting, stretching and re-compression of the overburden which accompanies the lowering of the land surface.

41. The Proposed Action is likely to adversely affect shrubby swamps in the Subsidence Area in the following ways:

a. Swamp cracking – Cracking is estimated to be "typically less than 25 mm", but "localised cracking greater than 50mm can also develop". Further, "larger surface deformations could also occur if increased scouring were to develop due to changes in swamp vegetation."[39]

[37] Ibid 88.
[38] Ibid 88.
[39] Ibid 94.

b. Bedrock fracturing – Bedrock fracturing is expected beneath the swamps directly above the proposed mining area and outside the mining area up to distances of 400 m. The fracture widths within the mining area are estimated to be 35 mm, with fracture widths outside the mining area to be less than 10 mm.[40]

42. According to the Subsidence Assessment, expected effects of bedrock fracturing and cracking in Tris Star Swamp and Twin Gully Swamp are expected to be similar to those experienced in Junction Swamp, Narrow Swamp, Narrow Swamp South and East Wolgan Swamp. These swamps experienced the following effects:

    a. Vegetation dieback;

    b. Major incision and erosion (in some cases down to the bedrock);

    c. Loss of peat layer;

    d. Significant loss of ecosystem function and ecological resilience; and
    e. Geomorphic threshold exceedance.[41]

43. Although MSEC noted that some of the above impacts may have been the result of mine discharge, these effects occurred at Junction Swamp, where no mine discharge from Springvale Colliery was recorded.

3.5 Significant Impact Analysis for THPSS and the Blue Mountains Water Skink

44. The EPBC Act Significant Impact Guidelines 1.1 provide:

> *"**Critically endangered and endangered species***
> ***Significant impact criteria***
>
> *An action is likely to have a significant impact on a critically endangered or endangered species if there is a real*
> *chance or possibility that it will:*
> *• lead to a long-term decrease in the size of a population*
> *• reduce the area of occupancy of the species*
> *• fragment an existing population into two or more populations*
> *• adversely affect habitat critical to the survival of a species*
> *• disrupt the breeding cycle of a population*
> *• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
> *• result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
> *• introduce disease that may cause the species to decline, or*
> *• interfere with the recovery of the species."*

[40] Ibid 94.

[41] Ibid 90.

45. The word “likely” is defined in Significant Impact Guidelines 1.1 as follows:

> *“**When is a significant impact likely?***
>
> *To be ‘likely’, it is not necessary for a significant impact to have a greater than 50% chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility.*
>
> *If there is scientific uncertainty about the impacts of your action and potential impacts are serious or irreversible, the precautionary principle is applicable. Accordingly, a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.”*

46. The impacts set out in paragraph 41 above are likely to impact the THPSS (Tri Star Swamp and Twin Gully Swamp) and the Blue Mountains Water Skink because the ecological collapse of these swamps will “reduce the area of occupancy of the species”.

47. Even if impacts are on a lesser scale and comprise a significant loss of ecosystem function, these impacts will still adversely impact habitat critical to the survival of the species. It is submitted that all remaining habitat of THPSS and the Blue Mountains Water Skink currently constitutes habitat critical to the survival of the species because of the (1) endangered status and (2) limited and fragmented distribution of such species.

