24 Aboriginal heritage

24.1 Impacts to Aboriginal sites

Submissions by OEH, the Nature Conservation Council of NSW (NCC) and some community members commented generally about the project's impact on Aboriginal sites.

The Nature Conservation Council stated that "we are concerned that the proponent acknowledges the two projects will impact eight sites of moderate significance."

OEH stated that: "The Aboriginal cultural heritage assessment has complied with OEH guidelines. While many of the recorded Aboriginal Cultural heritage sites within the impact area have been avoided, impacts to Aboriginal objects will still occur so mitigation is required."

A number of community submissions raised generally that the potential to Aboriginal heritage will result in a negative outcome, with some contending that all Aboriginal sites should be considered of high significance.

Five community submissions responded positively to the measures undertaken to avoid impacts to Aboriginal sites.

OEH's submission also requested that Hume Coal "confirm that there are no further ancillary impact areas, temporary vehicle tracks, service installations, stockpile locations and lay down areas (as well as any new machine access routes required) to be assessed for Aboriginal cultural heritage impacts."

It is acknowledged that Aboriginal sites will be impacted; however, as explained in the Hume Coal Project Aboriginal Cultural Heritage Assessment (ACHA) (EMM 2017d) the project has been refined to avoid, minimise and mitigate impacts where possible, which are the primary objectives in any environmental assessment.

Section 10.6.3 of the Hume Coal Project ACHA (EMM 2017d) provides the following summary of direct impacts:

- 20 sites will be directly impacted by the Hume Coal Project surface infrastructure area. This comprises:
  - no sites of high significance;
  - six sites of moderate significance, two of which are of higher moderate significance (HC_135 and HC_151); and
  - 14 sites of low significance.
- Eight sites will be directly impacted by the Berrima Rail Project, comprising:
  - no sites of high significance;
  - two sites of higher moderate significance (HC_176 and HC_177); and
  - six sites of low significance.

It is acknowledged that 28 Aboriginal sites will be directly impacted by the two projects. However, this outcome is the result of a process employed throughout the EIS that has aimed to minimise impacts to Aboriginal sites. As discussed in Section 10.5 of the ACHA, Hume Coal consulted with EMM archaeologists to avoid impacts to Aboriginal sites where possible. This involved desktop constraints analyses and staged archaeological surveys that firstly identified the most archaeologically sensitive areas so that the project could be designed to avoid or minimise impacts to these areas. Five of the twenty community submissions that mentioned Aboriginal cultural heritage acknowledged the attempts that have been made to avoid Aboriginal sites and objects where possible.

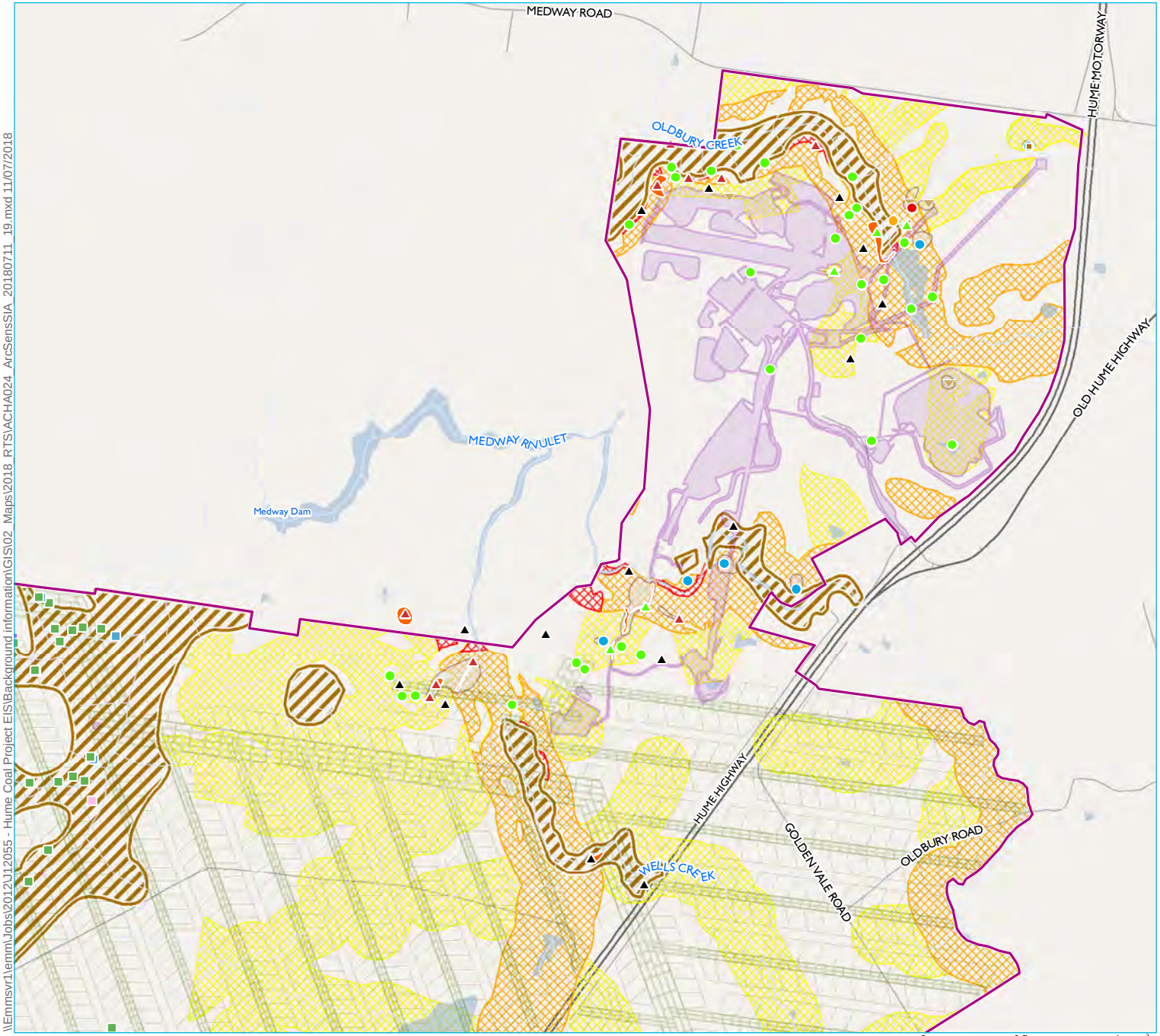
A major design modification involved setting back most of the surface infrastructure area beyond 200 m from the banks of the main water ways in the project area (Oldbury Creek and Medway Rivulet). Consequently, the surface infrastructure area will avoid most of the nearby Aboriginal sites and areas of moderate archaeological sensitivity. This is best shown visually in Figure 8.2 of the ACHA (EMM 2017d), and replicated below in Figure 24.1. Notwithstanding, some unavoidable impacts will result from the linear infrastructure that is required to traverse the main water ways such as conveyors, vehicle track upgrades and railways.

Overall, a substantial archaeological resource will remain in the project area, considering that 191 of the 219 Aboriginal sites assessed in the ACHA (91%) will not be directly impacted by the Hume Coal Project or Berrima Rail Project.

Mitigation measures will be carried out for all of the Aboriginal sites within the project disturbance footprints, as outlined in Section 11.2 of Hume Coal Project ACHA. This will involve either surface artefact collection or further archaeological excavation. In particular, six of the eight sites of moderate significance (as raised for concern by NCC) will be subject to salvage excavation measures which are the most comprehensive form of mitigation available. These six sites are likely to have the largest subsurface artefact assemblages but are generally disturbed by historical farming practices. From an archaeological perspective these sites do not have the contextual integrity to warrant outright conservation. The remaining two sites of moderate significance will have their surface contents collected only, because extensive subsurface artefact deposits within the portions that will be impacted are unlikely.

Two community submissions stated all Aboriginal sites should be considered of high significance. EMM acknowledge that the Aboriginal community generally considers Aboriginal objects of high cultural significance; however, they must also be given a scientific or archaeological level of significance. The rationale is that by attributing sites with different levels of significance, management measures can be targeted towards sites that warrant more attention (considering that there is a finite resource that can be allocated to Aboriginal heritage management). If all sites were attributed high significance, there would be less impetus to direct resources to conservation and mitigation appropriately.

OEH also requested confirmation that there will be no further ancillary impact areas, temporary vehicle tracks, service installations, stockpile locations and lay down areas (as well as any new machine access routes required) to be assessed for Aboriginal cultural heritage impacts. The disturbance footprint presented in the Hume Coal Project EIS and Berrima Rail Project EIS provided appropriate buffers to allow for minor changes in the project layout during the detailed design and construction process. All surface disturbances will occur within the footprint presented and assessed in the EIS and ACHA. Accordingly, no further impacted areas are anticipated to those presented in the EIS.



KEY

- Hume Coal Project area
- Hume Coal Project surface infrastructure area disturbance footprint

Archaeological sensitivity

- High
- Moderate
- Low

Site type

- PAD
- Open stone artefact site with PAD
- Grinding grooves with open stone artefact site and PAD
- Rock shelter with PAD
- Rock shelter with art and PAD
- Rock shelter with art, deposit and PAD
- Rock shelter with deposit and PAD
- PAD area
- Isolated find
- Grinding grooves
- Grinding grooves with rock pools
- Potential scar tree
- Rock pool
- Open stone artefact site
- Open stone artefact site with subsurface deposit
- Subsurface artefact deposit
- Rock shelter with art
- Aboriginal site area
- Outcropping sandstone

Existing features

- Main road
- Local road
- Drainage line

\\Emmsvr1\emm\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2018_RTS\ACHA024_ArcSensSIA_20180711_19.mxd 11/07/2018

Source: EMM (2018); DFSI (2017); Hume Coal (2017)

Areas of archaeological sensitivity - surface infrastructure area

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 24.1

HUMECOAL PROJECT

EMM

24.2 Development of an Aboriginal Heritage Management Plan

OEH's submission recommends the development of an Aboriginal heritage management plan (AHMP). OEH recommended that the AHMP includes the following information:

- Detailed consultation protocol setting out how and when the Registered Aboriginal Parties (RAPs) will be consulted in both the construction and operational phases of the projects.
- Detailed archaeological salvage excavation methodology.
- Detailed methodology for monitoring rock shelter sites within the area of underground mining.
- Detailed methodology for community collection of surface artefacts within the impact footprint.
- Detail of the mitigation and site protection works required.
- Procedure for updating AHIMS site cards throughout the project.
- Procedure to manage and newly identified Aboriginal Cultural heritage sites.
- Detail of the long term management of recovered Aboriginal objects.
- Research into testing the predictive model of site location, for example through testing at HC_146.
- The AHMP should use AHIMS site numbers as well as site names to refer to sites.

Hume Coal is committed to developing an AHMP, as outlined in Section 11.2.1 of the ACHA (EMM 2017d). It is proposed that the AHMP will cover both the Hume Coal Project and the Berrima Rail Project. The AHMP will be developed subsequent to development consent being granted and in consultation with OEH and the Registered Aboriginal Parties. The AHMP will include the information requested by OEH in their submission as summarised in the box above.

OEH submission item 9 "Research into testing the predictive model of site location, for example through testing at HC_146" listed above has been addressed during the RTS phase as part of an additional test excavation program (refer to Section 24.3). The results indicate that the predictive model is accurate based on the sample of artefacts retrieved from the test excavation. Furthermore, the additional data that will be gathered during the proposed salvage excavations will further refine the predictive model.

24.3 Additional archaeological investigation

OEH's submission recommended additional archaeological test excavation in areas of potential archaeological deposit (PAD), registered as HC_179. The site was identified during surveys within the Hume Coal Project disturbance footprint. The submission recommended that the test excavation be completed prior to project approval.

Additionally, OEH suggested that another PAD (HC_146) should be considered for test excavation to "add rigour to the archaeological sensitivity model presented by EMM and also to mitigate the loss of the sites through contributions to further research". Site HC_146 was recorded as an area of PAD during surveys for the Berrima Rail Project ACHA and was predicted to have low archaeological potential.

In response to OEH's submission, EMM completed a test excavation program covering the PADs HC_179 and HC_146, which is documented in a standalone report attached as Appendix 3.1. The overall aims of the test excavation program and reporting were to:

- determine whether Aboriginal objects occur at sites HC_179 and HC_146;
- characterise the archaeological deposits with reference to previous excavations completed for the ACHAs;
- revise the assessments of significance for each site;
- revise the impact assessment for each site; and
- determine whether the previously proposed management measures presented in the ACHA were still appropriate for each site.

Aboriginal stone artefacts were recovered from each of the PADs, verifying the areas as archaeological sites.

HC_179 is within an area of moderate archaeological sensitivity that was predicted to have an average artefact density of up to 14 artefacts/m^2, whereby the actual results was an average artefact density of 13 artefacts/m^2. HC_179 is considered to be of higher moderate archaeological significance and warrants salvage excavation as a mitigation measure because it will be impacted by the construction of a conveyor and storm management earthworks if the Hume Coal Project is approved. This proposed management measure remains the same as previously proposed in the Hume Coal Project ACHA.

HC_146 is within an area of low archaeological sensitivity that was predicted to have an average artefact density of up to 2.7 artefacts/m^2, which was confirmed by the test excavation. HC_146 is characteristic of the test excavation results recovered from areas of low archaeological sensitivity, which includes land within 150 m of ephemeral streams on level to gently inclined landforms (less than 10% slope) (EMM 2017d). The results are characterised by sporadic occurrences of stone artefacts (ie artefacts occurring less often in test pits than occurring) along transects in very low frequencies. The test excavation results confirmed that HC_146 is considered to be of low archaeological significance and further excavation is unwarranted at this location. As such, HC_146 will be impacted by the establishment of the temporary construction facility for the Berrima Rail Project, as per the original findings in the Berrima Rail Project ACHA (EMM 2017q).

Overall, the additional test excavation has contributed to the ACHA by strengthening the archaeological sensitivity model for the Hume Coal Project area and Berrima Rail Project area. It has done so by increasing the dataset while still providing results that agree with the original model. It has also allowed previously untested areas to be characterised so that informed mitigation measures can be developed when preparing the AHMP. Further details about the test excavation results and impact assessment are provided in the Test Excavation Report (EMM 2018c) in Appendix 3.1).

24.4 Subsidence impacts and monitoring

Submissions were received from OEH and the NCC regarding the proposed management for rock shelters identified during the archaeological survey for the ACHA. EMM recommended monitoring 16 of the most significant sites (comprising 14 rock shelters and all two grinding groove sites) out of the 34 rock shelters and two grinding groove sites identified above the underground mining area.

OEH's recommendation was that all rock shelters above the underground mining area should be subject to baseline recording followed by a subsidence monitoring program. This recommendation is derived from the conservative view that although no subsidence is predicted to occur to rock shelters, it still is only a prediction.

The NCC also questions the ACHA's reliance on the subsidence predictions developed for the Hume Coal Project and "cannot agree that the impacts on Aboriginal heritage sites [referring to rock shelters in this instance] will be nil." The NCC continues by providing the following recommendations:

- All 10 identified high significance aboriginal heritage sites should have baseline recording and future monitoring after mining, as requested by the RAPs.
- It should be a condition of development consent that such monitoring be done by officers of NSW Office of Environment and Heritage with experience in Aboriginal heritage. The cost of such monitoring should be paid for by Hume Coal. The experience of NCC and its member groups over the past few years has been that proponent employed staff and consultants are not appropriate to perform this role.

As stated above, EMM recommended monitoring for 16 of the most significant sites (comprising 14 rock shelters and all two grinding groove sites) out of the 34 rock shelters and two grinding groove sites above the underground mining area.

Nine of the 14 rock shelters selected for monitoring are the only sites above the underground mining area that are classed as 'Aboriginal rock shelters'; meaning that they have been identified as Aboriginal objects as defined by the *National Parks and Wildlife Act 1974*. The Aboriginal objects in these instances comprise either Aboriginal art on the shelter walls or stone artefacts at the base of the shelters. Four of the rock shelter sites were assessed to be of high archaeological significance and five of moderate archaeological significance.

The remaining rock shelters above the underground mining area are those that fulfilled certain criteria to be recorded (ie the minimum dimensions for recording were a roof height, length and depth of one metre in each direction (1 m^3)) but did not feature Aboriginal objects such as art or stone artefacts. These sites were recorded on a conservative basis, because theoretically they could retain artefacts or other archaeological features below the shelter's ground surface. These sites were classed as rock shelters with PAD. Without direct evidence of Aboriginal occupation, these sites were given an assessment of significance made on predictions, taking into account their potential to have significant features based on their size, amenity, disturbance levels and existing structural integrity. As such, if archaeological evidence was found at any of these sites it would require a reassessment of significance.

Five of the 23 rock shelters with only PAD (HC_013; HC_018; HC_033; HC_040 and HC_042) were added to the sites proposed for subsidence monitoring (totalling 14 rock shelters proposed for monitoring). These five sites were assessed to have moderate archaeological significance, primarily acknowledging that these examples presented the most favourable conditions for subsurface material to be present (eg shelters with a combination of features including high amenity, relatively large shelter floor areas and limited disturbance).

The 25 rock shelters that were not selected for monitoring are those above the underground mining area assessed to be of low archaeological significance. These sites typically had one or more features such as:

- small potential habitable floor areas;
- very limited PAD (eg large portions of floors were bare sandstone);
- very low ceiling heights or very high ceiling heights with narrow overhangs, providing low amenity;
- noticeably unstable shelters that had experienced moderate to major rock falls (applicable to four sites); and
- disturbance from animal burrows and rock falls that covered large portions of shelter floors.
- As noted above, such shelters were recorded to remain consistent with the recording criteria for rock shelters. However, it is unknown if these were used by Aboriginal people, but if so, they are likely to have only been used for temporary shelter given that much more substantial and favourable rock shelters were available nearby.

Importantly, the rock shelters of moderate and high archaeological significance above the underground mining area will be monitored. If all 34 rock shelters above the underground mining area had consistently favourable features and archaeological evidence then they would have been recommended for monitoring. However, given that there are 20 rock shelters predicted to have low archaeological significance which may not contain Aboriginal archaeological evidence, it was considered excessive to include 20 more sites in the monitoring program; each site representing potentially significant additional management costs.

Further, these recommendations have been made based on the predictions of the subsidence assessment (ie that negligible subsidence will occur), which has been assessed and peer reviewed by subsidence specialists, and further confirmed through numerical modelling undertaken of the mine design as part of the RTS process (refer to Section 4.2 and Chapter 16). Notwithstanding, the AHMP for the project will include provisions to reassess the scope of rock shelter monitoring if subsidence levels are recorded in excess of their predicted levels during mining operations (as committed to in Section 11.2.7 of the ACHA, EMM 2017d). The required Extraction Plan and accompanying management plans for the mine will also include this same provision in the form of a Trigger Action Response Plan (TARP), such that if subsidence levels are found to exceed predicted levels, or any changes to rock shelters are identified, then a review of the monitoring program will be undertaken by suitably qualified archaeologists.

Subsequently, EMM maintain that the proposed management measures for subsidence set out in 11.2.7 of the Hume Coal Project ACHA remain appropriate and that no additional rock shelters require monitoring unless subsidence levels exceed their predictions to a level that warrants revision of the proposed method. Baseline recording of the relevant sites and the development of a monitoring program will be completed as part of the AHMP development and implementation subsequent to project approval.

In relation to sites of high significance, NCC requested that all of these sites are monitored; however, four of these sites are outside the underground mining area and therefore are at no risk of impact.

NCC also recommended that any subsidence monitoring of Aboriginal sites should be completed by OEH staff engaged and not private heritage consultants. The implication that consultant assessments are inherently biased to benefit the proponent is rejected and it is maintained that suitably qualified consultant archaeologists would be appropriate to undertake the subsidence monitoring.

24.5 Berrima Rail – further assessment of the alternative rail alignment option

OEH's submission on the Berrima Rail Project ACHA included discussion about the assessment and proposed management measures for Aboriginal cultural heritage values within the project alternative rail alignment option, specifically where it extends north of Berrima Road. The items raised are as follows:

- The proposed salvage excavation in the alternative option north of the Berrima Road requires additional information. EMM has not conducted either survey or test excavation of this alternative option. This needs to be conducted prior to salvage excavation.
- Review the recommendations for salvage excavation north of Berrima Road in the alternate alignment of the Berrima Rail Project. Conduct test excavation at this location before developing a salvage methodology.
- Recent archaeological investigations by Wingecarribee Shire Council and Associates Archaeology (Oliver Brown 2017) has identified this area has having a low level of archaeological potential, however the Associates Archaeological survey and report was prepared before the EMM report was available.

24.5.1 Additional information for the alternative option

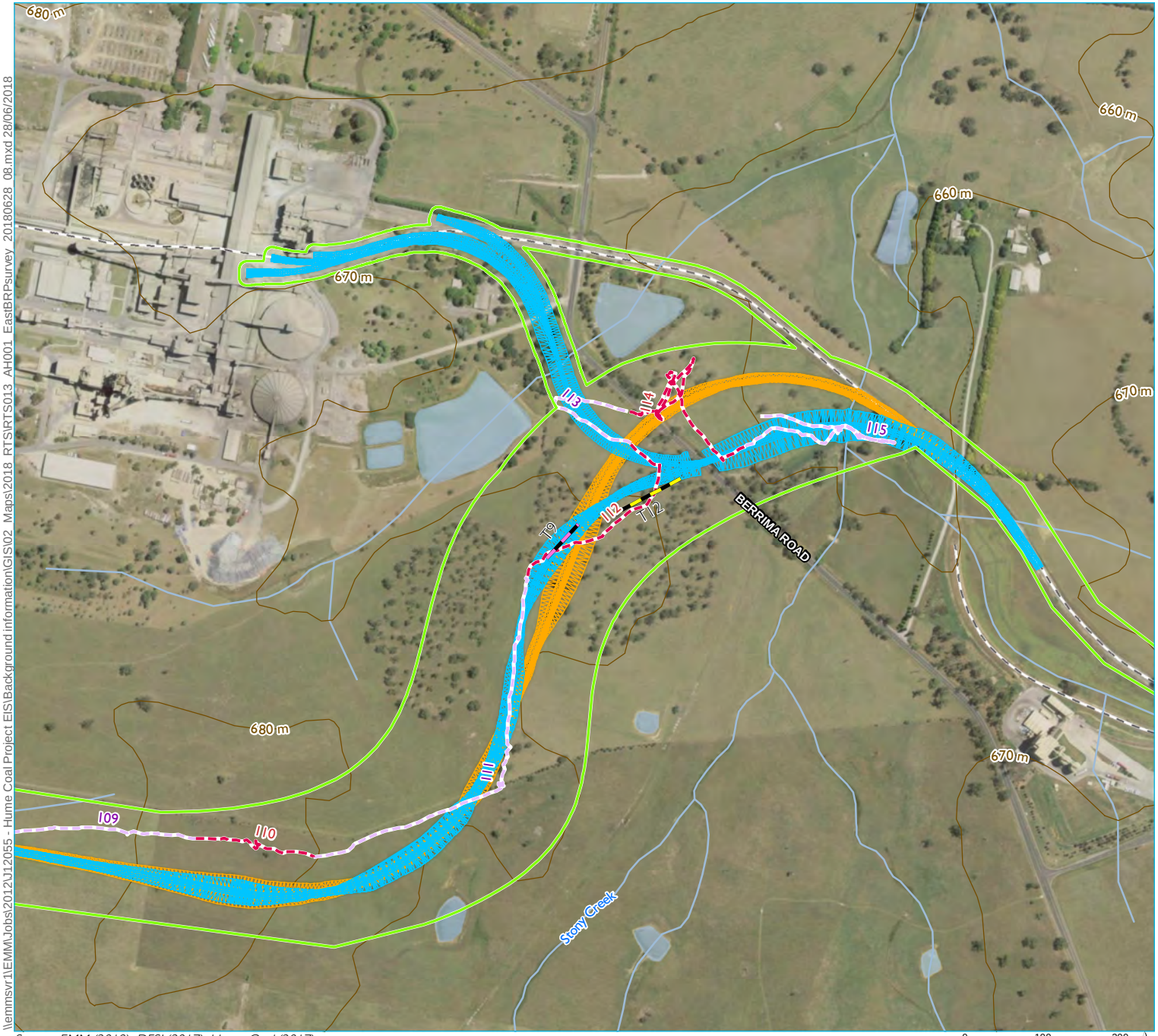
The submission relates to an area of land, north of Berrima Road, within the corridor of the alternative option to the Berrima Rail Line (refer to Figure 2.4). This area is part of a prominent hill crest that was predicted to have moderate archaeological sensitivity based on the results of the test excavation completed upslope on the southern side on Berrima Road. This alignment was partially surveyed on 28 October 2015 (Transect 114) but was met with very low effective coverage results (estimated at around 2%). However, it is acknowledged that the figure presented in the Berrima Rail ACHA (Figure 4.1) is at scale that does not show this clearly. Notwithstanding, it is agreed that test excavation is required in this area as proposed in Section 7.4.5 of the Berrima Rail Project ACHA (EMM 2017q).

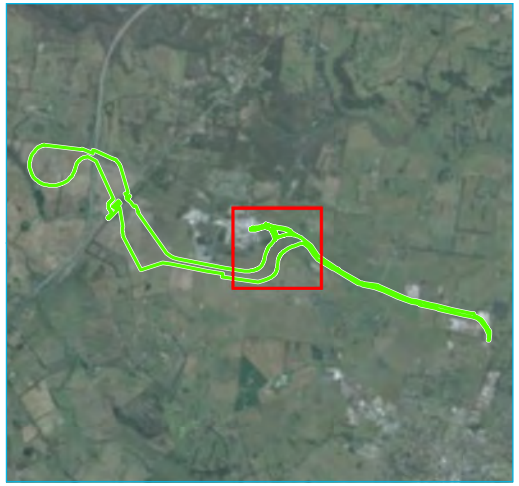
As described Section 7.4.5 of the ACHA, the necessity for salvage excavation at the nominated sites will be conditional; ie it will rely on a 'trigger' for salvage measures to be initiated. The preliminary trigger outlined in the ACHA is as follows:

> "In the event that an artefact density of 10 artefacts or above is encountered in a 50 cm x 50 cm pit (which is indicative of 40 artefacts/m^2 at that particular location), or if an archaeological feature such as a hearth is found, the test pits with such evidence will be expanded into an open area. Once the subject pit is expanded to 1 m x 1 m, the remaining pits in the open area can be dug in 1 m x 1 m squares. The final scope of salvage will be determined during the preparation of the AHMP (EMM 2017q)."

Considering the above, salvage excavation may not be required for the alternate option if nil or very few artefacts are recovered from the proposed test excavation. Furthermore, if the alternative option is not pursued for the project (ie the preferred option is chosen), then test and salvage excavation will not be required. WSC confirmed in their submission their commitment to re-aligning Berrima Road and constructing a rail overbridge to replace the level crossing. As such, it is likely then that the alternative rail alignment will be the option constructed, if the Berrima Rail Project is approved.

Although the salvage method is outlined above, it is acknowledged that the salvage methodology should be refined and detailed further during the preparation of the AHMP subsequent to project approval.





KEY

- Berrima Rail Project area
- Survey transects

Test pit transect

- T9
- T12
- New rail line - preferred option
- New rail line - alternate option
- Existing rail line
- Topographic contour
- Watercourse / drainage line
- Waterbody

Source: EMM (2018); DFSI (2017); Hume Coal (2017)

0 100 200 m

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMM\Jobs\2012\112055 - Hume Coal Project EIS\Background information\GIS\02 Maps\2018 RTS\RTS013 AH001 EastBRPsurvey 20180628 08.mxd 28/06/2018

Aboriginal heritage survey of rail line options

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 24.2

HUMECOAL PROJECT

EMM

24.5.2 Associates Archaeology report

EMM have reviewed the archaeological report prepared by Associates Archaeology (Oliver Brown 2017) which involved a test excavation program at locations near the alternative alignment of the Berrima Rail line. The program involved placing eight 50 cm x 50 cm test pits (2 m^2) along the alignment of the proposed Berrima Road Upgrade commissioned by Wingecarribee Shire Council. Although no stone artefacts were identified in the tested locations, EMM still consider that test excavation is warranted specifically within the alternative alignment of the Berrima Rail line. This would further test the predictive model established by EMM in accordance with methods consistent with those previously used for the ACHA.

EMM appreciate the additional information provided by OEH regarding the area in question. The results of the Associates Archaeology test excavation may indicate that salvage excavation will not be required in this area as opposed to that previously predicted in the ACHA for the Berrima Rail Project. However, the requirement for salvage would be determined based on the outcome of further test excavation and in accordance with conditions that would trigger such measures (refers to the response to item 1 in this section above).

24.6 Transfer of objects and care agreement

OEH's submission commented on a proposed Aboriginal keeping place which is a designated long term secure area for the purpose of storing and curating Aboriginal cultural materials and their associated documentation. The keeping place will accommodate all of the Aboriginal objects recovered from archaeological test excavation and salvage measures completed as part of the project. OEH stated the following:

- We support this request, provided that Yamanda submits a Transfer of Aboriginal Objects application to OEH.
- The Transfer of Aboriginal objects to Yamanda, as recommended by EMM (2017d), should be the first step taken in managing the Aboriginal objects found during the archaeological investigations. This should occur as soon as possible. The ACHA, however, is unclear on the nature of the proposed keeping place.
- Recommendation - 6) Clarification as to the proposed keeping place be provided.

During preparation of the ACHA for the Hume Coal Project and Berrima Rail Project, Yamanda Aboriginal Association was nominated to be the custodians of Aboriginal objects recovered from test excavation and salvage measures. EMM noted that the long-term facility for the recovered Aboriginal objects and the custodians would need to be confirmed during the development of an AHMP (EMM 2017d, p.191).

The measures outlined for the keeping place received no objection during the RAP review period for the ACHA. Following this, Gundungurra Aboriginal Heritage Association (GAHA) have made suggestions subsequent to the submission of the EIS that will need further resolution during the preparation of the AHMP.

In July 2017, Sharyn Halls (director of GAHA) requested to attend Hume Coal office and be briefed on the outcomes of the ACHA. This request was primarily because representatives from GAHA were unable to attend a previous RAP consultation meeting during the final stage of the ACHA on 25 October 2016. As such, Hume Coal and EMM representatives met with GAHA at the Hume Office on 18 July 2017.

During the meeting GAHA stated that they would prefer all salvaged Aboriginal objects to be kept in a neutral location such as an on-site office on Hume Coal owned land. GAHA stated that this measure would better control the access to the objects and prevent objects from being lost. The minutes of this meeting are provided in Appendix 3.2.

Considering the discussion above, matters concerning the proposed keeping place require further discussion with the RAPs before the final location is determined. This will be determined during Aboriginal consultation meetings as part of the preparation of the AHMP. The objects already recovered from test excavation will remain secure in the EMM office during the interim.

24.7 Gingenbullen Aboriginal burial mound

A submission by Colleen Morris stated the following:

> "With respect to the Aboriginal history of the area (Hume Coal Appendix S Table 2.3 Point 3), during research for the Berrima, Sutton Forest and Exeter Cultural Landscape Assessment it was found that there is serious doubt as to the claim of a massacre site on Mt Gingenbullen. The claim is based on a publication in which the author selectively uses source material in a debatable manner. Unfortunately this claim detracts from the real value of the history of the site, which was a genuine Aboriginal burial mound, at Mt Gingenbullen."

EMM acknowledges that there still remains some uncertainty about the specific nature and location of the alleged burial mound near or on Mount Gingenbullen. The archaeological survey team for the project were unable to access the alleged location as it is outside of the project area and on private property. Notwithstanding, the project will not impact this area or nearby as the surface disturbance footprint of the rail corridor is approximately 2.5 km north of the alleged location and the surface infrastructure area is approximately 4.5 km to the north-west.

24.8 Aboriginal consultation

A submission by Perica and Associates Urban Planning Pty Ltd and Battle for Berrima stated the following:

> "In terms of Aboriginal impacts, while the matter has been addressed in the EIS, there are 39 potentially affected sites. It is noted the Gandangara indigenous people are the spiritual guardians of the Southern Highlands and the impacts of the proposal should be carefully considered after full and appropriate consultation with the range of indigenous groups with an interest in the area."

Aboriginal consultation for the ACHA was completed in accordance with the *Aboriginal Consultation Requirements for Proponents* (DECCW 2010) as prescribed in the SEARs for the project. Full details of Aboriginal consultation for the project are provided in Chapter 2 of the ACHA (EMM 2017d). The following provides a summary of consultation to demonstrate that full and appropriate consultation measures were adopted for the ACHA.

In order to identify appropriate Aboriginal groups, two rounds of notification and registration were completed for the project, firstly in 2012 and then in 2013 to identify any groups that may have missed out on the first round of registration. Despite eight Aboriginal groups formally registering within the specified timeframes, consultation was also undertaken with three other groups (Joanne Goulding, Moyengully Natural Resource Management Group and Koori Kulcha Experience) who approached EMM. This was adopted to allow all groups with an interest in the project to be involved in the consultation process. The Aboriginal groups involved in consultation are referred to as registered Aboriginal parties (or RAPs).

Additional to written consultation correspondence about the ACHA and discussions during fieldwork, EMM and Hume Coal held consultation meetings with the RAPs. This has involved two formal consultation meetings (26 August 2015 and 25 October 2016) and three additional meetings to assist RAPs who were unable to attend meetings but still wanted face to face discussions. Two additional meetings were held with Yamanda Aboriginal Association (18 July and 31 October 2016) and one additional meeting was held with Gundungurra Aboriginal Heritage Association on 18 July 2017. Meeting minutes are provided in Appendix 3.

Overall, RAPs for the project have been consulted throughout each stage of the ACHA, given the opportunity to provide cultural information, review and comment on proposed assessment methods and to review and comment on appropriate management measures for the Aboriginal cultural heritage values within the project area.

24.9 Newly recorded site HC 181

In March 2017, a NSW Forestry employee identified a grinding groove site adjacent to a series of rock pools. This site was inspected by an EMM archaeologist the following month for verification and recording. The site is located on sandstone bedrock within the stream channel of Knapsack Gully in the Belanglo State Forest. This area was previously surveyed by EMM and project RAPs in 2015 but was not identified during that time. This may have been because of changes in ground coverage, as it was noted that recent rain and increased stream flow had exposed larger areas of sandstone that otherwise may be covered in leaf litter and moss in drier seasons.

The site was recorded as HC_181 and comprises a series of Aboriginal grinding grooves and nearby circular (some misshapen) waterhole features. The site features are in a number of small exposures approximately 2 m^2 in size, amongst surrounding ground coverage of moss, pine needles, small shrubs and leaf litter.

The site features extend over 10 m length and within a 5 m corridor. The site features three prominent rock pools and four shallower and smaller depressions that may also be rock pools. Additionally, there are four grinding grooves distributed over the 10 m site length.

The AHIMS site card for HC_181 is provided in Appendix 3.3.

HC_181 is assessed to have moderate archaeological significance. A statement of significance for HC_181 is provided in Table 24.1. Site HC_181 is above the underground mining area but no subsidence impacts are predicted for this area (refer to Section 10 of Appendix S to the EIS). Notwithstanding, this site will be monitored for subsidence in order to be consistent with the management measures proposed for sandstone type sites of moderate significance elsewhere above the underground mining footprint. Baseline recording of the site and its inclusion in a subsidence monitoring program will be completed when the project AHMP is prepared subsequent to project approval.

Table 24.1 Statement of significance for HC_181

Research potential	Moderate Methods of collecting water in rock pools may be compared locally and regionally. Grinding grooves however are typical of the area
Rarity and representativeness	High Grinding groove and rock pools together are a rare site type locally.
Integrity	Moderate Site features are in good condition but are largely obscured by surrounding vegetation.
Research themes	Moderate Site may contribute to understanding of rock pools used closely with grinding groove sites. The site alone can tell little further information, but may be of greater value if compared on a regional level.
Educational value	Moderate Good example of various types of grinding methods to create different site features. Easily accessible and identifiable. Nearby International House site is more easily accessible and provides more easily identifiable features and in greater numbers
Overall significance	Moderate The site is a relatively easily accessible site with a combination of features that make it rare for the local area, but there are limited site features and better examples nearby.

25 European heritage

This chapter responds to matters relating to European heritage that were raised in submissions on the Hume Coal Project and the Berrima Rail Project.

25.1 Adequacy of the historic heritage assessment

25.1.1 Misrepresentation of the 'character' of the area

Several respondents, including Wingecarribee Shire Council, claimed that the area's true character was misrepresented or disregarded in the EIS and Statement of Heritage Impact (SoHI), giving more weight to the mining and industrial history of the area rather than the rural, cultural and historic heritage aspects of the region. The respondents argue that the area's character was skewed in order to justify the development of the Hume Coal Project and Berrima Rail Project. The Berrima Residents Association specifically asked why Photograph 5.1 and 5.4 in the EIS illustrated the character of the project area with an image of Berrima Cement Works, but not Berrima village.

Community respondents also raised the predominant rural nature of the area, with one noting in their submission that most mines in the region closed before WWII and others have closed since this time. It was contended that mines operated in the region when the population was sparse and before tourism, agri-tourism and the wedding industries were present and economically viable in the region.

Another community respondent submitted that the assessment hasn't considered the negative historic heritage impacts that have occurred as a result of past and existing industry in the area. The respondent notes that such an assessment is necessary.

With specific reference to Mereworth house and garden, The National Trust Southern Highlands Branch (NTSHB) states that the SoHI characterises the rural Mereworth site as a "highly modified landscape" and makes repeated reference to the industry present within the area, using this description as a justification for the development of the mine surface infrastructure on the rural land surrounding the house and the garden.

i History of mining and the character of the area

The Hume Coal Project EIS presents a detailed characterisation of the project area and surrounds, and the claim that the EIS emphasises the mining and industrial history of the area is rejected. Chapter 5 (Site and Surrounds) of the Hume Coal Project EIS presents a detailed description of the area, with the second paragraph of the chapter explaining that:

> A variety of land uses exist in and surrounding the project area. Land uses within the project area include grazing properties, small-scale farm businesses, natural areas, forestry (in the Belanglo State Forest), scattered rural residences, and major transport infrastructure comprising the Hume Highway. A number of industrial operations exist to the east of the project area, including the Berrima Cement Works (which is evident in the background in Photograph 5.1 below), Berrima Feed Mill, and Omya's Moss Vale plant.

As evident, the industrial uses are not over-emphasised in this opening paragraph. The beginning of Chapter 5 also presents a series of photographs (photographs 5.1 - 5.4, which are re-produced below as photographs 25.1 - 25.4) to illustrate the project area, all of which illustrate the rural nature of the site. These photographs do not show a photo of Berrima itself, given it cannot be seen from the project area, noting though that the cement works can be seen as shown in photograph 23.1. Section 5.3.2 of the EIS provides a description of existing land uses in and surrounding the project area in the following order; agriculture, residential, mining, industry. This chapter provides a balanced description of each of these land uses in the area and was based on analysis of aerial photography and local knowledge of the area by the project team.

Photograph 25.1 The project area in the foreground - looking east from the Mereworth property towards the Hume Highway

Photograph 25.2 The project area from the edge of Mereworth garden - looking north-east towards the proposed train load-out area

Photograph 25.3 The project area looking south from Medway Road

Photograph 25.4 The project area, looking south towards the product stockpile area from south of Oldbury Creek on 'Mereworth'

In relation to mining in the area, the last mine to cease operation was the Berrima Colliery in 2013. Whilst the present landscape directly in and around the proposed Hume Coal Project is created predominantly by a combination of pastoral and agricultural operations, mining has also played a significant part in the history of this broader region, as described in the EIS. Section 5.3.2iii presents a factual account of this mining history and in no way attempts to provide more 'weight' to this part of the region's history when compared to its rural and cultural history. As described in Section 5.3.2iii, the historical mines within and in close proximity to the project area include Berrima Colliery (ceased operation in 2013) and the Loch Catherine Mine (abandoned in the 1960s), as well as Southern, Black Bobs, Belanglo, Belanglo Extended, and Flying Fox Collieries, all of which ceased many years ago. The EIS also provides a factual explanation of coal mining in the Wingecarribee LGA today, which still continues with CCL 747 of Tahmoor Colliery, an underground longwall mine operating in the Bulli Seam, extending into the northern end of the LGA. The mining leases associated with Dendrobium and Wongawilli Collieries also extend into the north-west of the LGA, as shown on the NSW Government Common Ground website (DRG 2018).

Similarly to mining, the EIS also presents a factual account of past and present industrial uses in the region, including the cement works which started as the Southern Portland Cement and Coal Company in 1926, brickworks, metal fabrication, mining equipment manufacture and quarries.

The analysis undertaken in the Hume Coal Project Statement of Heritage Impact (SoHI) (EMM 2017r) found that the Southern Highlands has aesthetic and historical significance, amongst other values, but that industrial enterprise has also played an important role in the historical development of the Southern Highlands, particularly around Berrima. The assessment does not minimise the importance of the pastoral industry, starting in the early days of European occupation of the land, but notes that mining and cement works are part of the area's history.

In relation to the claim that mines operated in the region when the population was sparse and before tourism, agri-tourism and the wedding industries were present and economically viable in the region, it is assumed this is inferring that mining and tourism-related industries cannot coexist. As demonstrated in the responses in Chapter 23, this is not the case. JSA (2017a) investigated the statistical relationship between mining and tourism employment across NSW and Australia, finding that an increase in tourist employment occurs when there is an increase in coal mining employment. This increase likely reflects the higher wages in coal mining leading to increased purchasing power in the region. However, as described in Chapter 23, this result of the JSA (2017a) study is not statistically significant and the best conclusion that, at the LGA scale, that there is no discernible relationship between coal mining and employment in tourism, either positive or negative. Notwithstanding though, as JSA note, a number of NSW LGAs with active coal mining (open cuts and underground) have significant employment in tourism industries, suggesting that the two uses are not incompatible. This includes the Hunter Valley region, Lake Macquarie, Wollongong and Lithgow.

Previous impacts as a result of past and present industrial activities in the area were assessed in the assessment and SoHI (EMM 2017r) in Section 7.6, which presents a cumulative impact assessment of the impacts of the Hume Coal Project in the context of local development by reviewing the impacts of surrounding developments. The report identifies earlier industry and recent residential development.

ii Mereworth house and garden

The use of the term 'highly modified landscape' in the assessment and SoHI is to highlight the contrast between what the report interprets as the garden design incorporating 'nature'; European in form, and the surrounding pastures and dams. In reality, both elements of this landscape are the result of deliberate design, but the view and the setting would have been very familiar to the early white settlers and subsequent generations. The description in the assessment and SoHI (EMM 2017r) has been taken out of context in the NTSHB submission.

The surface infrastructure area proposed to be built on the Mereworth property has been placed to avoid as many visual and physical impacts as possible. A number of changes were made by Hume Coal to avoid physical impacts and to ensure a legacy that will see the house and the garden at Mereworth repaired and maintained. As the project will not have a physical effect on the house and garden, it was considered that preparing a conservation management plan for the core area of Mereworth House and Garden, by experts in built and landscape garden heritage is the most suitable way to address the significance of the place and the best way of caring for it. Upon the cessation of mining, and as committed to in the Hume Coal Project EIS, surface infrastructure will be safely decommissioned. Infrastructure items will be dismantled or demolished. Further, the surrounding paddocks and the setting generally will be in returned to the state they are in today, if not improved because of the tenant farming that is currently taking place.

25.1.2 Scope of the assessment and expertise of authors

There were a number of general objections in regards to the quality and findings of the SoHI.

1. Authorship: The National Trust Southern Highlands Branch (NTSHB) claims a lack of expertise in built heritage conservation and cultural landscape resulting in a report which has not adequately addressed these important historic heritage aspects.

2. Accuracy and scope: Claims were made that the EIS and SoHI did not identify all heritage listed items in the area. The Southern Highland Greens claim there are 21 SHR listed sites in the 'study area' which is in excess of the items listed in the SoHI prepared for the project, the most notable omission being the farm and buildings at 'Oldbury'. The NTSHB contended that the report lacks any real assessment of the impact of the mine, particularly to areas outside the mine project area. The Berrima Residents Association and community submissions also claim that the SoHI excludes an assessment of heritage items beyond the footprint of the mine proposal, ignoring the impacts on the wider landscape (such as due to loss of groundwater and on groundwater dependant ecosystems). The SoHI prepared for Coal Free Southern Highlands also questioned the findings of the SoHI, contending that the cumulative impacts of the proposed mine and rail projects are highly adverse and the project presents unacceptable risks to the heritage values of the area. It also claimed that the SoHI is misleading in the quantity of listed heritage items and deficient in its approach to assessing to what extent the appreciation of this heritage resource will be impacted.

3. Burra charter: A community respondent claimed that the Burra Charter Process was dismissed during the historic heritage assessment process.

i Authorship

The SoHI (EMM 2017r) was prepared by suitably qualified archaeologists and in accordance with the SEARs and relevant guidelines, including:

- The Australian International Council on Monuments and Sites, Charter for Places of Cultural Significance (also known as the Burra Charter, Australian ICOMOS 2013);
- NSW Heritage Manual (Heritage Office 1996 and 2006);
- Statements of Heritage Impact Guidelines (Heritage Office 2006);
- Investigating Heritage Significance (Heritage Office 2004);
- Assessing Heritage Significance (Heritage Office 2001); and
- Assessing Significance for Historical Archaeological Sites and 'Relics' (Heritage Branch Department of Planning 2009).

A historical summary and analysis of the sources, including historical accounts and images, secondary sources and field inspection were incorporated into the assessment and SoHI and each aspect of the significant components in the project area were addressed.