3.6 Conclusion

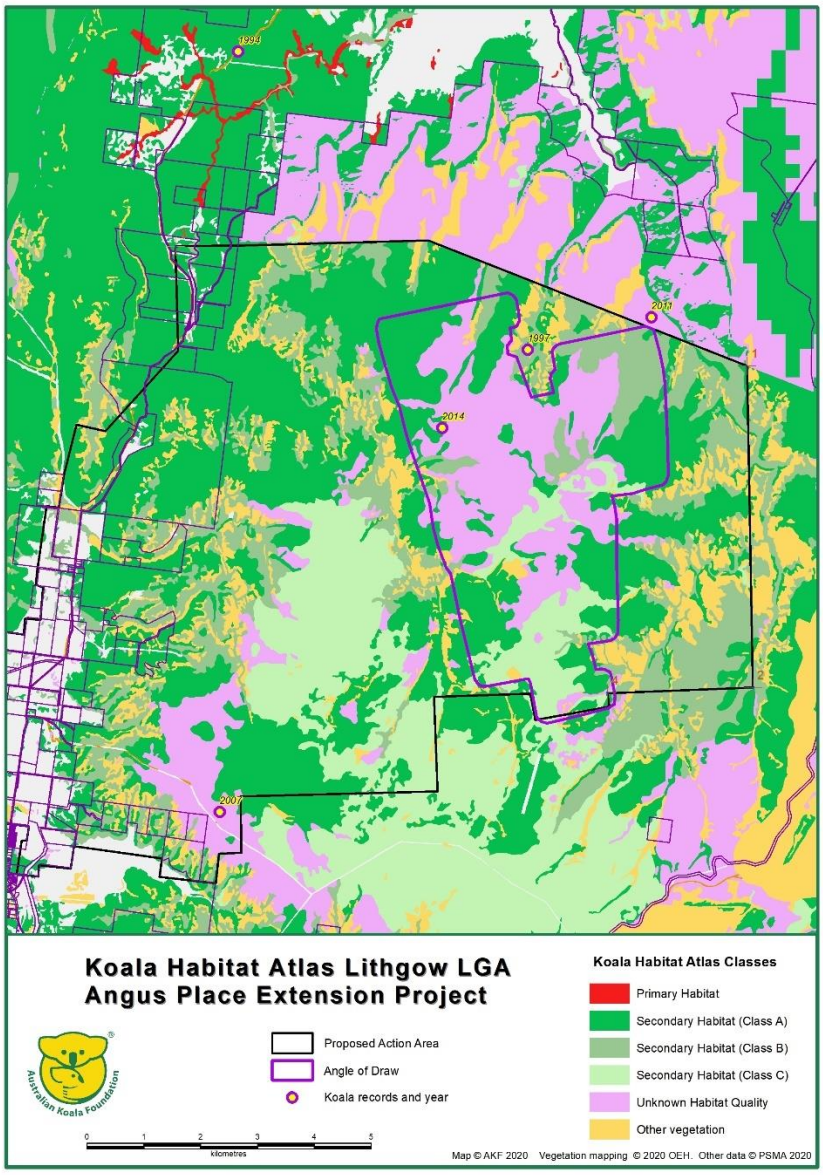
48. Centennial’s proposal to conduct longwall mining operations at W/H ratios that will result in maximum subsidence impacts in a sensitive environment is inappropriate and is likely to result in irreversible impacts to Endangered THPSS and the Blue Mountains Water Skink, which are protected under Chapter 2 of the EPBC Act. The approval of this action is contrary to the objects of protecting the environment and conserving biodiversity, as set out in s 3(1)(a) and (c) of the EPBC Act.

49. For these reasons, we submit that the Commonwealth Minister for the Environment should not approve the Proposed Action under s 133 of the EPBC act on grounds of unacceptable impacts to THPSS and the Blue Mountains Water Skink.

4. Koalas

4.1 Habitat critical to the survival of the species

50. According to scientific and mapping advice from the Australia Koala Foundation, the Extension Area, including the Subsidence Area, contains large areas of high-grade secondary habitat for koalas (Class A, B and C) (see Map 8 below). The map also shows a recent record of koala occurrence in 2014 within the Subsidence Area.



Map 8: AKF map for the Angus Place Extension Project

51. The areas in light purple Unknown Habitat Quality indicate that there is no recent vegetation map. In effect this means that most of the draw-down area has not been properly assessed and mapped, vegetation-wise, even at regional scale.

52. We note that Centennial and RPS' assessment of the presence of koala trees in the area is based on an outdated version of SEPP 44. All of the tree species within the Subsidence Area are on the current list of tree species under the Draft State Environmental Planning Policy (Koala Habitat Protection) Guideline 2019. These include:

    a. *E. dalrympleana*;

    b. *E. piperita*;

c. *E. cypellocarpaj*;

d. *E. pauciflora*;

e. *E. mannifera*;

f. *E. sclerophylla*; and

g. *E. divesk*.