The primary author of the assessment and SoHI, Pamela Kottaras, has expertise in built heritage assessment, as well as experience in archaeological landscapes and their management. Pamela is an archaeologist with over 18 years of experience, with a Bachelor of Arts (Hons) in prehistoric and historical archaeology (University of Sydney).She has worked on numerous heritage assessments. Some examples are listed below.

- New Life' residential development - 67-69 Harris Street and 14-16 Mount Street Pyrmont archaeological assessment, test excavation under exception notification, research design and open area archaeological test excavation for a complex 1840s urban development.
- Sydney Metro Northwest - European heritage and archaeology advisors for the Sydney Metro Northwest Delivery Authority heritage consultants to TfNSW (2013 – ongoing). Preparation of European archaeological assessments and excavation programs for Cherrybrook, Castle Hill, Showground and Kellyville Station and viaduct sites and White Hart Inn.
- Windsor Bridge Replacement Project, historical heritage statement of heritage impacts, archaeological test excavation and landscape design input.
- Grafton Bridge Duplication Project, non-Aboriginal heritage constraints reports and options report.
- Pipehead and Potts Hill Reservoirs 330 kV underground cable: statement of heritage impacts.
- Hume Highway Bypass at Tarcutta, archival record of Hambledon Homestead, Humula, Tarcutta Cemetery, and Unexpected Finds Reports: Tarcutta stock camp and buried bridge.
- Tallawarra Lands Redevelopment, Historical Heritage Assessment, Wollongong NSW.
- Nundah Bank Third Track (ARTC), historical heritage assessment and statement of heritage.
- Goat Island, conservation management plan. archaeological assessment, site analysis, archaeological policies & recommendations, Port Jackson NSW.
- Great Western Highway Upgrade, Lawson: heritage construction management plan, heritage management report, Regional NSW (RTA with Austral Archaeology Pty Ltd - 2008).

ii Accuracy and scope

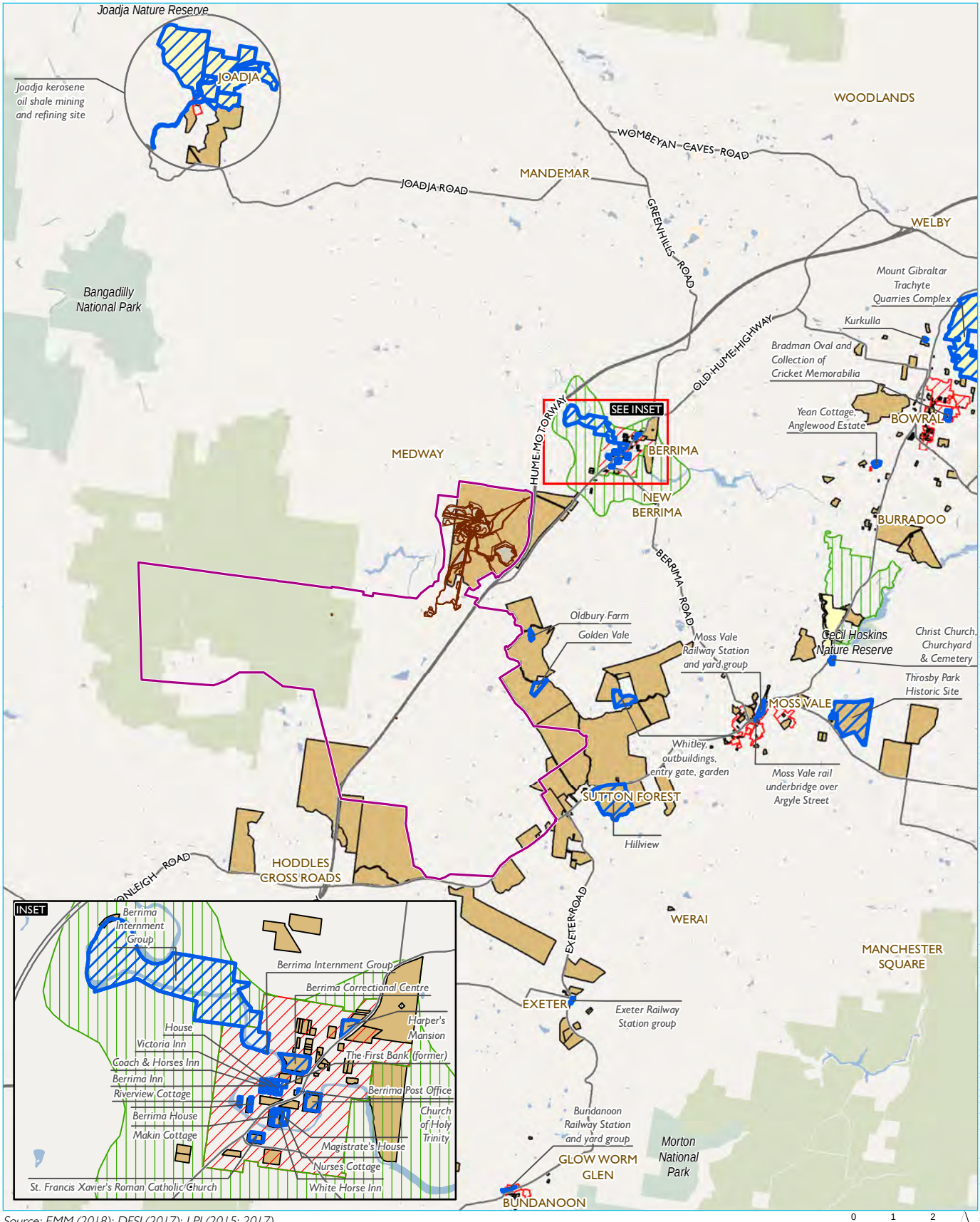
The list of heritage items included in the assessment and SoHI were those that fell within the boundary identified as the study area. The study area comprised the project area as well as the surrounding area within approximately 5 km from the project area boundary, which includes Berrima, Moss Vale and Exeter to the north, east and south, and large expanses of state forest to the west. Within the project area, the assessment focussed on the surface infrastructure footprint, as this is the area where surface disturbance will occur. The method for identification was through GIS analysis as well as manually reviewing Schedule 5 of the *Wingecarribee Local Environmental Plan 2010*. The assessment and SoHI lists 17 State Heritage Register items in the study area and a total of 113 heritage items listed on statutory registers; eight SHR items occur wholly or partially within the project area.

The SoHI therefore considered not only the heritage items within the project area, but items within the surrounding area that have the potential to be impacted. The potential for project related impacts were determined based on the findings of other technical studies prepared for the EIS, including the subsidence assessment, noise and vibration assessment, and water assessment. As discussed in detail in the response in Section 25.2, no impacts on any heritage listed property relating to vibration, dust, or changes to the water table are anticipated, nor will there be any subsidence related surface impacts. Further, there will be no surface disturbance outside the project area.

With respect to the number of items listed on the SHR that are presented in Table 2.2 of the SoHI, it is acknowledged that a number of items were missed. This oversight was unintentional and the outcomes of the SoHI are not affected by their omission. None of the sites are within, or in the vicinity of, the project area.

A revised version of Table 2.2 and 2.3 from the SoHI is presented in Table 25.1, which includes all items listed in Berrima. The items not reported in the SoHI are highlighted in grey. The SHR listed items in the vicinity of the project area is shown on Figure 25.1.

In relation to, Oldbury Farm, it was identified as a heritage item in the vicinity in Table 2.2 of the SoHI. It is also shown in Plate 5.2 relative to Mereworth house and garden and Evandale house and outbuildings. The history of Oldbury Farm and the involvement of the James Atkinson in the development of the local area are discussed in the historical analysis section of the SoHI (Chapter 3).



Source: EMM (2018); DFSI (2017); LPI (2015; 2017)

\\EMMSVR1\emmJobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2018_RTS\SOHI004_ListedHeritageItems_StudyArea_20180606_12.mxd 6/06/2018

KEY

- Hume Coal Project area
- Hume Coal Project indicative surface infrastructure footprint

Heritage Act 1977 (NSW)

- State Heritage Register item

Wingecarribee LEP 2010 heritage

- Item - Landscape
- Item - General
- Item - Archaeological
- Item - Aboriginal
- Conservation Area - General
- Conservation Area - Aboriginal
- Conservation Area - Landscape
- Main road
- Major waterway
- Waterbody
- State forest
- NPWS reserve

Listed heritage items in the vicinity of the project area

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.1

EMM

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Berrima, Berrima House	-	-	00095	-		-	-	-	Outside the project area
Berrima, Berrima Correctional Centre	-	-	00807	-	I109				Outside the project area
Berrima, Berrima Inn (McMahon's Inn)			00103		I132				Outside the project area
Berrima Post Office			00097		I138				Outside the project area
Berrima, Church of the Holy Trinity			00096		I147				Outside the project area
Berrima, First Bank			00105		I129				Outside the project area
Berrima, Harper's Mansion (not in NSW Planning Portal data)			01500		I113				Outside the project area
Berrima, Harper's Cottage (different lot to Harper's Mansion)			-		I134				
Berrima House (Jellor Street)			00095		I131				Outside the project area
Berrima, Gatehouse and walls of former gaol (part of Berrima training centre group, card 2 of 3), Wiltshire street	-	-	-	-	R6300	-	-	-	Outside the project area
Berrima, Berrima Internment Group	-	-	01848	-	I1882	R1428 R1430	Yes	-	Outside the project area
Berrima, Berrima Village	-	-		-	-	-	Yes	-	Outside the project area
Berrima, Nurses Cottage	-	-	00099	-	I228	-	-	-	Outside the project area
Berrima, Riverview Cottage	-	-	00100	-	I130	-	-	-	Outside the project area
Berrima, St Francis Xavier's Roman Catholic Church	-	-	01771	-	I120	R1438	Yes	-	Outside the project area
Berrima, Magistrate's House	-	-	00098	-	I125	-	-	-	Outside the project area
Berrima, Makin Cottage	-	-	00104	-	I227	-	-	-	Outside the project area
Berrima, White Horse Inn	-	-	00106		I123	-	-	-	Outside the project area
Berrima, Mail Coach Inn (SHR); Horse and Mail Inn (NSW Planning Portal); Former Coach and Horses Inn	-	-	00102	-	I133				
Berrima Conservation Area	-	-	-	-	C148	R1462	-	-	Outside the project area
Berrima Landscape Conservation Area	-	-	-	-	C1843	-	-	-	Outside the project area
Berrima, "The Gunyah"	-	-	-	-	I251	-	-	-	Outside the project area
Berrima, Sandstone and timber cottage	-	-	-	-	I239	-	-	-	Outside the project area
Berrima, Victoria Inn	-	-	00094	-	I128				
Berrima, Superintendent's House	-	-	-	-	I107				Outside the project area
Berrima, Stone cottage	-	-	-	-	I236				Outside the project area

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Berrima, Sovereign Cottage	-	-	-	-	I214				Outside the project area
Berrima, Finlayson Memorial Presbyterian Church	-	-	-	-	I146				Outside the project area
Berrima, Ardleigh Cottage	-	-	-	-	I211				Outside the project area
Berrima, Berrima Cemetery	-	-	-	-	I122				Outside the project area
Berrima, Munday Cottage (former Jellore Cottage)	-	-	-	-	I237				Outside the project area
Berrima, Lennox Bridge stonework	-	-	-	-	I474				Outside the project area
Berrima, Slab cottage	-	-	-	-	I230				Outside the project area
Berrima, Former Crown Inn	-	-	-	-	I141				Outside the project area
Berrima, Former Levy's Store	-	-	-	-	I137				Outside the project area
Berrima, Former Taylor's Butcher Shop	-	-	-	-	I216				Outside the project area
Berrima, Glebe Cottage	-	-	-	-	I177				Outside the project area
Berrima, Remembrance Driveway Plantings	-	-	-	-	I485				Outside the project area
Berrima, Market Place	-	-	-	-	I233				Outside the project area
Berrima, Bramber Cottage	-	-	-	-	I218				Outside the project area
Berrima, Woodley Cottage	-	-	-	-	I208				Outside the project area
Berrima, Former Cobb & Co timber buildings	-	-	-	-	I210, I344				Outside the project area
Berrima, Former Bakery	-	-	-	-	I142				Outside the project area
Berrima, Old Breens Inn (former Colonial Inn)	-	-	-	-	I140				Outside the project area
Berrima, Surveyor General's Inn	-	-	-	-	I139				Outside the project area
Berrima, Brick house	-	-	-	-	I232				Outside the project area
Berrima, Sandstock and timber house	-	-	-	-	I231				Outside the project area
Berrima, 'the Old Rose Cottage'	-	-	-	-	I1382				Outside the project area
Berrima, Berrima Glen Cottage (former Simon's Cottage)	-	-	-	-	I127				Outside the project area
Berrima, Greenwood House (former Taylor's Farmhouse)	-	-	-	-	I126				Outside the project area
Berrima, Bellevue House	-	-	-	-	I118				Outside the project area
Berrima, Berrima Public School and residence	-	-	-	-	I114				Outside the project area
Berrima, Parsley Cottage	-	-	-	-	I117				Outside the project area
Berrima, Armfield Cottage	-	-	-	-	I115				Outside the project area

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Berrima, 'Oaklea' Cottage	-	-	-	-	I1250				Outside the project area
Berrima, Cottage	-	-	-	-	I116				Outside the project area
Berrima, The Old Rectory	-	-	-	-	I105				Outside the project area
Berrima, Hillside Cottage	-	-	-	-	I209				Outside the project area
Berrima, Police Sergeant's Residence	-	-	-	-	I112				Outside the project area
Berrima, Bull's Head Drinking Fountain	-	-	-	-	I111				Outside the project area
Berrima, Berrima Court House	-	-	-	-	I108				Outside the project area
Berrima, Former Rectory	-	-	-	-	I104				Outside the project area
Berrima, Former Warden's Cottage	-	-	-	-	I220				Outside the project area
Berrima, Pickering Cottage	-	-	-	-	I219				Outside the project area
Berrima, Love in the Mist Cottage	-	-	-	-	I222				Outside the project area
Berrima, German Dam	-	-	-	-	I179				Outside the project area
Berrima, Lambie's Well	-	-	-	-	I234				Outside the project area
Bong Bong, Christ Church, Churchyard & Cemetery	-	-	01383	-	-	-	-	-	Outside the project area
Bong Bong, Bong Bong causeway	-	-	-	-	I1879				Outside the project area
Exeter, Exeter Railway Station	-	-	01142	TfNSW ID 4801254	I607, I610	-	-	-	Outside the project area
Exeter, "Invergowrie" house and garden	-	-	-	-	I372	-	-	-	Outside the project area
Exeter, St Aiden's Church and Memorial Hall	-	-	-	-	I375, I376	-	-	-	Outside the project area
Exeter, Vine Lodge house, grounds and outbuildings	-	-	-	-	I354	-	-	-	Outside the project area
Exeter, Exeter School of Arts Hall	-	-	-	-	I593	-	-	-	Outside the project area
Exeter, Romsey Cottage and Garden	-	-	-	-	I592	-	-	-	Outside the project area

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Exeter, “Cherrydell” house and garden formerly part of “Invergowrie”	-	-	-	-	I372	-	-	-	Outside the project area
Moss Vale, Moss Vale Underbridge over Argyle Street	-	-	01049	ARTC ID 4280314	I178	-	-	-	Outside the project area
Moss Vale, Moss Vale Railway Station and yard group	-	-	01200	TfNSW ID 4806253 co-owned with ARTC	I244	R4146 R4170	-	-	Outside the project area
Moss Vale, Throsby Park Historic Site	-	-	01008	-	I150, I053	R4160 R4161 R4162 R4163 R4164	Yes	-	Outside the project area
Moss Vale, Moss Vale Courthouse	-	-	-	Attorney General’s Dept 3080091		-	-	-	Outside the project area
Moss Vale, Whitley, outbuildings, entry gate, garden	-	-	00508	-	I361, I360, I055	R4165	-	-	Outside the project area
Moss Vale, “Bonhuer” house, grounds and outbuildings	-	-	-	-	I049	R4169	-	-	Outside the project area
Moss Vale, “Browley” house grounds and outbuildings	-	-	-	-	I239	R4168	-	-	Outside the project area
Moss Vale, “Willow Grange” house and grounds	-	-	-	-	I1192	-	-	-	Outside the project area
Moss Vale, St John’s Anglican Church	-	-	-	-	I175	-	-	-	Outside the project area
Moss Vale, I042, St Paul’s International College (former Dominican Convent)	-	-	-	-	I042	-	-	-	Outside the project area
Moss Vale, St Paul’s Roman Catholic Church	-	-	-	-	I408	-	-	-	Outside the project area
Moss Vale, Catholic Presbytery	-	-	-	-	I404	-	-	-	Outside the project area
Moss Vale, Leighton Gardens	-	-	-	-	I400	-	-	-	Outside the project area
Moss Vale, Leighton Garden pavilion	-	-	-	-	I172	-	-	-	Outside the project area
Moss Vale, “Glandalough”	-	-	-	-	I200	-	-	-	Outside the project area
Moss Vale, Semi-detached houses	-	-	-	-	I318	-	-	-	Outside the project area
Moss Vale, Coach House Antiques	-	-	-	-	I403	-	-	-	Outside the project area
Moss Vale, “Kalurgan”	-	-	-	-	I406	-	-	-	Outside the project area

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Moss Vale Public School	-	-	-	-	I201	-	-	-	Outside the project area
Moss Vale, Former St John's Anglican Rectory	-	-	-	-	I223	-	-	-	Outside the project area
Moss Vale, St Andrew's Presbyterian Church	-	-	-	-	I407	-	-	-	Outside the project area
Moss Vale, Whytes shop	-	-	-	-	I612	-	-	-	Outside the project area
Moss Vale, Argyle House	-	-	-	-	I040	-	-	-	Outside the project area
Moss Vale, Former School of Arts	-	-	-	-	I043	-	-	-	Outside the project area
Moss Vale, Hereford House	-	-	-	-	I418	-	-	-	Outside the project area
Moss Vale, Jemmy Moss Inn	-	-	-	-	I396	-	-	-	Outside the project area
Moss Vale, "Cardrona" (former Eagleroo) grounds	-	-	-	-	I352	-	-	-	Outside the project area
Moss Vale, "Peppers (former Mt Broughton) house, grounds and outbuildings	-	-	-	-	I488, I486, I487, I489	-	-	-	Outside the project area
Moss Vale, Argyle Street North Conservation Area	-	-	-	-	C1836	-	-	-	Outside the project area
Moss Vale, Argyle and Browley Streets Conservation Area	-	-	-	-	C1837	-	-	-	Outside the project area
Moss Vale, East Street Conservation Area	-	-	-	-	C1839	-	-	-	Outside the project area
Moss Vale, Throsby and Arthur Streets Conservation Area	-	-	-	-	C1839	-	-	-	Outside the project area
Moss Vale, Throsby Park Conservation Area	-	-	-	-	C1841	-	-	-	Outside the project area
Moss Vale, Valetta Street Conservation Area	-	-	-	-	C1840	-	-	-	Outside the project area
Sutton Forest, Comfort Hill house, grounds and outbuildings (buildings)	-	-	-	-	I357, I356, I021	R6302	-	-	Outside the project area
Sutton Forest, "Eccleston Park" house and outbuildings	-	-	-	-	I017	R5196	-	-	Outside the project area
Sutton Forest, "Black Horse Farm" house, grounds and outbuildings (former Black Horse Inn)	-	-	-	-	I020	R5198	Yes	-	Outside the project area
Sutton Forest, Hillview	-	-	00422	-	I008, I007, I358, I359	R5203	-	-	Outside the project area
Sutton Forest, "Bunya Hill" house, grounds and outbuildings (part)	-	-		-	I018	-	-	-	Outside the project area
Sutton Forest, Eling Forest Winery, house, grounds and outbuildings (buildings)	-	-	-	-	I004, I009, I010	R5189	-	-	Outside the project area
Sutton Forest, Boscobel house, grounds and outbuildings	-	-		-	I013	R5195		-	Outside the project area

Table 25.1 Listed heritage items in the vicinity of the project area

Item name	Register listing number								
	NHL	CHL	SHR	S170	LEP	NT	RNE	Other	Location
Sutton Forest, Remembrance Driveway Plantings	-	-	-	-	I1691				Outside the project area
Sutton Forest, Golden Vale	-	-	00489	-	I003, I005, I001, I002	R5197	1635	-	Outside the project area
Sutton Forest, Newbury Farm, house, grounds and outbuildings	-	-		-	I202			-	Outside the project area
Sutton Forest, Oldbury Farm (shown as being located in Moss Vale in the LEP entry)	-	-	00488	-	I246, I247	R4166	Yes	-	Outside the project area
Sutton Forest, "Everything Store" Old (or former) Butcher Shop (A little piece of Scotland) and General Store;	-	-	-	-	I490	R5193 R5194	-	-	Outside the project area
Sutton Forest, "Rosedale" House and Grounds(identified as an archaeological site on the Department of Planning and Environment Planning Viewer Beta);	-	-	-	-	I031	R5207	-	-	Outside the project area
Sutton Forest Inn (former Royal Hotel)	-	-	-	-	I1187		-	-	Outside the project area
Sutton Forest, All Saints Anglican Church	-	-	-	-	I026, I022, I025, I350	R5188, R5201 R5202 R6303	-	-	Outside the project area
Sutton Forest, Black Bobs Bridge (identified as an archaeological site on the Department of Planning and Environment Planning Viewer Beta);	-	-	-	-	I019	R5199	-	-	Outside the project area
Sutton Forest, "Clover Hill" house grounds and outbuildings	-	-	-	-	I203		-	-	Outside the project area
Sutton Forest, "Charlie Grey's" Cottage	-	-	-	-	I014	R5191	-	-	Outside the project area
Sutton Forest, "Montrose" house and grounds	-	-	-	-	I006	R5192	-	-	Outside the project area
Sutton Forest, Former Post Office	-	-	-	-	I016	R5205	-	-	Outside the project area
Sutton Forest, "Rotherwood" house, grounds and outbuildings	-	-	-	-	I033, I032	R5206 R5209	Yes	-	Outside the project area
Sutton Forest, "Spring Grove Farm" house, grounds and outbuildings	-	-	-	-	I492		-	-	Outside the project area
Sutton Forest, Summerlees" house and grounds	-	-	-	-	I362, I037	R5211	-	-	Outside the project area
Sutton Forest, St Patrick's Roman Catholic Church and cemetery	-	-	-	-	I034, I349, I023	R5185 R5210	-	-	Outside the project area
Sutton Forest, Cottage (Illawarra Highway next to Medway Rivulet)	-	-	-	-	I028	R5204	-	-	Outside the project area

iii Burra charter

Chapter 6 of the SoHI presents an assessment of heritage significance which, as explained in Section 6.1, is based on the *Burra Charter* (Australia ICOMOS 2013) in NSW and further expanded upon in the Heritage Manual's Assessing Heritage Significance (Heritage Office 2001). It lists seven criteria to identify and assess heritage values that apply when considering if an item is of state or local heritage significance, and these seven criteria were used in the assessment of significance for each historic heritage item identified in the project area, as presented in detail in Chapter 6. The claim that the *Burra Charter* was dismissed is therefore rejected. *The Burra Charter* has been used throughout the report to offset changes proposed for the surface. The aim has been to ensure that further research and conservation occurs in tandem with the project activities so that change is managed in such a way that it can be reversed at the end of the project life and to ensure that where opportunities for research arise, they are acted upon. In addition, the project design has been modified to avoid impacts to significant fabric and landscape elements. Those changes include:

- the creation of an access road through the paddock to the south of the driveway leading to the Mereworth avenue of trees to avoid impacts to the existing driveway and row of cypress pines;
- the commitment to prepare a conservation management plan for Mereworth, which incorporates the house, the surrounding gardens and rural landscape. The plan will identify appropriate uses for the house (of which vacancy will not be considered) plus a suitable maintenance cycle for the house, garden and surrounding farming practices;
- the commitment to prepare an historical heritage management plan to address the discovery of unknown heritage items if they arise, particularly unexpected relics and will include archaeological monitoring of groundwork around the Mereworth house complex to ensure that relics are not destroyed and commitment to relocate services if relics are encountered; and
- the historical heritage management plan is to include dilapidation reports of every heritage building in the project area, as well as a response plan for unexpected impacts.

iv Historical Archaeology

The Heritage Council of NSW notes that the EIS is not supported by a separate Historical Archaeological Assessment to clarify that there are no additional historical archaeological sites which may fall within the project boundary. The Heritage Council of NSW submitted that:

i. Three Legs of Man Inn is identified outside the study area, however it is unclear how subsidence to this site would be avoided by the proposed mining activity.

ii. Newbury and the Eling Forest Winery Group are both identified in the EIS as highly likely to retain research potential. These items are within the impact area; however, the EIS is silent as to the likely impact that the proposed mining activities may cause to likely subsurface archaeological deposits associated with these items.

iii. The EIS should be supplemented with a detailed historical archaeological assessment prepared by a suitably qualified and experienced historical archaeologist. The assessment should be prepared in accordance with Heritage Council of NSW guidelines including *Archaeological Assessments 1996* and A*ssessing Significance for Historical Archaeological Sites and Relics 2009.*

iv. It should address, in sufficient detail through historical investigation of primary records, the potential for other historical archaeological sites within the subject area and reassess the significance of the sites it identifies.

v. It should clarify how archaeological sites of the 1820s associated with the Atkinson Family and other early settlers in NSW would not be of potential state significance, rather than local. The assessment should also clearly outline what the impact would be to these sites, both within the study area subject to the coal mining works below and above ground and how mitigation of relics may or may not be required. This impact should be clearly explained so that conditions of consent can be reasonably imposed to manage such impacts to these significant archaeological deposits.

vi. The detailed historical archaeological assessment should be provided to the Heritage Council of NSW for review prior to any determination of the application. Based on this supplementary assessment to address these elements in sufficient detail, the Heritage Council of NSW would be able to provide more specific advice for recommended conditions of approval to manage this resource.

i. The Kentish Arms/Three Legs of Man was demolished in around 1918 to make way for the Hume Highway[47], leaving no identifiable trace of a building or ruin, and is outside of the project area). No mining will occur beneath this item, and no subsidence is predicted to occur.

ii. The SoHI is not silent on the Newbury property or the Eling Forestry Winery. Section 2.2.1 of the SoHI identifies both as being partially located in the Hume Coal underground mining area, with only some of their paddocks overlying areas that will be mined. Both properties are listed on the *Wingecarribee Local Environmental Plan 2011*. As described in Chapter 4, these properties were not surveyed given that only the surrounding paddocks associated with these heritage items are within the project area and not any building or structures, combined with the anticipated negligible subsidence impacts in these areas. Notwithstanding, an assessment of significance of each of these items is provided in Chapter 6 of the SoHI; both being of local significance. Chapter 7 provides an impact assessment on identified heritage items in and surrounding the project area; finding there will be no impacts to Newbury or Eling Winery as a result of the project, due to their distance from the surface infrastructure area (ie no surface disturbance will occur) and that no subsidence-related impacts are predicted.

iii. The heritage assessment and statement of heritage impact addressed archaeological heritage where it is relevant and was prepared by a suitably qualified and experienced historical archaeologist, as explained in Section 25.1.2i. As described in Section 1.9 of the SoHI (EMM 2017r), it was prepared in accordance with the guidelines A*ssessing Significance for Historical Archaeological Sites and Relics* (Heritage Branch 2009). Further, built heritage and relics are not mutually exclusive and are part of the same processes. Two separate reports were not prepared because built, archaeological and landscape heritage are components of the historical values of the project area and should be considered as a whole.

iv. The areas that the archaeological assessment focussed on were those that will be affected by changes to the ground surface. The primary source of information for Mereworth and the surrounding properties was T. Higginbotham's thesis that was awarded a doctorate based on his thesis (*The historical archaeology of rural settlement in the south western districts*, 1992). The thesis includes information on early land grants and a tally of buildings and people on each property and it is an excellent source of detailed information. It is not feasible, nor warranted to undertake detailed research on every parcel of land in the project area where surface impacts are not proposed and subsidence impacts have been assessed as being negligible. Current uses, which are predominantly cultivation and grazing, will continue on these parcels so new uses will only occur where they have been identified.

[47] https://www.southernhighlandnews.com.au/story/5326941/grand-old-inn-demolished/

v. The archaeological sites associated with the Atkinson family situated at Mereworth would have been predominantly in the area that the existing house and gardens now occupy. It is likely that construction of the house, the gardens and the swimming pool have removed much of the early archaeological resource relating to John Atkinson's second house (the first being the Three Legs o' Man, now demolished). The house and gardens complex will not be impacted by the project; therefore any surviving relics belonging to the early dwelling, which are anticipated to be fragmentary, will not be affected.

The only component of Atkinson's homestead complex that may survive and is in a possible impact area is the stockyard to the east of the dwelling. This early stockyard is likely to have had an effect by later additions to the farming infrastructure at Mereworth and confirmation of the existence of archaeological resources through archaeological testing will be destructive and may be unnecessary. Further, as the relics, if they survive, are expected to be ephemeral and insubstantial because of the nature of stockyard structures, it is likely that the information provided will be predominantly about their existence. While this information is valuable in providing knowledge about the layout of Atkinson's homestead, information that could be provided about the complex is not available as, at best, it has been substantially destroyed by the current house and gardens; therefore the research value of the homestead features that may be impacted by the project, is low.

No evidence of any archaeological sites associated with John Atkinson's occupation of the site was found during the investigations undertaken for the project. Hume Coal is not proposing any surface disturbance in the location of the stockyard evident in the 1949 aerial photograph.

John Atkinson was the brother of James Atkinson who is a prominent figure in colonial history. James Atkinson settled in the Berrima district and built Oldbury, which is now listed on the State Heritage Register. James authored books on the rural economy of the colony and was associated with the Macarthur family. His daughter, Louisa Atkinson was a naturalist and an author of fiction and non-fiction and her works have informed on the early colonial landscape and relations between Aboriginal people and new settlers. John Atkinson does not appear to have left a substantial footprint on the cultural landscape of the colony. His significance as an individual is as a publican, early homesteader and brother to James Atkinson.

vi. As explained in the response above in point 3, the heritage assessment and statement of heritage impact addressed archaeological heritage in detail where it is relevant. It is considered that the conservation management plan combined with the historical heritage management plan will provide sufficient guidance to suitably manage impacts to relics that may survive in the vicinity of the existing house and gardens at Mereworth. The historical heritage management plan will be prepared after project approval and prior to project impacts to manage heritage-related aspects of the project so that relics are not inadvertently impacted and that the first option considered is to avoid by redesign.

v Landscape values

i.	DPI Agriculture claim that the heritage assessment does not address the impact on landscape values, and particularly whether there would be any potential impacts on the landscape values of Mereworth.
ii.	The SoHI prepared by Colleen Morris notes that despite assessing that the cultural landscape is remarkably intact and important to the identity of the Southern Highlands, the SoHI prepared for the project asserts that the impact of introducing very large scale mining infrastructure within the intact cultural landscape will be minimal. The respondent notes that the method used to derive this conclusion is based on a percentage of landscapes in the proposed infrastructure area, which in their view is flawed as it does not take into consideration the impacts on the qualitative aspects of the area including the perception of the area as an important rural landscape and the impacts on the identity of the Southern Highlands.

i. The SoHI does assess the impact on landscape values, with a discussion of cultural landscapes presented in Section 5.4 of the SoHI, and impacts incorporated into the assessment of impacts in the SoHI in the sections "Visual impact within Mereworth" (7.5.2.ii) and "Views to Mereworth from the public domain" (5.7.2.iii).

   Impacts to significant landscapes were described in the SoHI as being 'minimal' (Section 7.5.12). While it is acknowledged that some impacts to the cultural landscape will occur as a result of the project, and that the landscape does not have to be visible to have significance, the majority of impacts are limited to the area west of Mereworth House and Garden with impacts, to a lesser degree, to the northern area of Evandale. The largest expanse of the significant cultural landscape, which is the combination of the 'Exeter/Sutton Forest landscape conservation area' (National Trust) and 'Key Historic Unit 6 Sutton Forest' (Varman - Wingecarribee Heritage Study 1991), will be free of any surface impacts. The combination of these two identified landscapes extends to the east and south of the project area and takes in the industrial zone of New Berrima.

   It is also noted that the proposed changes are not permanent, and upon cessation of mining all mine related surface infrastructure will be removed and rehabilitated with the aim of reinstating the aesthetics of the current landscape.

ii. The percentage impacts to the landscape were calculated using the GIS analysis. The assessment and SoHI confirms the significance of the landscapes and does not question its legibility or that it is the result of years of stewardship. It should be noted that the cultural landscape was not listed by Wingecarribee Shire Council when new items were gazetted in 2017.

   Notwithstanding, the SoHI does make an assessment of the impact of the project on the landscape. Given the very low percentage of the identified cultural landscapes contained in the proposed surface infrastructure area (1% of the Key Historic Unit 6 and 0.02% of the Exeter/Sutton Forest Landscape), as well as the limited visibility of the project, the impact of the project on these landscapes was found to be minimal.

25.1.3 Lack of access

The Heritage Council of NSW submitted that due to the access restrictions referred to in the EIS, it is unclear how the EIS could have adequately identified and assessed archaeological potential within the subject land.

All areas that will be subject to ground disturbance were assessed and surveyed.

The conclusions of the subsidence assessment are that impacts from ground movement associated with the mine operations will be negligible, therefore understanding the archaeological potential of the project area as a whole is not necessary for this project. Impacts are not anticipated to areas not included in the subsidence impact zones.

25.2 State Heritage Register Items

25.2.1 Potential impacts

The NTSHB noted the several SHR listed properties surrounding the mine area, claiming that the SoHI prepared for the EIS (EMM 2017r) largely negates any impacts on these properties due to them being outside the project area. The NTSHB contend that changes to landscape and groundwater could have serious impacts to the significance of the properties.

The Heritage Council of NSW also raised concerns about the potential impacts from the mining operation on the SHR listed items of Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no. 442), and specifically on the condition and structural stability of these items from:

- vibration;
- coal dust contamination; and
- changes to the water table and groundwater;

The Heritage Council of NSW contend the potential for adverse impacts is exacerbated by the considerable age and fragility of adjacent built SHR listed buildings, structures and mature plantings.

The study area for the SoHI comprised the project area, as well as the surrounding area within approximately 5 km from the project area boundary which includes Berrima, Moss Vale and Exeter to the north, east and south, and large expanses of state forest to the west. Therefore, the SoHI considered the potential for impacts to listed items both in and outside the project area.

Notably, the mine plan was developed to specially avoid undermining SHR listed properties, as shown on Figure 25.1. Any potential impacts to these properties as a result of the proposed mine could only therefore occur as a result of indirect impacts. The heritage assessment and SoHI was informed by the results of the technical reports prepared for the Hume Coal Project EIS, including the noise and vibration assessment (EMM 2017l), air quality impact assessment (Ramboll Environ 2017a), groundwater impact assessment (Coffey 2016b) and subsidence assessment (Mine Advice 2017). These aspects and the potential for impacts to SHR listed properties are discussed below.

i Noise and vibration

The potential for vibration related impacts as a result of the project was investigated as part of the noise and vibration assessment of the Hume Coal Project (EMM 2017l). As noted in this assessment, humans can detect vibration levels which are well below those causing any risk of damage to a building or its contents.

Project-related sources of vibration will include the intermittent sources of operational rail pass-bys and construction related activities such as impact hammering, rolling or general excavation work.

As described in Section 5.8.2 of the noise and vibration assessment (EMM 2017l), safe working distances for typical items of vibration intensive plant are established for both “Cosmetic Damage” in the British Standard BS 7385 and “Human Comfort” in British Standard BS 6472-1. These distances are reproduced in Table 25.2.

Table 25.2 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Vibratory Roller	<50kN (Typically 1-2 tonnes)	5 m	15 to 20 m
	<100kN (Typically 2-4 tonnes)	6 m	20 m
	<200kN (Typically 4-6 tonnes)	12 m	40 m
	<300kN (Typically 7-13 tonnes)	15 m	100 m
	>300kN (Typically 13-18 tonnes)	20 m	100 m
	>300kN (>18 tonnes)	25 m	100 m
Small hydraulic hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18t excavator)	7 m	23 m
Large hydraulic hammer	(1600 kg - 18 to 34t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

The SHR listed properties referred to in the Heritage Council's submission are well over the safe working distances for cosmetic damage (as listed in Table 25.2) from any likely construction activity. Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no. 442) are around 1.5 km, 3 km and 6 km away respectively, and therefore any vibration related impacts are not predicted to these buildings.

In addition to vibration intensive plant, minor blast activity which is another source of vibration will also be required for personnel material portal, drift portal and ventilation shaft construction. There is capacity in the blast design process to limit certain parameters to prevent excessive blast overpressure and vibration levels. One of the key parameters used to control blast overpressure and vibration is the maximum instantaneous change (MIC), quantified in kilograms (kg).

A quantitative blast assessment was undertaken by EMM (2017l), which calculated the maximum allowable MIC (kg) based on the distance between blasting and assessment locations. The results showed that a range of MICs can be adopted based on the location of blasting to the nearest assessment locations. With appropriate blast design and management there is minimal risk of exceeding ANZECC blast criteria during the construction phase. For example, a maximum MIC of 180 kg for the personnel and materials portal construction is predicted to result in an overpressure level of ≤115 and a peak particle velocity vibration level of ≤5 mm/s at the nearest assessment location, satisfying ANZECC blast criteria. This is well in excess of the maximum potential MIC that would be employed in any drift shotfiring that may be undertaken during drift construction.

Notwithstanding all of the above, a construction vibration management plan will be prepared for the Hume Coal Project and Berrima Rail Project which will include as a minimum:

- identification of nearby residences and sensitive land uses;
- a description of approved hours of work and what work will be undertaken;
- a description of what work practices will be applied to minimise vibration;
- a description of the complaints handling process; and
- a description of monitoring that is required.

ii Coal dust contamination

As documented in Section 2.3 of the air quality impact assessment report prepared for the project (Ramboll Environ 2017a), air quality impacts were predicted for a range of representative receptors surrounding the project area, along with individual town receptors for Medway, Berrima, New Berrima, Bowral, Burradoo, Sutton Forest and Moss Vale. The results of the dispersion modelling presented in Section 9 of the air quality impact assessment report show that impacts from both the construction and operation of the Hume Coal Project would be well below applicable air quality impact assessment criteria at all surrounding receptors. Predicted coal dust deposition levels from the operational coal mine are very low beyond the boundary of the project area and would not adversely impact upon neighbouring residences in the surrounding environment.

Whilst the air quality impact assessment did not specifically mention the SHR listed properties of Oldbury Farm, Golden Vale and Hillview, with dust levels predicted to be well below all applicable air quality standards at all residences around the project area, it follows that there will be no dust related impacts to these SHR listed properties.

iii Groundwater

The existing depth of the water table at the State Heritage listed items mentioned in the Heritage Council's submission (Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no. 442), as well as Whitely House) is considered significantly deep enough for changes not to affect structural stability of buildings at surface. The approximate depth to groundwater below these properties is approximately 10-15 m below the surface.

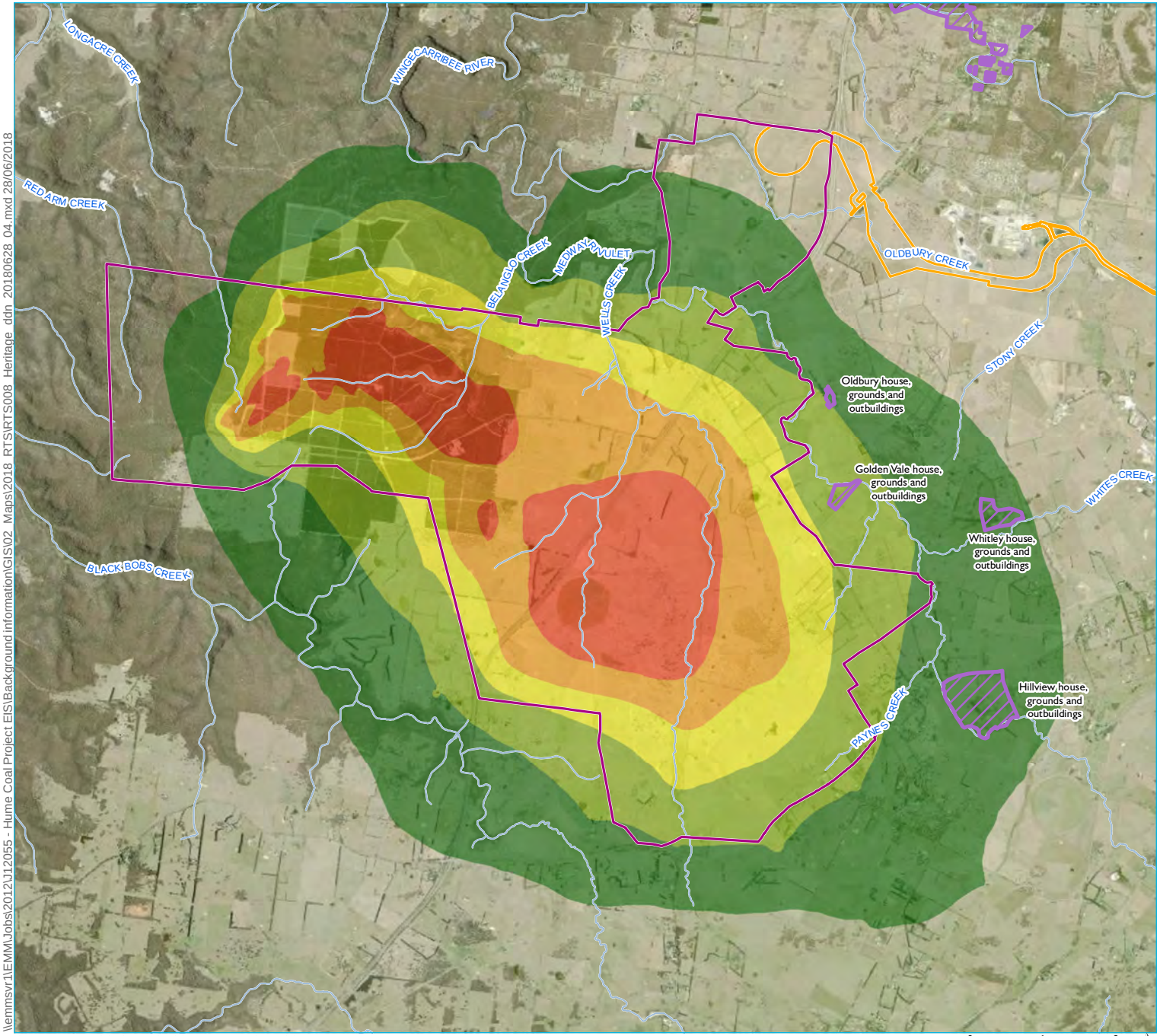
The predicted maximum drawdown and SHR listed properties is shown on Figure 25.2 and listed in Table 25.3. This drawdown is based on the conservative outcomes of the extensive numerical groundwater modelling undertaken for the project (refer to Appendix 2, Revised Water Assessment EMM 2018a). As shown, the SHR listed properties are predominately near the edge of the zone of groundwater drawdown and for some of these areas, the predicted change (ie the magnitude of water table drawdown) is comparable to what would be experienced during natural seasonal variations and local landholder pumping.

Table 25.3 State Heritage Listed items and predicted water table drawdown

State Heritage Listed item	Approximate depth to water table - existing[1]	Approximate magnitude of water table drawdown[1]
Oldbury Farm	>15 m	4-5 m
Golden Vale	10-15 m	6-9 m
Whitley House	>15 m	2-3 m
Hillview House	10-15 m	2-4 m

Note: 1. from groundwater modelling uncertainty analysis 67%ile results.

Further detail on the predicted groundwater drawdown is provided in the Revised Water Assessment (EMM 2018a, Appendix 2).



\\emmsvr1\EMM\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02 Maps\2018 RTS\RTS008 Heritage ddn 20180628 04.mxd 28/06/2018

Source: EMM (2018); DFSI (2017); Hume Coal (2017)

Predicted maximum magnitude of groundwater drawdown and items listed on the State Heritage Register

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.2

iv Subsidence

The subsidence assessment concluded that there will be no subsidence-related impacts on the surface from the mine due to the non-caving method employed and corresponding negligible levels of subsidence. Therefore, the only potential for impacts to built features on the surface as a result of the project is from direct disturbance for the construction of surface infrastructure. There are no SHR listed items in the surface infrastructure footprint of the project, nor within the entire project area, and as such, there is no potential for any project-related impacts to these items.

As explained in Section 8.2.2 of the SoHI, the mine plan was designed so that it avoids the area occupied by and beneath items listed on the SHR. By excising the land beneath SHR items from the mine plan, Hume Coal removed all potential for subsidence related impacts to occur to these items. Nevertheless, the conservative nature of the mine design means that no subsidence related surface impacts will occur even within the mining footprint, and therefore avoiding undermining SHR items is an even more conservative approach.

v Landscape

Potential changes and impacts to the landscape are discussed further in the response in section 25.1.2iv.