53. We refer to the EPBC Act Referral Guidelines for the Vulnerable Koala (**Koala Referral Guidelines**) for the purpose of evaluating whether the Subsidence Area constitutes habitat critical to the survival of the species. The Koala Referral Guidelines contains a Koala Habitat Assessment Tool, which is a scoring system to assess habitat values specific to koalas.

54. For the reasons set out in Table 5 below, we believe the Subsidence Area constitutes habitat critical to the survival of the koala with a score of 8 out of 10.

Table 5: Koala Habitat Assessment Tool

Attribute	Score	Coastal Criteria	Comments
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	**Score =0**
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.	
	0 (low)	None of the above.	
Vegetation composition	+2 (high)	Has forest or woodland with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	The Subsidence Area contains more than 2 food tree species. **Score = 2**
	+1 (medium)	Has forest or woodland with only 1 species of known koala food tree	

Attribute	Score	Coastal Criteria	Comments
		present.	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	The Subsidence Area is part of a large area of contiguous landscape including Wollemi National Park, the Gardens of Stone National Park and the rest of Newnes State Forest. **Score = 2**
	+1 (medium)	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	There is no evidence of koala mortality from vehicle strike or dog attack at present in EMBA, which scores 2 for koala occurrence. **Score = 2**
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, OR Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	

Attribute	Score	Coastal Criteria	Comments
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, OR Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	The average rainfall in Lithgow is 908 mm per year. This means that the recovery interim recovery objectives for the coastal context apply, as set out in the Koala Referral Guidelines. The Extension Area, including the Subsidence Area, is important for achieving the interim recovery goals of protecting and conserving large connected areas of koala habitat and maintaining corridors and connective habitat that allow movement of koalas between large areas of habitat because of the presence of koala trees and connectivity with large areas of koala habitat. **Score: 2**
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
Total			**8**

4.2 Significant Impacts on Koalas

55. The Significant Impact Guidelines 1.1 provide:

> *"**Vulnerable species***
> ***Significant impact criteria***
>
> *An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that*
> *it will:*
>
> *• lead to a long-term decrease in the size of an important population of a species*
> *• reduce the area of occupancy of an important population*
> *• fragment an existing important population into two or more populations*
> *• adversely affect habitat critical to the survival of a species*
> *• disrupt the breeding cycle of an important population*
> *• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
> *• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*
> *• introduce disease that may cause the species to decline, or*
> *• interfere substantially with the recovery of the species."*

56. The term "important population" is defined in the Significant Impact Guidelines as follows:

> *"**What is an important population of a species?***
>
> *An 'important population' is a population that is necessary for a species' long-term survival and recovery.*
> *This may include populations identified as such in recovery plans, and/or that are:*
> *• key source populations either for breeding or dispersal*
> *• populations that are necessary for maintaining genetic diversity, and/or*
> *• populations that are near the limit of the species range."*

57. It is submitted that koalas in the Extension Area are part of the population of Blue Mountain koalas. It is further submitted that this population constitutes an "important population" because it is one of the most genetically diverse koala populations in NSW/Qld. A 2018 national-scale koala genomics study that involved James Cook University, the University of Sydney and San Diego Zoo Global found that:

> *"The Blue Mountains (koala) population appears to hold much of the genetic diversity of the species… Subsequently, although it is important to preserve all populations of koalas, this region should be highlighted for future study if we are seeking to preserve existing diversity for the entire species."*[42]

[42] Kjeldsen, S.R., Raadsma, H.W., Leigh, K.A. et al. Genomic comparisons reveal biogeographic and anthropogenic impacts in the koala (*Phascolarctos cinereus*): a dietary-specialist species distributed across heterogeneous

58. The Proposed Action is likely to affect critical habitat for the Blue Mountains koala population for the following reasons:

    a. Vegetation clearance for the construction of surface infrastructure will permanently destroy critical koala habitat;

    b. Cracks in the areas of subsidence can rip tree roots apart, the effects of which can range from damage to death of koala trees. Where the cracks run close to trees, it can cause trees to fall over; and

    c. Areas of subsidence in between the surface cracks may fill with water, which can inundate trees. These types of landscapes frequently exhibit extensive stands of dead trees, similar to artificial lakes. The base of inundated areas can also drain into voids below, creating a wetting and drying cycle which is unsuitable for trees.