25.2.2 Management and mitigation

The Heritage Council of NSW recommends that the following conditions should be included in any approval of the Hume Coal and Berrima Rail projects:

1. A dilapidation report is to be undertaken prior to the commencement of both the Hume Coal and the Berrima Rail projects for each of the SHR items adjacent to the Hume Coal Project; Oldbury Farm (SHR no. 488), Golden Vale (SHR no., 489) and Hillview (SHR no. 442). The dilapidation study is to report on the condition of the properties prior to any construction or excavation. It is to record any existing damage, and the state of any particular aspects of the property that are likely to be affected by construction work, excavation and demolition.
2. An inspection and monitoring program should be established for the SHR items adjacent to the Hume Coal Project, including Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no.442) to ensure that any structural changes are identified. The program is to inspect and monitor the condition of the buildings, structures as well as the level and extent of ground water for the full duration of the mine, from inception to final decommissioning and for two years following decommissioning and site remediation.
3. Any damage due to the mine construction and operation and for the two years following decommissioning should be firstly prevented. Any damage must be carefully rectified immediately in accordance with conservation Australia ICOMOS Burra Charter, best industry practice and Heritage Council of NSW guidelines. This includes damage to buildings' structure, external and internal claddings, finishes and built in fittings due to any movement, contamination, leaching, accelerated corrosion and deterioration, or discolouration. This program should be included in the proposed HHMP for both the project and the SSD 7171.

It is anticipated that if the project is approved, the conditions of development consent will include the requirement to prepare a historic heritage management plan, which must be implemented throughout the life of the project. As described in the SoHI, Hume Coal have committed to the preparation of this plan, which be prepared in consultation with relevant stakeholders prior to the commencement of the Hume Coal Project and the Berrima Rail Project. This management plan will detail baseline surveys to be completed of heritage listed items before commencement, as well as the inspection and monitoring program of listed items to be undertaken during the mine life.

The historic heritage management plan will also describe measures for the rectification of any damage to heritage items, in the highly unlikely event that this was to occur.

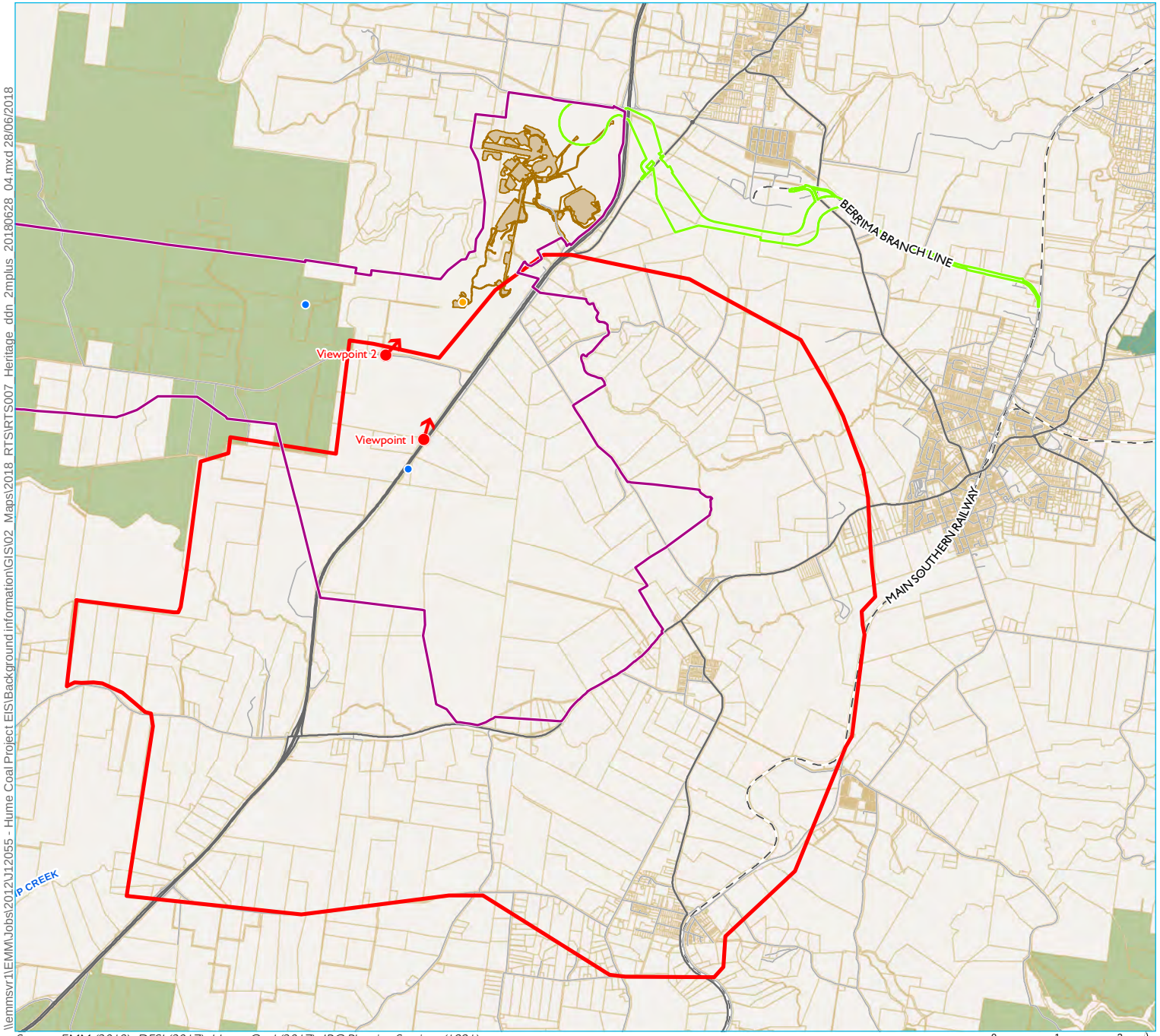
25.3 Berrima, Sutton Forest and Exeter Cultural Landscape

25.3.1 Scope of the assessment

The Heritage Council of NSW claimed that the EIS's analysis of potential adverse impacts of the mine and rail loop on the Berrima, Sutton Forest and Exeter Cultural Landscape is insufficient, and that the EIS should include a more detailed assessment of the potential for impacts to the landscape.

A discussion and analysis of cultural landscapes is presented in Section 5.4 and 7.5.12 of the SOHI (EMM 2017). The assessment considered the impact to the setting of this landscape, such as from impacts to air quality, noise and visual amenity, finding overall a low to moderate impact. As shown in Figure 25.3, the main surface infrastructure area is located outside of the cultural landscape, with the exception of a small portion of the underground entry, which just extends across the landscape boundary, and a downcast ventilation shaft on the eastern side of the Hume Highway. The footprint of the ventilation shaft will be very small within the landscape context, comprising less than 0.01 ha. The Berrima, Sutton Forest and Exeter Cultural Landscape covers over 10,000 ha.

A further discussion on the potential impacts to the cultural landscape is provided in the responses below (Section 25.3.2).



Berrima, Sutton Forest and Exeter Cultural Landscape

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.3

25.3.2 Potential impacts on the landscape

A number of submissions raised concerns relating to the potential for impacts to the Berrima, Sutton Forest and Exeter Cultural Landscapes. It was contended that the project may have significant adverse impacts to the heritage values and the landscape of this region.

As mentioned above, a discussion on cultural landscapes is presented in Section 5.4 and 7.5.12 of the SoHI. Impacts to cultural landscapes were described in the SoHI as being 'minimal'.

In relation to the broader landscape, while it is acknowledged that some impacts will occur as a result of the project, the majority of impacts are limited to the area west of Mereworth House and Garden with impacts, to a lesser degree, to the northern area of Evandale. Placement of the surface infrastructure in this landscape will result in long-term (approximately 23 years) but not permanent adverse impacts to the existing aesthetic of the project area. The visual impacts of the surface infrastructure on the landscape were assessed using 3D modelling of the surface infrastructure area and photomontages. Being an underground mine, the potential for visual impact is limited to the surface infrastructure area. No significant new landforms, such as permanent surface coal reject waste emplacements, form part of the project.

The largest expanse of the significant cultural landscape, which is the combination of the 'Exeter/Sutton Forest landscape conservation area' (National Trust) and 'Key Historic Unit 6 Sutton Forest' (Varman - Wingecarribee Heritage Study 1991), will be free of any surface impacts, with the exception of the downcast shaft adjacent to the Hume Highway. The combination of these two identified landscapes extends to the east and south of the project area and takes in the industrial zone of New Berrima.

Two viewpoints within the Berrima, Sutton Forest and Exeter Cultural Landscapes were assessed as part of the Visual Impact Assessment for the Hume Coal Project (EMM 2017g); viewpoint 1 (along the Hume Highway) and viewpoint 2 (Belanglo Road). The location of these viewpoints is shown on Figure 25.3.

The assessment found that at viewpoint 1, viewers will not have views of the project due to the distance from the highway at this point to the surface infrastructure area, the topography and intermittent tree planting within the landscape (refer to photograph 25.5). Therefore no change to the view will occur. At viewpoint 2 along Belanglo Road (refer to photograph 25.6), viewers will not see the project infrastructure due to the distance from the main surface infrastructure area, the topography and existing intermittent tree planting within the landscape. The nearest infrastructure element to Belanglo Road is the main ventilation shaft, which is of a low height and will therefore not be seen. As such, there will be no changes to the view from this location.

Given that these viewpoints are within the northern end of the landscape closest to the surface infrastructure area, it follows that the project will not have a significant impact on the broader landscape with respect to visual amenity.

Other aspects which relate to amenity are noise and dust. As discussed in the Hume Coal EIS (EMM 2017a), all dust emissions from the project are predicted to be well below the applicable EPA criteria. The underground nature of the project is a significant avoidance measure in relation to potential air quality impacts, as most of the major emissions sources normally associated with mining projects will not be present. In relation to noise, whilst some exceedances of the relevant EPA criteria at neighbouring residents close to the surface infrastructure area are predicted, all exceedances are to the north of the project area and therefore not within the Berrima, Sutton Forest and Exeter Cultural Landscape.

Photograph 25.5 Viewpoint 1 – Hume Highway looking north towards the surface infrastructure area, within the Berrima, Sutton Forest and Exeter Cultural Landscape

Photograph 25.6 Viewpoint 2 – Photograph from Belanglo Road looking north-east towards the surface infrastructure area

25.3.3 Traffic related impacts

A special interest group submitted that increased traffic to the area to service the Hume Coal Project will put pressure on the WSC to upgrade roads, thus changing the existing rural character of the Southern Highlands, Berrima and the cultural landscape.

The traffic assessment examined the project's potential impacts on the safety and efficiency of the local and regional road network. It identified no significant adverse traffic impacts as a result of traffic movements to be generated by the project during both the construction and operation phases. There will be no requirement for WSC to upgrade roads as a direct result of the project.

With the exception of the intersections along Argyle Street in Moss Vale, all assessed intersections to be used by project-related traffic will remain operating at a high level of service. Although the traffic assessment found that the future peak hourly intersection traffic conditions at the two Argyle Street intersections will be congested (in particular at the Lackey Road intersection), as they are now, there will be no significant worsening of intersection traffic operations at these intersections in Moss Vale with the addition of project-related traffic.

Therefore, the addition of project-related traffic to the local road network will not impact upon the existing rural character or cultural landscape.

25.3.4 Closure and rehabilitation

The Southern Highland Greens questioned whether the intact rural landscape could ever be returned to its undisturbed heritage significant state, claiming it will not be the case for the land between the freeway and the Old Hume Highway, as it is highly unlikely that the bridge and associated embankment over the Old Hume Highway will be removed.

As discussed in the Hume Coal Project Rehabilitation and Closure Strategy (EMM 2017), Hume Coal have committed to removing all mine related surface infrastructure upon cessation of mining and rehabilitating the area, with the aim of reinstating the aesthetics of the current landscape. Importantly, no permanent changes in the landform are proposed, with the emplacement of rejects underground eliminating the need for a permanent surface waste emplacement.

In relation to the rail infrastructure mentioned in the submission, Chapter 2 (Section 2.6) of the Berrima Rail EIS (EMM 2017b) describes the specific rehabilitation objectives committed to by Hume Coal upon completion of the project (ie when the new rail spur and loop is no longer required by Hume Coal). The first of these objectives is to ensure that all Hume Coal rail-related infrastructure is removed. This includes rail track, signalling equipment, bridges (such as the rail bridge over the Old Hume Highway), culverts, maintenance and provisioning sidings, and noise wall.

A detailed closure plan will be prepared within five years of closure of the mine. This plan will be prepared in consultation with relevant stakeholders and will describe in detail the rehabilitation activities to be undertaken so that the final land use and relevant completion criteria is achieved. In addition, Hume Coal will be required to lodge a security deposit with the NSW Government for the life of the project; the amount of which is based on the conservative cost to remediate the mine site by third party contractors. This security bond system adds further assurance that the site will be appropriately rehabilitated.

25.4 The township of Berrima

Submissions from Wingecarribee Shire Council, The National Trust of Australia (NSW), The National Trust Southern Highlands Branch, Berrima Residents Association, Statement of Heritage Impact prepared by Colleen Morris for Battle for Berrima, Southern Highlands Greens, and a number of community members raised issues related to the impact on the township of Berrima. The issues raised are summarised below:

i. The significance of Berrima – A number of submissions raised the heritage importance of Berrima, contending it is the best-conserved town from the colonial period. The Berrima Residents Association, Southern Highland Greens, and Battle for Berrima contend that Berrima was largely ignored in the EIS; with the Southern Highland Greens stating this is a significant issue because the town will be directly impacted by the mine. The BRA also contend that the SoHI is misleading in that the report only shows eight items of State significance in Berrima when in fact there are 16 located in the town, including the Berrima Correctional Centre. The Southern Highlands Greens contend Berrima is a village of recognised State and National significance.

ii. The proximity of Berrima to mine infrastructure – WSC submit that the infrastructure is in the range of 2-3 km from Berrima, yet this is not described in the EIS. Additionally, the rail maintenance facility is on land proposed to be included in the BLCA, as per WSC's Local Planning Strategy, Berrima Village Precinct Plan, March 2016.

iii. Potential impacts of the mine on the town - Concerns were raised over the impact the mine could have on the town, and it was claimed by some that mining is not compatible with the public image of the Southern Highlands, and thus Berrima, and that this incompatibility will subsequently influence tourism, local businesses and the community. BRA also contend that a major industrial enterprise on the landscape a few kilometres from Berrima threatens its unique heritage.

25.4.1 The significance of Berrima

Berrima, and all other notable towns in the region surrounding the project area are mentioned and described in the SoHI and the EIS. All listed heritage items with the heritage study area; ie within approximately 5 km of the project area, were identified and reported in the SoHI.

Fifteen items of heritage significance were identified in Berrima; 12 are listed on the LEP and eight are listed on the SHR. This total was reached using GIS data provided by the DPE. The Berrima Correctional Centre is not in the table of heritage items in the vicinity in the SOHI (EMM 2017r) and this is an oversight. It has since been included.

The significance of Berrima is acknowledged, in that it is an important town from the colonial period, as reflected in the number of listings on the WLEP. However, a specific impact assessment of Berrima was not undertaken as part of the SoHI because it is not in the project area, nor is it visible from the project area.

25.4.2 Proximity of project-related infrastructure to Berrima and potential impacts

The centre of Berrima is approximately 3 km from the nearest piece of mine related infrastructure in the surface infrastructure area (the train load-out) and 2.5 km from the Berrima Rail Project. No impacts are predicted from the mine on the township. The assertion that Berrima was deliberately left out to minimise the level of impact on the surrounding environment is rejected. The air quality, noise and visual assessments all assessed potential impacts of the project in the vicinity of Berrima, and the SoHI drew on findings of these studies. Assessment locations for the air and noise assessments were identified in Berrima, finding no predicted impacts as a result of the project in or near the township, with noise and dust levels predicted to be well within the criteria at all times there. Similarly, the proposed mine will not impact on the visual amenity township of Berrima, given that mine-related surface infrastructure will not be visible from the town.

The compatibility of mining within the Southern Highlands and the ability for mining and other industries such as tourism to coexist is discussed in Chapter 23 and earlier in this chapter in Section 25.1.1. As noted, tourism and mining are not incompatible.

25.5 Subsidence related impacts

Some community and special interest groups raised concerns about the potential structural effects to heritage properties in Berrima, Sutton Forest, Exeter and Moss Vale areas, including the impacts to structures, paving and drainage during the mining operations and the movement of earth's surface. The NTSHB noted that the risks to these buildings are potentially great, unquantified and have not been addressed in the Hume Coal EIS.

As discussed above in the response in section 25.2.1 iv, the non-caving mining method adopted for the project means that there will be no subsidence related impacts at the surface as a result of the mine. The subsidence modelling undertaken as part of the Hume Coal Project EIS confirmed that subsidence will be negligible. This was re-affirmed by the results of the two and three-dimensional numerical modelling of the mine design that has been undertaken since exhibition of the EIS (and described in detail in Chapter 16 of this report). Notwithstanding, the proposed mine does not extend beneath SHR listed items, nor any heritage properties in Berrima, Sutton Forest, Exeter and Moss Vale.

25.6 Economic impacts

This Australian Institute's Submission on the economic assessment of the project claims that a number of local businesses could suffer as a result of the impact to heritage buildings from the Hume Coal project, and that likewise, heritage buildings could suffer due to the potential negative impact on local businesses. For instance, a reduction in groundwater resources due to the project will impact on the ability to retain beautiful gardens that businesses rely on to attract visitors and customers. The Australian Institute uses the example of Montrose House and Berry Farm heritage listed buildings, which have gardens that attract weddings and other events. Another example used is the Eschalot restaurant that is located within a house built in the 1800s.

The respondent mentions that these businesses could not afford the upkeep required to maintain these historic businesses without tourists, and that any impact on tourism as a result of the project would therefore impact on the maintenance of these historic buildings. Thus, the Australian Institute argues that while a value has not been placed on the potential impact to these businesses located within old historic buildings, the values could be considered qualitatively against the net benefits of the project.

Some community submissions also raised similar concerns relating to the impact on heritage buildings and the related tourism industry.

As described in previous responses in this chapter (see sections 25.2, 25.4, 25.5), the project will not have any impacts on heritage listed properties, primarily as a result of the non-caving mining method.

The potential for impacts to the tourism industry as a result of the project are discussed in detail in Chapter 23, and in the response in Section 25.1.1. In summary, a report was commissioned by JSA (2017a) to investigate the statistical relationship between mining and tourism employment across NSW and Australia, finding that an increase in tourist employment occurs when there is an increase in coal mining employment. However, as described in Chapter 23 this result of the JSA (2017a) study is not statistically significant and the best conclusion that, at the LGA scale, that there is no discernible relationship between coal mining and employment in tourism, either positive or negative. Notwithstanding though, as JSA note, a number of NSW LGAs with active coal mining (open cuts and underground) have significant employment in tourism industries, suggesting that the two uses are not incompatible. This includes the Hunter Valley region, Lake Macquarie, Wollongong and Lithgow.

It is also noted that the general location around the project area has some established industry, and these industrial establishments have not adversely affected the Southern Highlands as a tourist destination.

Further, in relation to the impacts on groundwater resources and the potential for related impacts on heritage properties and tourism, as discussed in detail in Chapter 9 (groundwater), where impacts to privately owned bores have been identified by the groundwater model prepared for the project, appropriate make good agreements will be established and implemented in consultation with the bore owner. This is so that any impacts to groundwater resources are mitigated, such that flow-on impacts to other industries including tourism do not occur.

Further discussion on the potential for impacts to local businesses is provided in Chapter 20 (economics) and Chapter 21 (social assessment).

25.7 Mereworth House and Garden

25.7.1 Mereworth House and Garden listing and significance

The SOHI prepared by Colleen Morris claims that the EIS dismisses the Mereworth grant as a whole and states that the significant elements of the property are the house and surrounding garden, despite the extensive research into possible archaeological sites of former buildings and activities on the property as a whole. It was contended that the significance of heritage items goes beyond their built form. The context of a heritage item is an important aspect of its significance.

The Southern Highland Greens contend that Mereworth House and Garden represent a significant part of the cultural landscape evocative of the early colonial settlement in the period of convictism in Australia, and the EIS was dismissive of Mereworth's heritage significance.

It is acknowledged that the significance of heritage items goes beyond their built form, and that the context of a heritage item is an important aspect of its significance. Accordingly, the EIS and SoHI considered both the potential for impacts as a result of the proposed mine on the physical house and garden (Section 7.5.2i of the SOHI (EMM 2017)), as well as broader impacts on the landscape and context as a result of the construction of mine related surface infrastructure and the potential resultant visual amenity impacts (Section 7.5.2ii and 7.5.2iii (EMM 2017)).

The Mereworth property is made up of Lot 200 and Lot 201 DP 839314, and Lot 2 DP 1138694, and is dissected by the Hume Highway. Heritage items are described in Schedule 5 of the *Wingecarribee Local Environmental Plan 2010* (WLEP), and in relation to Mereworth, the following appears in Schedule 5:

Suburb	Item name	Address	Property* description	Significance	Item No.
Berrima	"Mereworth" house and garden	Old Hume Highway	Lot 100 DP 839316, Lot 200 DP 839314	Local	I351

*Lot 100 DP 839316 referred to in the listing is the same as Lot 2 DP 1138694.

Although Lot 2 and Lot 200 are coloured brown on the WLEP Heritage Map, they are not identified as being within any form of the conservation area. To determine the extent of what is listed, it is necessary to have regard to the definitions in the WLEP and the nature of restrictions that apply to the listing. Accordingly, a "heritage item" is defined in the WLEP as:

> a building, work, place, relic, tree, object or archaeological site the location and nature of which is described in Schedule 5.

The Mereworth item listed involves a building (the house) and a place (the garden). The Statement of Significance for Mereworth House and Garden in the Council's Heritage Inventory provides further insight into the intention of the listing. It provides the following description:

1965 house with important early nineteenth century historical connections. The garden is important for its connection with Paul Sorensen, the renowned cold-climate designer.

The provisions of the WLEP and the Statement of Significance support the proposition that the 'heritage item' is limited to the actual house and garden, not the curtilage. Although that Schedule 5 refers to both Lot 2 and Lot 200, it is not the property that is listed, it is the items themselves.

Notwithstanding, and as discussed in above, the SOHI considered the property as a whole, noting the significant aspects are restricted to the house and garden in the listing, rather than the broader property.

Further, the heritage significance of Mereworth and the broader landscape was considered at all stages of planning for the project. The non-caving mining method was chosen so as to eliminate the risk of surface related impacts from subsidence on the area. The purchase and use of Mereworth house has also led to positive conservation outcomes for the house and garden, with substantial repairs and maintenance works undertaken to date. The house was vacant prior to the purchase by Hume Coal and in a state of disrepair. Occupation and use is a positive form of conservation. The house and garden is now used for a variety of functions, and will continue to be used during the mine life.

In relation to the claim in submissions regarding archaeological sites, the earliest recorded homestead in the location of Mereworth House belonged to John Atkinson, and was in the location of the existing buildings and gardens. Relics may survive in the surrounding garden but it is likely that they would be fragmentary due to the extensive landscaping and the construction of the house.

The evocation of the early colonial settlement in the period of convictism is arguable as it is a mid-twentieth century design. There is no visible trace left of the 1820s establishment of the Mereworth beyond the use of high ground to place the main homestead. Nevertheless, the settlement pattern is still visible in the spatial arrangements seen today. Physical evidence of convicts on Mereworth was not found during the research and fieldwork phases of the project.

25.7.2 Views to the north and east from the garden

The Heritage Council of NSW raised concerns about the potential adverse impact of the proposed mine on a key feature of Sorensen's garden design at Mereworth; the view to the north and east. The Heritage Council submitted that the proposed mine surface infrastructure north of Mereworth has the potential to adversely impact the quality of Sorensen's garden design which borrows the long open view to the north and east. It was also submitted that insufficient information was provided in the Statement of Heritage Impact to understand the height and size of the mine's above ground workings and structures north of Mereworth. Therefore, the Heritage Council made two recommendations:

i. The EIS include a comparative analysis of Sorensen's design at Mereworth within his whole body of work for an up-to-date understanding of Mereworth's level of significance; ie state or local. The analysis should be undertaken by a heritage landscape consultant with demonstrated experience with similar historic landscapes. Then, based on the comparative analysis, the EIS should reassess the impact of the Hume Coal Project above ground workings in greater detail.

ii. The following three views need to be rendered and presented at least at A4 size for clarity:

- the view from within Sorensen's Garden out to the north;
- the view from within Sorensen's Garden out to the east;
- the view to Mereworth House and Garden from the highest point on the original Mereworth drive; and
- the view to Mereworth House and Garden from the Old Hume Highway parallel to the original drive, now disused.

- The National Trust Southern Highlands Branch (NTSHB) also raised concerns regarding the changes to the rural landscape of the Mereworth property, submitting the changes will be highly intrusive and that the visual impacts were downplayed in the EIS. The NTSHB noted that several views to and from the Mereworth house and garden were assessed as 'moderate' in the EIS, submitting that this ignores the contribution the surrounding rural setting makes to the significance of the item and undermines the Sorensen design, which sought to blend interior views of the garden with longer rural vistas.

i Analysis of Sorensen's design

As committed to in the Hume Coal Project SoHI (EMM 2017r), a conservation management plan will be prepared for Mereworth House and Garden. Further, as described in the response in Section 25.1.1ii, the surface infrastructure area proposed to be built on the Mereworth property has been placed to avoid as many visual and physical impacts as possible. A number of changes were made by Hume Coal to avoid physical impacts and to ensure a legacy that will see the house and the garden at Mereworth repaired and maintained. As the project will not have a physical effect on the house and garden, it was considered that preparing a conservation management plan for the core area of Mereworth House and Garden, by experts in built and landscape garden heritage is the most suitable way to address the significance of the place and the best way of caring for it.

ii Views from the Mereworth House and Garden

As stated in Section 22.4.2 of the Hume Coal Project EIS, it is acknowledged that the main impact on Mereworth House and Garden arising from the project will be of a visual nature. Construction of the surface infrastructure area will change some aspects of the Mereworth landscape and immediate surrounds. The only place where views from the house and garden will be affected is to the north across the ha-ha to the surrounding paddocks and dam. Importantly however, the design of the garden is deliberately inward-looking. Views from the house to the surrounding landscape are generally constrained by the perimeter plantings of Bhutan cypress, as shown in Photograph 25.1.

Photograph 25.1 The double ha-ha wall around the northern and western perimeter of the house complex. View south west

The majority of the surface infrastructure will be placed to the north-west, west and south of the Mereworth House and Garden, and while extensive, public access to the grounds is not permitted, nor was it permitted prior to Hume Coal's acquisition of the property. A large dam to the east and downslope from the house and garden will be visible from public access points but from the Hume Motorway those views will be transitory. Dams are infrastructure common in rural areas and will be visually absorbed into the landscape.

The photomontages requested by the Heritage Council are provided in Figures 25.4, 25.5 and 25.6; which show the view from within Sorensen's Garden out to the north, the view to Mereworth House and Garden from the highest point on the original Mereworth drive, and the view to Mereworth House and Garden from the Old Hume Highway parallel to the original drive, now disused, respectively. A photomontage showing the view from the Old Hume Highway in year 5 when the tree screens are established is also shown in Figure 25.7. Views of mine related infrastructure to the east/south-east of Mereworth (ie the primary water dam) will be very limited, if not possible at all due to the thick plantings in the garden looking in that direction. This view is illustrated in Photograph 25.2. The three other photomontages are discussed below.

Photograph 25.2 The view looking directly east from inside the Mereworth garden

The view from within Sorensen's Garden out to the north (Figure 25.4)

The photomontage of this view in Figure 25.4 is from the edge of the ha-ha looking north towards the surface infrastructure area. Importantly, this view is from outside the garden (ie in front of the ha-ha). The view immediately behind this point inside the garden is shown in Photograph 25.2. As shown, the views to the north from within the garden are almost impossible due to the thick row of trees lining the garden, meaning that the garden is inward looking and does not rely on views across the broader landscape, as was the intent of the original design. Photograph 25.3 shows the view from the inside of the house, and therefore from an elevated position, to the north-east.

Photomontage - View from the edge of the garden of Mereworth looking north-west

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.4

Source: EMM (2018); Hume Coal (2017)

T:\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2018_RTS\RTS009_Photomontage_20180612_02.mxd 12/06/2018

Photograph 25.3 View through the ha-ha at Mereworth. View north-west toward the surface infrastructure area

Photograph 25.4 The view from the master bedroom veranda, across the sunken lawn and beyond the ha-ha. View north, north-east

The view to Mereworth House and Garden from the highest point on the original Mereworth drive

As shown in Figure 25.5, there will be very minimal change to this view as a result of the project. The top of the coal stockpile can just be seen in the distance above the row of trees.

The view to Mereworth House and Garden from the Old Hume Highway parallel to the original drive

Figure 25.6 shows that the primary water dam will be visible from the Old Hume Highway. A coal stockpile and transfer point can just be seen in the distance, although due to distance and the colour of the infrastructure, this coal handling infrastructure results in very minimal change to the view. Figure 25.7 shows the tree screen once grown, which significantly screens the view from the highway.

The additional photomontages support the findings of the EIS. A similar view from the Old Hume Highway was assessed in the EIS (viewpoint 7), finding that the tree screen already planted along the highway will substantially screen the infrastructure from this viewpoint, reducing the significance of the potential visual impact from moderate to low, to low, particularly in consideration of the fact that receptors of this view will be transient motorists. In relation to the view from within the garden at Mereworth, the EIS identified that the construction of the surface infrastructure area will change some aspects of the Mereworth landscape and immediate surrounds to the north and north-east. However, views from the house and within the garden to the surrounding landscape are generally constrained by the perimeter plantings of Bhutan cypress and the design of the garden is deliberately inward-looking.

\\EMMSVR1\emm\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2018_RTS\RTS016_Photomontage2_20180620_01.mxd 20/06/2018

Photomontage - view to Mereworth House and Garden from the highest point on the original Mereworth drive

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.5

HUMECOAL PROJECT

EMM

\\EMMSVR1\emm\Jobs\2012\J12055 - Hume Coal Project EIS\Background information\GIS\02_Maps\2018_RTS\RTS017_Photomontage3_20180620_01.mxd 20/06/2018

Photomontage - view to Mereworth House and Garden from Old Hume Hwy (existing)

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.6

HUMECOAL PROJECT

EMM

Photomontage - view to Mereworth House and Garden from Old Hume Hwy (year 5)

Hume Coal Project and Berrima Rail Project
Response to submissions
Figure 25.7

HUMECOAL PROJECT

EMM

25.7.3 Impacts to the setting, landscape and context of Mereworth

In addition to the specific concerns raised regarding the potential visual impact to the north and east of Mereworth, a number of special interest group submissions raised concerns relating to the overall impact of the proposed mine on the context and landscape setting of Mereworth. It was submitted that whilst the house and garden will be maintained, the mine will have a substantial negative impact on the setting of the house and garden.

Specific concerns were raised over potential impacts relating to:

i. Noise and dust.

ii. proximity of the construction accommodation village.

iii. the primary water dam, as well as the water treatment plant and the substation near the entrance road into Mereworth, which it was submitted are out of scale and character with the Mereworth experience. The NTSHB claimed that the permanent impact of the proposed primary water dam and tree buffers on the landscape has been downplayed. The AGS submitted that any approval should be subject to the visual separation of these elements from the curtilage of Mereworth and the entry (including the new driveway, if it is used as the entrance road to the property).

i Noise and dust

The results of the air quality impact assessment show that predicted dust levels will be low, due to the underground nature of the mine and other mitigation measures that will be implemented such as watering of stockpiles. Despite the reasonably close proximity of Mereworth House and Garden to this infrastructure, the dust isopleths presented in Appendix 5 of the Hume Coal Project Air Quality and Greenhouse Gas Assessment (Ramboll 2017a) show dust concentrations will be minimal at Mereworth House. For example, average dust deposition levels will be below 0.5 $g/m^2/m$ at the house during construction and around 1 $g/m^2/m$ during operations. The relevant EPA criterion at a sensitive receptor such as a privately owned dwelling is $4g/m^2/m$. Similarly, PM_{10} levels will also be very low, with average annual concentrations predicted to be approximately 1 ug/m^3.

In relation to noise, Mereworth house and garden is owned by Hume Coal, and therefore private residents will not be living there during the project life.

ii Construction accommodation village

The accommodation village will be approximately 0.7 km to the west of the garden. The view from the garden in this direction is effectively screened by the thick tree plantings, similar to that shown in Photograph 25.3. The village will also be a temporary structure, and will be dismantled when no longer required following the completion of the construction period.

iii Primary water dam

The primary water dam will be to the east/south-east of Mereworth House and Garden. As explained in the response in Section 25.7.2, and shown by the photo of this existing view in Photograph 25.2, views from within the garden will be very limited, if not possible at all, of the dam. Notwithstanding, whilst acknowledged that this dam will be a large dam when full, smaller farm dams are very common across this landscape. Further, the dam will not be a permanent structure in the landscape but will be removed and the area rehabilitated at the cessation of mining.

25.7.4 Long term use

The NTSHB submitted that the impact of long term vacancy of Mereworth (which it presumes will be over the 23 year life of the mine) was not assessed in the SoHI.

As per the recommendations in the SoHI and EIS, a conservation management plan will be prepared for Mereworth post approval, which will lay out the most effective way to conserve Mereworth, including addressing the issue of vacancy. The best conservation tool of a heritage item is use. Hume Coal intends to continue using Mereworth house and garden, as it does now, for a variety of functions and to provide accommodation. It will not be left unattended, and therefore this scenario was not assessed in the EIS and SoHI.

Mereworth is currently used to host events such as meetings with stakeholders and information/open days. There are permanent information displays set up within the billiards room, which is used for ongoing consultation with interested community members.

Hume Coal is committed to maintaining the garden and house at Mereworth while adhering to Sorensen's design. This work will be undertaken by specialists in their field and will be fully funded by Hume Coal. The grounds are maintained as part of the Hume Coal property budget, with an annual budget set aside for maintenance, repairs and upgrades. During operations, Mereworth will also be used as short term guest accommodation for visiting POSCO representatives.

Works have been completed to upgrade the pool water systems and the irrigation system around the gardens. An arborist has also been engaged to manage the aging trees within the gardens.

25.7.5 Historic Heritage Management Plan and Conservation Management Plan

The SoHI prepared for the Coal Free Southern Highlands submission contended that preparation of a Historic heritage management plan (HHMP) for Mereworth House and Garden is unacceptable in the context of what is proposed, and that the EIS should explain in detail how the heritage issues with respect to the introduction of above ground infrastructure will be managed.

The NTSHB also suggested that there seems to be a deliberate avoidance of detail about the content and timing of the historic heritage management plan and conservation management plan for the 'Mereworth' site. It was also suggested that the public be given the opportunity to comment on the HHMP and the Conservation Management Plan (CMP) to be prepared for the Mereworth House and Garden.

The historical heritage management plan (HHMP) and the conservation management plan (CMP) for Mereworth House and Garden will be prepared in accordance with the relevant conditions of the development consent, in consultation with relevant stakeholders, and to the satisfaction of the DPE.

There was no 'deliberate' avoidance of detail about the timing and content of the HHMP and CMP. It is standard for development consents for all developments of this nature to require the preparation and approval of a suite of management plans following the grant project approval, and prior to works commencing on a project.

Further, Hume Coal has a plan for the management and maintenance of the Mereworth property, where substantial maintenance and repair works have been undertaken already. As described in the response in Section 25.7.4, a substantial allocation for maintenance, repairs and upgrades has been set aside in the 2018 budget for works at the property.

25.8 The Sorensen garden at the Berrima Cement Works

The NTSHB notes in their submission that the proposed Berrima Rail Project would remove a section of a garden within the Boral Cement Works site in New Berrima designed by noted cold climate landscape designer and gardener, Paul Sorensen. The NTSHB objects to the loss of any remaining Sorensen garden, noting that it has been identified by the WSC as a potential heritage item and is also associated with local prominent gardens designers Claude and Isobel Crowe.

The garden, which fronts Berrima Road in New Berrima, contains plantings in varying health, some of which are mature and robust and others that have failed to thrive.

The section of the garden proposed to be removed is in poor condition with the individual trees being planted in the 1940s but having failed to grow. One mature and healthy tree will be removed. Towards the rear (west) of the garden, a number of other plantings survive in good and in poor health; these plantings are also believed to be part of the Sorensen/Crowe garden and can be tended or replaced (possibly with cuttings) to grow and fulfil their design potential.

The rail line through the centre is a continuation of the industrial use of the site, which the gardens were designed to beautify. Improving the quality and health of the entire garden as a result of this project is a positive outcome for the heritage values of this location.

25.9 Locally significant heritage items

The Heritage Council noted that eight locally significant heritage items listed on Schedule 5 of the Wingecarribee LEP are wholly or partially in the project area. Despite reassurances in the EIS that subsidence and disturbance to the water table and groundwater will be minimised by state-of-the-art mining methods, concern remains that some damage is possible to the items due to the size and longevity of the subterranean operations and the age and fragility of historic buildings, structures and mature plantings.

The non-caving mining method means that there will be no surface impacts related to subsidence, as stated in the Hume Coal Project Subsidence Assessment (Mine Advice 2017). This includes to any locally listed heritage items. The two and three-dimensional modelling of the mine plan undertaken by Dr Keith Heasley (refer to Chapter 16 and Appendix 7) re-affirmed this, confirming subsidence will be negligible at less than 20 mm. Locally listed heritage items will not be impacted by subsidence. Further, and as explained in Section 25.2.1iii, the predicted change (ie the magnitude of water table drawdown) is expected to be generally comparable to what would be experienced during natural seasonal variations and local landholder pumping.

25.10 Monitoring and mitigation measures

The Heritage Council recommended that the following be included in the conditions of approval for the monitoring, prevention and rectification of locally listed heritage items:

1. A dilapidation report is to be undertaken prior to the commencement of both the Hume Coal Project (SSD 7172) and the Berrima Rail Project (SSD 7171) of each of the locally significant heritage items listed on Schedule 5 of the Wingecarribee Local Environmental Plan (LEP) 2010 adjacent to the Hume Coal Project. The dilapidation study is to report on the condition of the properties prior to any construction or excavation. It is to record any existing damage, and the state of any particular aspects of the property that are likely to be affected by construction work, excavation or demolition.

2. An inspection and monitoring program should be established for each of the locally significant heritage items adjacent to the Hume Coal Project. The program is to inspect and monitor the condition of the buildings, structures as well as the level and extent of ground water for the full duration of the mine, from inception to final decommissioning and for two year following decommissioning and site remediation.

3. Any damage due to the mine construction and operation and for the two years following decommissioning should be firstly prevented. Any damage should be carefully rectified immediately in accordance with conservation Australia ICOMOS Burra Charter, best industry practice and Heritage Council of NSW guidelines. This includes damage to buildings' structure, external and internal claddings, finishes and built in fittings due to any movement, contamination, leaching, accelerated corrosion and deterioration, or discolouration. This program should be included in the proposed Historic Heritage Management Plan for both the projects.

As described in Section 25.7.5, an historical heritage management plan (HHMP) will be prepared for the Hume Coal Project and Berrima Rail Project, in accordance with the relevant conditions of the development consent, in consultation with relevant stakeholders, and to the satisfaction of DPE. This management plan will include the details of dilapidation reports to be undertaken, as well as an ongoing inspection and monitoring program.

26 Greenhouse gas

26.1 Contribution of the project to climate change

Community and special interest group respondents raised concerns and objections on the basis that the project would directly contribute to climate change as a result of carbon emissions, during both mining and as a result of the end use of the product coal (it is noted that some respondents stated a range of carbon emission estimates that would be generated by the project which were inconsistent with those stated in the EIS; the source of the estimates quoted in submissions was not stated). Some respondents highlighted that POSCO understands the criticality of reducing carbon emissions, as stated in POSCO's 2015 report which identified the burning of fossil fuels as contributing to climate change globally.

Some respondents questioned the conclusions in the EIS that the total greenhouse gas emissions from the Hume Coal Project will be "minimal" and "minor", stating that this is a large and significant amount from one source.

Respondents highlighted the significant implications of climate change locally to the Southern Highlands region of NSW, nationally and globally, including agricultural and food production issues, increasing pressure on water resources, sea level rise, and extreme weather events.

As stated in Section 1.7 of the Hume Coal Project EIS (EMM 2017a), the project will produce both metallurgical and thermal coal, producing around 39 Mt of product coal over the life of the mine. The project will both directly (Scope 1 and 2) and indirectly (Scope 3) generate carbon dioxide emissions which are recognised as a key contributor to climate change.

The summary provided in Section 13.3 of the EIS of the predicted total greenhouse gas emissions (GHG) over the life of the project, estimated as tonnes (t) of carbon dioxide equivalent ($CO_{2\text{-}e}$), show that the emissions from the Hume Coal Project will be an extremely small contributor to national and NSW GHG emissions. The annual average scope 1, 2 and 3 emissions (excluding the end use of coal) from the project represent approximately 0.068% and 0.017% of total GHG emissions for NSW and Australia, respectively, based on the latest available National Greenhouse Gas Inventory, being that for 2014. Further discussion on Scope 3 emissions is provided in the response in Section 26.2.

It is common practice in an environmental impact statement to compare a project's emissions with total state and national emissions, which has been done in the Hume Coal Project GHG assessment, and shown to be a very small percentage of these emissions. However, attempting to quantify a project's impact on climate change on the basis of its contribution to total emissions is unscientific as climate change impacts are not linear with increases in emissions. For this reason, the EIS simply presented the emissions data to enable these best estimates to be included in future regional or global emission projections, and for consideration by decision makers and other stakeholders.

26.2 Scope 3 emissions

Community and special interest group respondents' stated concerns and objections on the basis that:

- the EIS fails to address climate change because Scope 3 emissions from the combustion of coal are not addressed (ie the end use of the coking and thermal coal is not assessed);
- the combustion and end use of product coal (both coking and thermal) from the project will result in significant additional CO2 to the atmosphere;
- 45% of product coal extracted from the project would be thermal coal, the combustion of which is recognised as a major contributor to climate change; and
- burning thermal coal for energy production has been identified as a leading cause of anthropogenic climate change by the Intergovernmental Panel on Climate Change along with many leading scientists. When the Hume Coal project was first proposed, the extraction of high quality metallurgical coal promoted; however the EIS identifies that product coal will be almost 50% thermal.

The GHG assessment provided in Appendix K of the Hume Coal Project EIS was prepared by qualified and experienced energy and carbon specialists in accordance with Australian and international standards. Reporting of Scope 3 emissions is voluntary under all of the relevant standards and was not required by the SEARs for the Project. Notwithstanding, Scope 3 emissions were calculated and presented in the EIS.

Chapter 13 of the EIS addresses the predicted Scope 3 emissions generated by the project, which are indirect emissions that are generated as a consequence of an organisation's activities, but which are physically produced by the activities of another organisation (DoE 2016). This includes the end use of the product coal, being the combustion of coal for energy and use of coking coal in the steel-making process. Section 13.3 of the EIS provides a summary of the predicted Scope 3 emissions over the life of the project and includes:

- upstream emissions from the extraction, production and transport of diesel and petrol fuel;
- upstream emissions from electricity lost in delivery in the transmission and distribution network; and
- downstream emissions generated from the end use of product coal.

Scope 3 emissions from the end use of coking coal and thermal coal have been revised from the Hume Coal Project EIS AQIA (Ramboll Environ 2017a) to include product coal combustion using Scope 1 fuel combustion emission factors, in addition to the Scope 3 emission factors already applied. The following Scope 1 factors were used in the quantification of Scope 3 emissions from coal combustion by end users:

- Coking coal – Coking coal emission factors from Table 1 of the NGAP Workbook (2016); and
- Thermal coal – Bituminous coal emission factors from Table 1 of the NGAP Workbook (2016).

The detailed predicted Scope 1, 2 and 3 emissions for the project are presented below in Table 26.1, and a summary is presented in Table 26.2.

It is acknowledged that the Hume Coal Project will be part of the coal supply chain, and that the ultimate end use of coal produced by the Hume Coal mine will result in GHG emissions. Scope 3 emissions were included in the project's inventory accordingly. However, these upstream and downstream activities are subject to separate approval and reporting processes. Associated GHG emissions are reported by these organisations as Scope 1 and 2 emissions and scrutinised accordingly.