59. The above impacts are likely to be amplified at areas where maximum subsidence is expected near the centrelines of the longwalls. Further, greater subsidence is expected from this project due to the high W/H ratios and the extraction of multiple panels.

60. We disagree with the significant impact assessment analysis by Centennial and RPS for the reasons set out in Table 6 below.

    Table 6: Significant Impact Analysis for the Vulnerable Koala

	Significant Impact Criteria for Vulnerable Species	SHG Assessment
1.	Lead to a long-term decrease in the size of an important population of a species	The Blue Mountains koala population was severely impacted by the 2019-2020 bushfires, with an estimated 80% of forest areas burned.[43] It is submitted that the destruction of any remaining habitat of koalas will lead to a long-term decrease in the size of this population. **Significant impact**
2.	Reduce the area of occupancy of an important population	Clearing of critical habitat for the Blue Mountains koala population will reduce the area of occupancy of this population. **Significant impact**
3.	Fragment an existing important population into two or more	**No significant impact**
4.	Adversely affect habitat critical to the survival of a species	The Proposed Action will clear habitat critical to the survival of the species. Habitat within the Subsidence Area that is in the close vicinity of the proposed longwalls is also likely to be adversely

environments. *Heredity* 122, 525–544 (2019). https://doi.org/10.1038/s41437-018-0144-4. See also http://scienceforwildlife.org/blue-mountains-koalas-are-the-most-genetically-diverse-population-recorded/.

[43] <https://www.sbs.com.au/news/it-s-huge-fears-80-per-cent-of-nsw-s-iconic-blue-mountains-lost-to-bushfires>

	Significant Impact Criteria for Vulnerable Species	SHG Assessment
		affected because of damage to trees, inundated habitat and potential impacts to the water table. **Significant impact**
5.	Disrupt the breeding cycle of an important population	The loss of critical habitat is likely to disrupt the breeding cycle of the Blue Mountains koala population. **Significant impact**
6.	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The Blue Mountains koala population is already in severe decline because of habitat loss from the recent bushfires. Any additional stresses to this population, such as those that are likely to result from the Proposed Action may result "real" or "not remote" chance of the species declining. **Significant impact**
7.	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The mining operations, both above and below ground, have the potential to disturb habitat and result in increased invasive species, leading such species to becoming established in the Blue Mountains koala population's habitat. **Significant impact**
8.	Introduce disease that may cause the species to decline	No mitigation measures have been proposed by Centennial to prevent the introduction of disease to koalas on site. In particular, no translocation quarantine procedures for Chlamydia and Koala retrovirus have been proposed. No Biosecurity and hygiene procedure for Phytophthora cinnamomi and Myrtle Rust have been proposed. **Significant impact**
9.	Interfere substantially with the recovery of the species	The further loss or degradation of critical habitat for the Blue Mountains koala population especially in relation to existing large areas of habitat and connective corridors is contrary to the Interim Recovery Objectives for the species. **Significant Impact**

4.3 Conclusion

61. Centennial's proposal to conduct longwall mining operations at W/H ratios that will result in maximum subsidence impacts in critical habitat for the survival of koalas is inappropriate and is likely to result in irreversible impacts to Blue Mountains koala population, which is protected under Chapter 2 of the EPBC Act. The approval of this action is contrary to the objects of

protecting the environment and conserving biodiversity, as set out in s 3(1)(a) and (c) of the EPBC Act.

62. For these reasons, we submit that the Commonwealth Minister for the Environment should not approve the Proposed Action under s 133 of the EPBC act on grounds of unacceptable impacts to the Koala.

63. Alternatively, if this argument is rejected, we ask that Centennial be required to conduct a comprehensive assessment of cumulative impacts to the Koala from the Proposed Action, taking into consideration impacts from the Gospers Mountain fire.