Table 26.1 Estimated GHG emissions (tonnes CO2-e) by emissions source

Year	ROM (Mt)	Scope 1					Scope 2	Scope 3				
		Diesel (on-site, mobile equipment)	Diesel (on-site, stationary equipment)	Diesel (Hume owned locomotives)	Petrol	Mine ventilation gas	Electricity	Diesel fuel	Electricity	Petrol	End use of Coking Coal	End use of Thermal Coal
Construction Y1	-	11,281	-	-	306	-	3,155	584	451	16	-	-
Construction Y2	0.033	12,169	5	41	315	23	25,797	633	3,685	16	53,147	30,207
Operations Y1	1.0	1,776	14	1,155	17	703	45,284	152	6,469	1	1,505,826	855,851
Operations Y2	2.4	2,663	14	2,703	26	1,656	67,925	279	9,704	1	3,525,404	2,003,699
Operations Y3	3.1	3,551	16	3,559	33	2,108	90,567	369	12,938	2	4,641,487	2,638,036
Operations Y4	2.2	3,551	19	2,432	33	1,482	90,567	311	12,938	2	3,171,092	1,802,322
Operations Y5	3.1	3,551	22	3,410	33	2,125	90,567	362	12,938	2	4,446,616	2,527,279
Operations Y6	3.1	3,551	24	3,315	33	2,119	90,567	357	12,938	2	4,322,606	2,456,797
Operations Y7	3.2	3,551	27	3,260	33	2,175	90,567	354	12,938	2	4,251,744	2,416,522
Operations Y8	3.2	3,551	27	3,383	33	2,206	90,567	361	12,938	2	4,411,184	2,507,141
Operations Y9	3.3	3,551	27	3,641	33	2,244	90,567	374	12,938	2	4,747,781	2,698,449
Operations Y10	2.3	3,551	27	2,608	33	1,589	90,567	320	12,938	2	3,401,395	1,933,217
Operations Y11	3.0	3,551	27	3,369	33	2,066	90,567	360	12,938	2	4,393,469	2,497,072
Operations Y12	3.1	3,551	27	3,478	33	2,151	90,567	365	12,938	2	4,535,194	2,577,623
Operations Y13	3.4	3,551	27	3,532	33	2,324	90,567	368	12,938	2	4,606,056	2,617,898
Operations Y14	3.1	3,551	27	2,771	33	2,129	90,567	329	12,938	2	3,613,982	2,054,043
Operations Y15	2.6	3,551	27	2,337	33	1,752	90,567	306	12,938	2	3,047,083	1,731,840
Operations Y16	3.2	3,551	27	3,573	33	2,190	90,567	370	12,938	2	4,659,203	2,648,105
Operations Y17	2.7	3,551	27	3,097	33	1,871	90,567	346	12,938	2	4,039,157	2,295,696
Operations Y18	2.2	2,841	27	2,445	29	1,501	72,454	275	10,351	1	3,188,808	1,812,391
Operations Y19	0.2	710	27	217	7	137	18,113	49	2,588	0	283,097	160,901
Rehabilitation Y1	-	11,281	-	-	306	-	3,155	584	451	16	-	-
Rehabilitation Y2	-	11,281	-	-	306	-	3,155	584	451	16	-	-
Project Total		107,268	468	54,327	1,812	34,550	1,597,547	8,394	228,221	94	70,844,332	40,265,091
Annual average		4,664	20	2,362	79	1,502	69,459	365	9,923	4	3,080,188	1,750,656

Table 26.2 Summary of scope 1, 2 and 3 emissions

Project Year	Scope 1	Scope 2	Scope 3
Construction Y1	11,586	3,155	1,051
Construction Y2	12,553	25,797	87,688
Operations Y1	3,664	45,284	2,368,300
Operations Y2	7,062	67,925	5,539,087
Operations Y3	9,268	90,567	7,292,832
Operations Y4	7,517	90,567	4,986,666
Operations Y5	9,141	90,567	6,987,196
Operations Y6	9,043	90,567	6,792,700
Operations Y7	9,047	90,567	6,681,560
Operations Y8	9,200	90,567	6,931,626
Operations Y9	9,496	90,567	7,459,544
Operations Y10	7,809	90,567	5,347,873
Operations Y11	9,046	90,567	6,903,841
Operations Y12	9,241	90,567	7,126,122
Operations Y13	9,468	90,567	7,237,263
Operations Y14	8,512	90,567	5,681,295
Operations Y15	7,700	90,567	4,792,170
Operations Y16	9,375	90,567	7,320,618
Operations Y17	8,581	90,567	6,348,138
Operations Y18	6,843	72,454	5,011,826
Operations Y19	1,098	18,113	446,636
Rehabilitation Y1	11,586	3,155	1,051
Rehabilitation Y2	11,586	3,155	1,051
Project Total	198,422	1,597,543	111,346,132
Annual average	8,627	69,458	4,841,136

As stated in Section 1.7 of the Hume Coal Project EIS, the project will produce both metallurgical and thermal coal, extracting around 50 Mt over the life of the mine, of which 39 Mt would be product coal. The product split will be about 55% metallurgical coal and 45% thermal coal. In relation to submissions regarding this product split, it is acknowledged that the preliminary environmental assessment submitted to the DPE with the original request for SEARs stated that the primary product from the mine would be marketed as a metallurgical coal. This is still the case, albeit with a large proportion of thermal coal. The predicted breakdown of the product coal between metallurgical and thermal has been refined as a result of additional results from exploration drilling and coal quality analysis conducted as part of the preparation of the EIS.

The International Energy Agency (IEA) has identified increasing demand for coal in emerging economies for the period 2016-22 (IEA 2017). The IEA (2017) identified that outside the power sector, growth in thermal coal demand is centred in the industrial sector which comes as a result of robust economic growth. Even with the advances in technology and decreasing cost of renewable energy sources and evidence of a shift away from fossil fuels, there is still a need for coal as an energy source and in the industrial sector, in particular in emerging economies around the world. Further discussion on energy policy and the demand for coal is provided below.

26.3 Inconsistency with energy policy objectives

Community and special interest group respondents' stated objections to the project on the basis that the development of new coal mines is not appropriate, that coal is old technology and its use as an energy source is in decline, unsustainable and no longer needed. Concerns were identified relating to the perceived inconsistency of the project with state, federal and global policy objectives, including that the mining of additional thermal coal and its subsequent burning, would be inconsistent with the NSW Climate Change Policy Framework, and that the project would be inconsistent with Australia's ratification of the Paris Agreement.

Respondents stated the need for greater investment in renewable energy sources, stating that countries are moving away from coal and towards renewable alternatives, that coal was no longer a viable energy source, and that NSW should lead the way in renewable energy development, highlighting the importance of prioritising renewable energy. Respondents questioned the need for energy generation from coal when renewable alternatives were available.

One respondent also noted that the intention of the project to supply coal to POSCO's Korean industries including steel production was in contrast with the announcements of the newly elected government in South Korea, regarding closure of a number of its coal fired power stations because of the health dangers of particulate pollution. Another respondent identified that the project was inconsistent with energy policy changes in South Korea to permanently lower Korea's reliance on imported coal amid increasing concerns about emissions and pollution, stating that investment in a high cost, greenfield mine that produces such a high percentage of thermal coal appears to be in conflict with this policy change.

It is acknowledged that the production of energy from renewable sources is predicted to grow and make important contributions to the NSW and national economies. The Clean Energy Council's *Clean Energy Australia Report 2016* identified that in 2016, 17.3 percent of Australia's energy came from renewable sources; an increase of more than 3 percent compared to 2015 (Clean Energy Council 2016). In NSW, 12 percent of energy was produced from renewable sources, with the greatest proportion of renewable energy generation in Tasmania (93 percent) and South Australia (43 percent).

Australia ratified the Paris Agreement in November 2016 reinforcing its commitment to action on climate change and further reductions to GHG emissions. The Paris Agreement builds upon the United Nations Framework Convention on Climate Change and aims to strengthen the global response to the threat of climate change. Under the Paris Agreement, Australia has committed to reduce its emissions by 26–28% below 2005 levels by 2030 (DoEE 2016). This emissions reduction target builds upon the national 2020 target of reducing emissions by 5% below 2000 levels (DoEE 2016). The target represents a 50–52% reduction in emissions per capita and a 64–65% reduction in the emissions intensity of the Australian economy between 2005 and 2030 (DoEE 2016). In addition to the ratification of the Paris Agreement, the Commonwealth Government has demonstrated its ongoing commitment to GHG emission reductions through the implementation of a suite of national policies. These policies are already contributing to emission reductions and encouraging both technological innovation and further expansions to the country's clean energy sector.

While it is acknowledged that there is a need to reduce global GHG emissions, the IEA has identified increasing demand for coal in emerging economies for the period 2016-22, including in Southeast Asia (IEA 2017). The demand for coal in emerging economies was identified in the IEA outlook on coal released in December 2017, *Coal 2017 Analysis and Forecasts to 2022* (IEA 2017), for the period 2016-22. The IEA stated that, while global coal demand decreased in 2016 by 1.6 percent, and by 4.2 percent since 2014, coal consumption in India and other Asian countries was increasing. Predicted growth in coal demand to 2022 is concentrated in India, Southeast Asia and several other Asian countries. Coal-fired power generation is predicted to increase marginally by 1.2 percent per year in the period 2016-22, although its share of the power mix is predicted to fall to the lowest level since IEA statistics began, to just below 36 percent by 2022 (IEA 2017). In contrast, coal-fired generation in India is forecast to increase at nearly 4 percent per year through to 2022. The IEA (2017) identified that outside the power sector, growth in thermal coal demand is centred in the industrial sector which comes as a result of robust economic growth, and in coking coal as a result of increased steel consumption for development of infrastructure and steel-intensive industries such as shipbuilding, defence and vehicle manufacturing.

In response to the IEA outlook on coal, the Word Coal Association (WCA) highlighted that fossil fuels, despite progress in renewable technology and decreasing costs, will still account for around 75 percent of global energy supply in 2022, with a particular focus on emerging economies such as India, Pakistan and Southeast Asia (WCA 2017). WCA also highlighted that, in the IEA's latest *World Energy Outlook 2017* report, it indicated that Southeast Asia will increase its share in power generation from 32% in 2014 to 50% in 2040 (WCA 2017). The number of people globally without access to electricity is also relevant in emerging economies. The IEA's *Energy Access Outlook 2017* (IEA 2017a) states that the pace of progress to promote electricity access has increased, with the number of people without access to electricity falling to below 1.1 billion people for the first time in 2016. Since 2000, nearly 1.2 billion people gained access to electricity, 870 million of which were in developing Asia (including 500 million in India). However, on balance, there are still more people without electricity in 2017 than there were in 2000 (IEA 2017a).

It is clear that there remains a market and a global need for the energy produced through the burning of fossil fuels into the future, balanced with development of alternative energy sources so that national and global GHG emission reduction targets are able to be achieved in line with the Paris Agreement. It will be the responsibility of signatories to the Paris Agreement to ensure that energy generation, investment and policy align to enable emission targets to be achieved.

In relation to steel making, metallurgical coal is one of the two primary ingredients used in the steel-making process, with the other being iron ore. Steel is an essential engineering and construction material used in most industry sectors: energy, construction, transportation and vehicles, infrastructure, packaging and machinery. It is a basic component of many items used every day by the community including cars, reinforced concrete, buildings and household appliances. Thermal coal is used to generate electricity which is the main source of energy for heating, cooling, lighting, mobility, communications and industry.

The global demand for steel has grown substantially and is forecast to increase even further in the future. The World Steel Association estimates that demand will grow by 50 per cent above current levels by 2050 (World Steel Association 2015). Global per capita steel use increased from 150 kg in 2001 to 217 kg in 2014. This occurred despite development of stronger steel alloys which reduced requirements for individual structures.

Both metallurgical and thermal coal enables the provision of goods and services that are an integral part of all our daily lives. The project will help to provide these important materials in a socially and environmentally responsible manner. While the project will result in the extraction of coal that will directly and indirectly contribute to climate change through the release of GHG emissions, the demand for coal particularly in emerging economies in India and Asia, is expected to continue for the foreseeable future.

In response to concerns raised by respondents regarding the perceived inconsistency of the project with South Korea's energy policy and direction of Korean industries including steel production, the EIS identifies that coal from the project is destined for export to overseas markets (as well as the domestic market), and not specifically South Korea. Further, POSCO, as a south Korean steel maker, will use coal exported from the Hume Coal Project in its manufacturing processes. These are not linked to national energy policies. Coal will still make up a large percentage of the Korean energy mix. South Korea's power generation mix will remain dominated by nuclear and thermal coal, which will still account for 60 percent of electricity in 2030[48]. As noted above, even with the advances in technology and decreasing cost of renewable energy sources and evidence of a shift away from fossil fuels in many countries, there is still a clear need for coal as an energy source as part of the energy mix, and in the industrial sector, in particular in emerging economies around the world.

[48] https://www.reuters.com/article/us-southkorea-energy-policy/south-korea-plans-shift-to-renewables-but-coal-nuclear-to-remain-strong-idUSKBN1E80FZ

27 Other matters

27.1 EIS adequacy

Concerns were raised in submissions from community members, businesses and special interest groups about the adequacy and accuracy of the information presented in the Hume Coal EIS. It was contended that:

i. the EIS is a marketing document, overly long and complex, incorrect, and is misleading;

iii. omits an assessment of key places surrounding the coal and rail projects such as Berrima and Medway; and

iiii. does not address Hume Coal's supply chain.

i. A robust EIS was prepared over a number of years in accordance with the requirements of the DPE, DoEE and other government agencies, as set out in the SEARs. Hume Coal acquired Authorisation 349 (A349) in December 2010, and began exploration drilling in May 2011. Since this time extensive baseline studies have been undertaken, enabling a thorough understanding of the existing environment on which to base environmental assessments of the project. The project evolved progressively with input from detailed geological, engineering, environmental, financial and other technical investigations.

Technical assessments were prepared for the EIS by qualified, experienced and well respected industry professionals, in accordance with the relevant guidelines and policies that would need to be followed by anyone undertaking the assessments. They were prepared in consultation with government agencies and other stakeholders which included site visits by some government agencies. Assessments accounted for baseline environmental conditions based on monitoring results, as well as cumulative impacts based on known developments likely to occur in the local area. To further assure the EIS rigour and independence, aspects requiring more complex technical studies and/or identified as a potential area of community concern were reviewed by independent experts and their input incorporated; namely the groundwater numerical model and assessment, and the subsidence assessment. Hume Coal submitted its draft Environmental Impact Statement for the Hume Coal Project (SSD7172) to DPE on 29 November 2016 for DPE adequacy review and subsequently the Berrima Rail Project EIS (SSD7171) on 30 November 2016. The DPE reviewed the draft EIS to ensure it adequately met its requirements in the SEARs. The EIS was then finalised addressing some minor adequacy review comments and the DPE deemed that it adequately met the SEARs.

ii. In relation to Berrima and Medway, the nearest privately owned residents in these localities were assessed for potential impacts, including visual impact, noise, air quality and water resources. These studies all involved an iterative process in assessing the impacts of various project design options and in doing so carefully identifying any privately owned land owners that may be affected. In relation to visual amenity, a viewshed analysis was undertaken using GIS software which enabled the privately owned land where views of surface infrastructure may be possible to be identified, and therefore enabling the identification of appropriate viewpoints which were then ground-truthed in the field and assessed in detail in the visual amenity assessment. The locations of privately owned residents for assessment in the noise and air quality assessments were identified through a combination of the use of land ownership and cadastral information, aerial photography, and ground truthing in the local area. The identification of privately owned bores for consideration in the water assessment involved a thorough investigation of publically available bore records and consultation with the relevant authorities, such as Water NSW.

iii. The Hume Coal Project and Berrima Rail Project is for a coal mine and associated rail spur and loop, and does not include upstream activities, such as the supply of materials required to construct and operate the mine and rail project, which are the responsibility of others. Notwithstanding, and as described in the EIS, Hume Coal will maximise local business opportunities by giving preference to local suppliers where reliability, quality and financial competitiveness criteria can be satisfied. Suppliers of equipment for the project will be chosen following a detailed engineering design and procurement process, which will occur after the development application is determined so that investment decisions can be made with certainty.

27.2 General objections

27.2.1 Objections on the basis of environmental impacts

Submissions from community members and special interest groups objected to the proposal on the basis of concerns about the general environmental impacts of the Hume Coal Project, contending that damage would occur in the local area and the broader Southern Highlands as a result of the proposed mine and the benefits of the proposed mine would not outweigh the impacts. Claims were made that mining is not suitable to the area which is seen as 'green', 'clean' and 'pristine', with the project seen as compromising both the environmental integrity and image of the region. It was also claimed that the project puts financial gains before environmental health.

The above views are noted. However, it is submitted that the impacts of the Hume Coal Project have been adequately addressed in accordance with the SEARs. The EIS for the project concluded that while the proposed mine and rail projects could cause some adverse impacts, mitigation or compensation measures have been developed to address each of these so that residual impacts are either avoided or readily managed and within acceptable, government set criteria. The environmental management measures committed to are provided in Chapter 25 of this RTS report, and include best practice measures and commitments to prepare environmental management plans for construction and operations.

The suitability of the project area for the development of the proposal, and compatibility of the mine with the region is discussed in detail in Chapter 6 (Legislation, planning instruments and policies). Principally, the Hume Coal Project will efficiently recover an economic coal resource beneath privately owned land where underground mining is permissible. Resources extracted in this way avoid land use conflicts by continuing existing land uses at the surface and minimising impacts to significant environmental, cultural and built features. The site is well served by necessary services and infrastructure, particularly nearby rail infrastructure and Port Kembla. A range of commitments have been made by Hume Coal to mitigate potential impacts on surrounding land uses. When these commitments are applied, the project is unlikely to have a significant land use impacts. Further, the Southern Coalfield is the only significant source of quality hard metallurgical or coking coal in NSW. Proposed mining developments need to balance the impacts of a development in a particular area, with the location of the resource. The remaining unallocated prime coking coal resources in the Southern Coalfield are in the Bulli and Balgownie seams underlying the Campbelltown-Camden-Picton region, and in the Wongawilli Seam in the southern part of the coalfield. Further mine development in much of the Campbelltown-Camden-Picton area is constrained by its closeness to existing and planned urban areas. Conversely, mining in the Wongawilli Seam in the project area is relatively unconstrained and has the substantial advantage of closeness to rail infrastructure that links directly to the Port Kembla coal terminal. The coal project seeks to draw on these positive features.

The claim that the project puts financial gain before environmental health is incorrect. The design of the project was a result of an iterative process undertaken to achieve a project design that provides efficient extraction of the resource whilst also delivering environmental protection and socio-economic benefits. For example, before the proposed non-caving mining method was chosen for the proposal, the initial concept study investigated a combination of longwall and bord and pillar mining which would have delivered up to 4.5 Mtpa of ROM coal (compared to the 3.5 Mtpa of ROM coal for which approval is sought under the proposed non-caving mining method).

Generally, the advantage of longwall mining is that it maximises resource recovery compared with other underground mining methods. However, it also causes subsidence impacts with the potential to damage natural and built surface features, as well as potentially increasing water inflow to underground workings due to increased hydraulic conductivity in the rock strata above the goaf. Longwall mining is also less flexible in being able to avoid sensitive surface features and geological constraints. While this would have maximised resource recovery, it was considered by Hume Coal that the environmental impacts were unacceptable and this option was not pursued any further.

The non-caving mining method for which approval is sought will enable economic resource recovery whilst leaving sufficient coal in place in the form of web and barrier pillars to keep the overlying strata supported and provides long-term geotechnical stability, thus meeting the goals of minimising and/or eliminating subsidence impacts and minimising groundwater impacts. Further, Hume Coal has committed to adopting a number of leading practice mitigation measures, such as covering rail wagons to transport product coal, thereby reducing the potential for dust emissions during transport. Hume Coal will be the first coal mining company in Australia to do this. In addition, all coal rejects will be returned underground to partially backfill mined-out voids, rather than leaving them in large above-ground emplacements or trucking them off-site to remote emplacements. Whilst mine backfill is a mature technology in underground metalliferous mines, this technology has so far only been adopted at one other Australian underground coal mine as a trial and is considered to be leading international practice. The adoption of these innovative mitigation measures is proof that financial gain has not been placed before environmental protection.

Despite all of these mitigation measures being implemented and a mine method that will result in a lower resource recovery when compared to other secondary extraction methods such as longwall mining, the economic impact assessment shows that the project will have significant economic benefits when all costs, including the costs associated with mitigation measures and residual environmental impacts, are taken into account.

27.2.2 Experience in the Hunter Valley

Some submissions objected to the project using the example of coal mining in the Hunter Valley. It was contended that there is a detrimental environmental legacy in the Hunter region as a result of coal mining and that the Hume Coal Project will have the same effect in the Southern Highlands.

The local and cumulative impact of coal mines in the Hunter are dealt with in separate environmental assessment processes for each mine, and is the responsibility of regulators and mining companies there. The Hunter Valley has a very long history of coal mining with around 31 coal mines operating in the region today (17 in the Upper Hunter and 14 in the Lower Hunter), the majority of which are large open cut mining operations which is an entirely different scenario to that proposed for the Southern Highlands with the Hume Coal Project. Further, many of these mining operations were approved and commenced operation before the implementation of modern, more stringent legal frameworks relating to environmental management and protection. Should any additional coal mines be proposed in the future in the Southern Highlands, the required development application and accompanying EIS would be need to include an assessment of the cumulative impacts of the proposal with the Hume Coal Project, and would be subject to the same rigorous assessment and approval process under the EP&A Act.

27.2.3 General objections and poll results

Community members, businesses and special interest groups submitted general objections to the Hume Coal and the Berrima Rail Projects, stating that the local community is strongly opposed to the proposed mine and that it is not in the best interests of the local community and region.

A number of respondents referred to a Galaxy Research poll undertaken in April 2017 that found support for the Hume Coal Project among Wingecarribee Shire residents is at 18%. The poll results suggest that 59% of Wingecarribee Shire residents oppose the Hume Coal mine proposal. Residents responding to the poll cited concerns over risks to groundwater, catchment water supply, dust and biodiversity, as well as concerns over potential impacts to existing local industries such as agriculture, equine, tourism and local food production, and the culture and lifestyle of the Southern Highlands.

Hume Coal acknowledges that there is some community opposition to coal mining; however this does not reflect the view of all Southern Highland residents. Approximately 30% of the unique community submissions received on the Hume Coal Project were in support of the project. Many of the submissions supporting the project cited the employment benefits the project will bring to the region. Over 500 enquiries have been received by Hume Coal to date about employment opportunities at the mine.

The concerns raised in the poll in relation to groundwater, water supply, dust, biodiversity, agriculture and tourism are all discussed in detail in this RTS. The overall conclusion of the EIS, supported by extensive technical studies prepared by experts in each field, is that on balance the project will deliver net benefits to the community and the state of NSW.

The project is justified on economic, social and environmental grounds. This is demonstrated by its consistency with key objectives of the EP&A Act. The project will develop a valuable, publically owned natural resource – Wongawilli Seam coal. At the same time valuable environmental and cultural resources will be managed effectively and will be protected.

27.3 POSCO

27.3.1 Corporate reputation

Community respondents raised concerns about POSCO; the owner of the applicant Hume Coal, claiming the company and its subsidiaries has a poor reputation and international track record in relation to aspects such as corruption, environmental management and human rights. It was contended this poor track record is documented in countries including India, Vietnam, Uzbekistan, South Korea, Vietnam and West Papua.

On the basis of these claims, it was contended by some that POSCO/Hume Coal is not a “fit and proper person” within the meaning of section 380A of the *NSW Mining Act 1992*. Further, it was claimed that given the company’s alleged poor track record in other countries, POSCO cannot be trusted to operate the Hume Coal Project in an environmentally and socially responsible manner.

Section 380A of the NSW *Mining Act* 1992 requires the consideration of whether the applicant is a ‘fit and proper person’ in making certain decisions about mining rights, such as the grant of a mining lease. It is not a matter for consideration in assessing and granting development consent in accordance with the provisions of the EP&A Act. Whilst it is not a consideration, as a separate matter it is noted that the DPE – Resource Regulator conducted an investigation into an allegation that Hume Coal was unfit to hold a mining title within NSW, pursuant to Section 380A. In a letter to Hume Coal dated 11 April 2018 from the Resource Regulator, it was confirmed that this investigation found there was insufficient evidence to substantiate the allegation, and no further action was proposed.

Notwithstanding, the claim that POSCO cannot be trusted to operate the mine in an environmentally and socially responsible manner is rejected. POSCO is committed to constructing and operating the Hume Coal Project in accordance with the commitments outlined in the EIS and in strict compliance with all relevant NSW and Commonwealth legislation, conditions of approval and licences.

POSCO undertakes all of its operations in accordance with its ethics charter which, in regards to human rights, states:

> Respect for International Standards Regarding Human Rights
>
> 1. We will support and respect internationally recognised standards on human rights, such as the Universal Declaration of Human Rights, Guiding Principles on Business and Human Rights, UN Global Compact, and OECD Guidelines for Multinational Enterprises.
>
> 2. We will establish clear policy and systems for protection of human rights and endeavour not to violate human rights in our management activities.
>
> 3. We will support business partners to comply with internationally recognised human rights standards and regulations, protect their employee's human rights and treat them fairly.

The POSCO ethics charter can be found at:

http://www.posco.com/homepage/docs/eng5/jsp/company/ethics/s91a3000050c.jsp

POSCO has invested around $2.2 billion in nine projects in Australia across a range of commodities, including coal and iron ore. These investments are managed to the highest standards, in full compliance with all Australian regulations and guidelines.

POSCO is also committed to making a positive contribution in the communities in which it operates, as evident by the significant financial contribution made each year to local communities and charities. Internationally, POSCO has consistently contributed to disaster and poverty relief, with some examples listed below.

i. Donation of $300,000 to Haiti Relief (2010).

ii. Provision of over 100 new homes in southern Vietnam (2017).

iii. Offers free educational courses on big data, artificial intelligence (AI) and internet of things (IoTs) for young jobseekers (2017).

iv. POSCO DAEWOO teamed up with Vision Care to provide free medical services to 1,800 eye patients in Uzbekistan. Nearly 10,000 people have benefited from the program since 2014.

v. POSCO DAEWOO helps children with facial deformations in Myanmar, with 140 children treated in the annual "Smile for Children" event with Seoul National University Bundang Hospital since 2015.

As described in the EIS, and in keeping with this commitment to positive social contribution, Hume Coal established the charitable foundation.

27.3.2 Foreign ownership

Concerns were also raised regarding the foreign ownership of POSCO/Hume Coal, contending this means there will be no benefit to the local or broader NSW community from the project.

The economic assessment clearly demonstrates that, with the foreign ownership of the applicant taken into account as is required by the NSW guidelines (2015), there will be a significant net benefit of the project to both the state of NSW and the local community.

As reported in Chapter 20 (economics) of this RTS report, the net benefit of the project of $295 million will go entirely to NSW households. Included in this estimate is the share of any corporate taxes paid in Australia that can be attributed to NSW. Australia has a strict regime governing foreign investment in Australia which is overseen by the Foreign Investment Review Board. The operation of the Board, together with relevant State planning regulations are designed to ensure that foreign owned projects operating in Australia contribute a net benefit to Australians.

To date, Hume Coal has spent approximately $185,000,000 on the development of the project, utilised the services of over 100 local business, and contributed over $1,000,000 in sponsorships and community initiatives.

The company currently employs 10 full time employees and has renovated several farm cottages which has allowed for families to occupy the company owned properties.

27.3.3 South Korean Energy Policy

It was claimed that the president in South Korea has shown strong policy reform to permanently lower Korea's reliance on imported coal amid increasing concerns about emissions and pollution. It was therefore claimed that the Hume Coal Project is inconsistent with this policy position.

It was also claimed that given the contribution POSCO makes to South Korea's greenhouse gas emissions, the company has previously announced it would spend $44.1 million combating its emissions. Again, the project is inconsistent with this announcement.

The primary product of the Hume Coal Project will be metallurgical coal used in the production of steel. Although there will be a secondary thermal product, the proposed mine will not be solely reliant on the energy coal market, and as such any drastic changes to South Korean energy policy will not significantly impact the Hume Coal Project.

South Korea's current energy mix is made up of coal (45%), nuclear (30%), liquefied natural gas (17%) and renewables (6%). While South Korea plans to increase its electricity generation from renewable sources to 20 per cent by 2030, the nation's electricity demand continues to grow by 1.3 per cent annually, and will continue to be underpinned by its baseload coal fired and nuclear power generators[49].

Furthermore, South Korea has installed of over 19,000 MW of coal fired power generation since 2006, with the majority completed in the last few years, as illustrated in Figure 27.1.

49 https://www.reuters.com/article/us-southkorea-energy-policy/south-korea-plans-shift-to-renewables-but-coal-nuclear-to-remain-strong-idUSKBN1E80FZ]

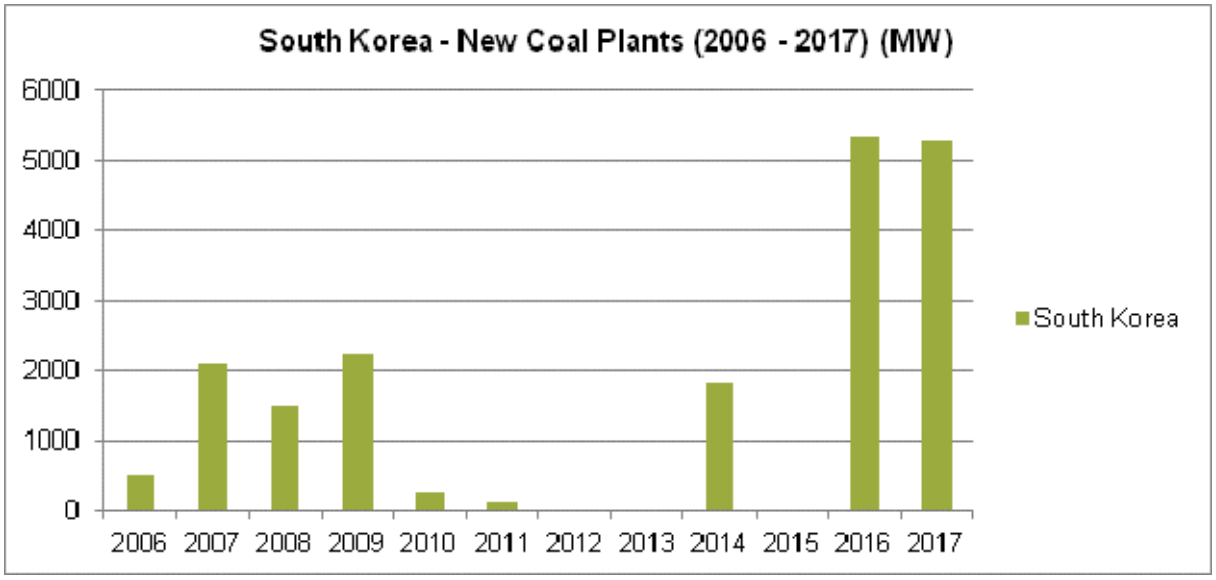


Figure 27.1 New coal fired power stations constructed in South Korea (2006-2017) (Source: Global Coal Plant Tracker)

27.4 Hume Coal

Claims were also made in a number of community submissions regarding Hume Coal and its approach to the project and the local community. Claims included:

i. The use of aggressive tactics to gain entry to properties and intimidating behaviour towards local residents.

ii. A lack of transparency in the information provided about the project. It was contended that Hume Coal has been selective and inconsistent in the information shared with the community.

iii. Purchasing practices: it was contended that Hume Coal cannot be trusted due to past actions involving purchasing large farming properties under a different company name.

iv. Hume Coal initially reassured the community at their information sessions that coal would not be used for thermal energy. The EIS states that in fact both thermal and coking coal will be produced.

v. Hume Coal has been seen as bribing and dividing local charities and sporting organisations with promises of financial support.

i. Hume Coal's approach to land access involved initially writing to the identified landowners to commence discussions about negotiating access to their property for the exploration program. While Hume Coal's preference was to prefer to come to an agreement mutually, in some instances the NSW *Mining Act 1992* does allow for an arbitrator to be appointed to facilitate a mutual agreement, including terms of access and compensation. At all times, Hume Coal operated in accordance with the requirements of Authorisation 349, the Review of Environmental Factors prepared for the exploration program and the relevant requirements of the *Mining Act 1992*.

ii. As with any Greenfield project, throughout the pre-feasibility stage and preparation of the environmental assessment of the project, as further information was obtained from the results of baseline monitoring and technical investigations, the project design was amended, updated and improved. Hume Coal continued to communicate the progress of the project with the community through tools such as the local media, Water Advisory Group, Social Reference Group, and open days. Hume Coal held six community information sessions upon the publication of the preliminary environmental assessment, as well as open days and community events prior to and during the 90 day exhibition period of the environmental impact statement. In 2016, Hume Coal also established its social media presence, which presented further opportunities to engage and communicate with those interested in the project. Further detail on the extensive community consultation undertaken is provided in Chapter 7of this RTS report.

iii. As a large multinational business, POSCO operates a number of different entities associated with various different business units. This is not unusual for a large organisation such as POSCO. Purchasing properties under one of POSCO's entities (other than Hume Coal) was not an act to deceive, but based on decisions relating to the structure of the business in Australia.

iv. Early results of exploration drilling indicated that the resource was predominantly a coking coal product. Hume Coal therefore explained this in early communications to the community about the project, based on the best information available on the coal quality at the time. However, as further detailed exploration drilling was conducted as part of the mine planning process and the resource was further defined, it became apparent that some of the coal within the mine plan is a thermal product. The relevant assessments in the EIS were therefore conducted on that basis (such as the greenhouse gas assessment).

v. The Hume Coal Community Investment Program consists of the Charitable Foundation and Apprenticeship program. It has been a successful program and supportive of local sporting groups, community organisations and individuals. All funding decisions are decided by the Directors of the foundation, three of whom are local members of the community. The policy is approach based only, and all eligible applicants must reside in the Wingecarribee LGA. In 2017, Hume Coal joined forces with the University of Wollongong to offer three scholarships per annum to students in a number of study areas including engineering, environmental science and business. Hume Coal has supported organisations that have applied directly to the company for sponsorship and funding, and has not offered unsolicited financial assistance to individuals, community groups or organisations.

27.5 Bushfire risk

A number of submissions raised concerns about potential risks associated with bushfires. Claims include:

- there is potential for the coal stockpiles to catch fire, leading to an increased bushfire risk;
- the project will increase the risk of bushfires through the use of explosives; and
- airborne coal dust from stockpiles may pose a significant fire hazard during extreme and catastrophic fire conditions.

As a landholder, Hume Coal is bound to comply with the requirements of the *NSW Rural Fires Act 1997*. Bushfire risk was considered and assessed in the EIS; both the risk that a bushfire could damage project infrastructure, and the potential for project-related activities to ignite a bushfire. Notably, as reported in the Hume Coal Project EIS (in Section 18.6.1), no surface infrastructure area is proposed on bushfire prone land. Notwithstanding, a bushfire management plan will be prepared by Hume Coal that will contain measures to minimise the risk of a bushfire damaging project-related infrastructure, or the project initiating a bushfire.

The bushfire assessment considered potential sources of ignition of a bushfire, identifying that a fire or explosion in the surface infrastructure area or CPP could start a bushfire. The risk of this occurring will be reduced by implementation of the following measures:

- vehicle refuelling will be confined to designated refuelling bays (there will not be any vegetation in these areas);
- fire extinguishers will be provided in buildings, vehicles and refuelling areas;
- no smoking in the project area; and
- spill response kits will be available should there be a spill of flammable substances.

In addition, the severity of fires will be reduced by implementing the following:

- a bushfire management plan will be prepared and implemented as part of the mine's operating procedures;
- risk reduction, such as slashing, will be undertaken where appropriate, such as along fence-lines; and
- the RFS will be contacted if there is a fire.

The specific bushfire risks raised in the submissions are addressed below. It is also noted that Hume Coal has provided support to the Berrima Rural Fire Service by donating equipment to help the volunteers undertake their work more efficiently and effectively when responding to an emergency situation. Items donated include a backpack blower and specialised fire fighting nozzle.

i Fire in the coal stockpiles

A fire in a coal stockpile can start as a result of spontaneous combustion. However, in the case of the Hume Coal Project, the risk of spontaneous combustion is very low. The spontaneous combustion potential of the coal in the project area was assessed using samples from the seam, roof and floor, including using the SponComSIM test conducted by CB3 Mine Services Pty Ltd. These tests demonstrated that the coal is typical of the Wongawilli Seam and South Coast coals and has a low potential for spontaneous combustion. To date, there have not been any recorded incidents of spontaneous combustion in South Coast mines (Ramboll Environ 2017a).

Notwithstanding, and as reported in Chapter 12 of the EIS, Hume Coal will manage the potential risk of spontaneous combustion through the implementation of the following measures, as appropriate:

- undertake a spontaneous combustion risk assessment for coal and rejects and develop and implement a Spontaneous Combustion Management Plan if deemed necessary;
- undertake continuous real-time monitoring of ventilation air for the presence of the products of combustion; and
- stockpile management in accordance with good practice.

ii Use of explosives

Given the underground nature of the project the use of explosives will be limited. Minor blast activity will be required for personnel material portal, drift portal and ventilation shaft construction. Their use will be short term and minimal during the construction period. A hazard and risk assessment of the use of explosives was carried in accordance with the DP&E's qualitative risk assessment criteria in *Hazardous Industry Planning Advisory Paper No 4: Risk Criteria for Land Use Safety Planning* (DoP 2011b).

During the construction phase, up to 5 tonnes of detonators and packaged emulsion explosives will be stored separately on-site for use during construction of the drifts and shaft pre-sink. During operations, up to 400 kg of packaged emulsion explosives with electric detonators may be stored on-site to assist with excavation on the infrequent occasions where mechanical mining is not practical.

The explosives storage will be designed and constructed in accordance with *Australian Standard 2187.1 - 1998 Explosives – Storage, Transport and Use: Storage.* Ammonium nitrate will be stored in a low sensitivity state (ie without impurities or additives) and separate to initiating explosives.

The potentially hazardous buffer zone for 5 t of explosives is 240 m and for 400 kg of explosives is up to 150 m assuming no public access is allowed in the buffer zone (Figure 27.2). The explosives storage will be approximately 290 m from the nearest boundary of Hume owned land. These distances are outside the potentially hazardous region.

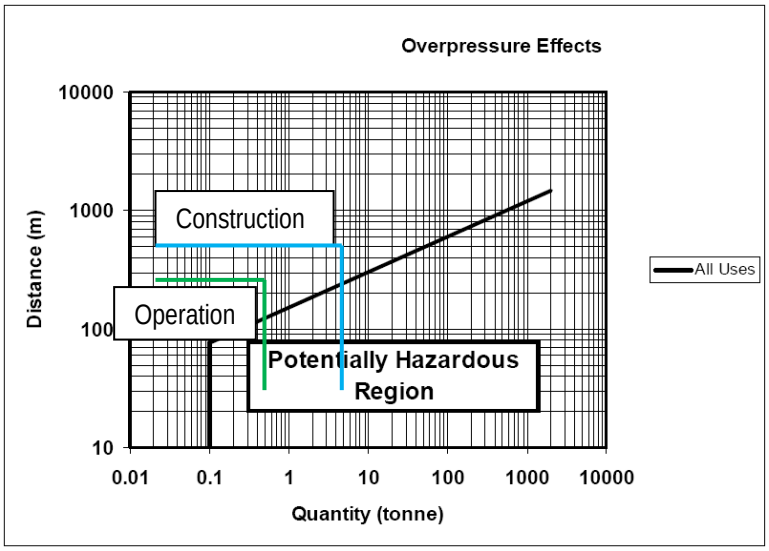


Figure 27.2 SEPP 33 criteria for Class 1.1 explosives (DoP 2011b)

Given the limited use of explosives required, their storage in accordance with the relevant Australian Standard, and that the storage and use will be such that the development is not deemed potentially hazardous or offensive in accordance with SEPP 33, the use and storage of explosives will not lead to an increase in bushfire risk.

iii Air borne dust

Risks associated with coal dust were also assessed in the hazard and risk assessment completed for the EIS (refer to Chapter 18), and specifically whether there is an increased risk of a coal dust explosion underground or at the CPP.

Appendix 3 of DoP (2011b) lists industries that may be potentially hazardous, which includes coal handling due to the potential for coal dust explosions to occur. The main potential initiators of a coal dust explosion in an underground coal mines are a methane explosion or detonation of explosives. Due to the following factors, a coal dust explosion is unlikely:

- An effective ventilation system will be in operation so that excessive amounts of coal dust do not accrue.
- The Wongawilli Seam, which is proposed to be mined, has a low gas content (typically less than 0.5 m3/t).
- Explosives will be used sparingly in controlled circumstances and only involve minor amounts.

Procedures for use of explosives underground typically involve the liberal application of stone dust (an explosion suppressant dust) in the immediate area beforehand. Furthermore, the regular application of stone dust to all accessible areas of the mine is a statutory requirement, along with regular sampling of coal dust and stone dust concentrations throughout the mine, to provide for reapplication of stone dust before the coal dust can reach potentially explosive concentrations. These measures in combination mean a coal dust explosion is extremely unlikely to occur.

Furthermore, the exits of the personnel and materials drift and conveyor drift will face north, away from the Hume Highway to the east and private property to the west, so that any blast from an uncontrolled underground explosion, should one make it to the surface, would be directed away from publicly accessible areas.

The risk of a coal dust explosion related to handling of coal in the CPP is very unlikely as coal is not proposed to be pulverised at the CPP. Therefore, handling of coal will not qualify the project as a potentially hazardous or offensive development.

It follows therefore that airborne coal dust from stockpiles does not pose a significant fire hazard.

27.6 Transition to renewable energy

A number of respondents argued that the Australian and NSW Governments should be focusing on renewable energy projects rather than coal.

Support for the renewable energy sector is recognised. The use of renewable energy sources continues to rise, and is anticipated to become the number one source of power generation in the mid-2020s (International Energy Agency (IEA) 2017). However, growth in the use of fossil fuels, including coal (US Energy Information Administration 2011, IEA 2017) is also predicted. Australia is well placed to meet increasing global energy demand (Australian Bureau of Agricultural & Resource Economics & Sciences 2011) and capture the associated economic benefits. The Hume Coal Project will be developed in response to demand for the high quality coal that it will produce, for both steel making and thermal uses.

Australia will continue to rely on a diverse energy mix to meet its energy needs. There is no evidence to suggest that the Hume Coal Project will impede use or investment in other energy sources; rather it will contribute in meeting the increasing demand for coking and thermal coal sources. The long term outlook for coal demand is discussed in the response below.

27.7 Demand for coal and the economic sustainability of coal mining

Community, interest group and business respondents' stated concerns and objections on the basis that, more broadly, coal mining is not economically sustainable, particularly in light of the need to arrest carbon emissions to combat climate change, and decreases in global demand for coal. Specific matters raised in submissions included:

i. there is significant uncertainty around longer term market demand for coal and energy policy changes; The current weak international market for coal has caused mine closures in Australia and puts into doubt the economic sustainability of the project;

ii. demand and price forecasts for metallurgical coal (published by the Australian Department of Industry, Innovation and Science in its publication Resources and Energy Quarterly) are weak for internationally traded metallurgical coal, which imposes medium term financial risk for the project, potentially undermining the economic viability of the project.

iii. development of new mines will undercut the profit margins of existing mines, further reducing coal prices and affecting the sustainability of the coal industry at a local and national level;

iv. at a local level, the Southern Highlands region would become dependent on a declining industry, with the risk that it will fail in the future and compromise the other industries on which the region currently depends; and

v. the use of coal is an 'old' technology. It was contended that coal fired power stations are being closed down, and that there are no further plans to build power stations in Australia.

i Longer term market demand for coal

The *World Energy Outlook: Coal* (International Energy Agency 2017) was released in November 2017. This outlook investigated a number of scenarios in relation to coal demand, incorporating various energy policy possibilities.

The outlook predicts that export-oriented coal producers such as Australia will continue to expand their coking coal production over the next 25 years, primarily targeting rapidly growing steel producers like India. In India, coal imports are forecast to resume growing from the early 2020s, and increase through to 2040. India will therefore become the world's largest importer, with an anticipated demand for imported coal of over 235 Mtce in 2040, a 45 per cent rise on 2016 import levels. Three-quarters of this increase in imports will be from coking coal. Similarly, fast growing and price sensitive economies like Vietnam, Pakistan, Malaysia, Thailand, the Philippines and Pakistan will increasingly turn to coal imports to meet their energy needs.

For thermal coal, whilst coal's share of world power output is predicted to fall from 37 per cent today to about 25 per cent in 2040 as the use of renewables continues to rise, electricity generation from coal is predicted to rise by some 10 per cent through 2040 to meet increasing power demand.

The predictions produced by the International Energy Agency (2017) do not therefore support the claims in the submissions that demand for coal is weakening.

ii Coal price forecast

The coal price forecasts used in the economic assessment were consensus estimates of the long run coal prices for relevant coal qualities (BAE 2017). As described above, demand for metallurgical coal is not weak, and to the contrary continues to rise.

iii 'Undercutting' and the sustainability of the coal industry

Australia is one of the world's largest coal producers. In 2015-2016 Australia exported over 180 Mt of metallurgical coal and approximately 200 Mt of thermal coal[50]. Given the scale of the industry, it is evident that the production of up to 3.5 Mtpa of coal per year will not affect the sustainability of the coal industry in NSW or more broadly in Australia.

iv Reliance on coal

The Southern Highlands has a mixed economy which is therefore not reliant on any one industry in particular. As discussed in Chapter 21, the significant employers in the region comprise a broad range of industries, including health care and social assistance, retail and trade, tourism, manufacturing, and education and training (JSA 2017a). The Hume Coal Project will add to this diverse economy. According to the 2016 census, the population of the Wingecarribee LGA is around 47,882. Whilst the 300 FTE jobs that the mine will generate is a considerable benefit of the project, due to the size of the population and the varied economy that already exists, the Hume Coal Project will in no way result in the area becoming 'reliant' on the mining industry.

v 'Old technology'

As noted above in response (i), the IEA (2017) *World Energy Outlook: Coal* predicts that electricity generation from coal will rise by some 10 per cent through to 2040. Interestingly, coal burn in the power sector is anticipated to remain about the same, a clear sign that the world's coal fleet is anticipated (and is) becoming more efficient. 75 per cent of the 880 GW of new coal plant entering into service over the next 25 years is predicted to use either supercritical (440 GW) or ultra-supercritical technology (235 GW), bringing down the share of the less efficient subcritical plants in the global coal fleet from over 60 per cent in 2016 to less than 40 per cent in 2040. As described above in Section 27.3.3, South Korea has added over 19,000 MW of coal fired power capacity in the last decade, with over 5,000MW of coal fired capacity added in 2017. So whilst older power stations may be closing down, new, more efficient plants are being built to meet demand.

50 https://industry.gov.au/resource/Mining/AustralianMineralCommodities/Documents/Australias-major-export-commodities-coal-fact-sheet.pdf

Part D

Summary of commitments and project evaluation

Chapter 28: Updated summary of commitments
Chapter 29: Project evaluation and conclusion

28 Revised summary of commitments

28.1 Overview

Chapter 23 of the Hume Coal Project EIS (EMM 2017a) and Chapter 17 of the Berrima Rail Project EIS (EMM 2017b) provide a summary of the management and mitigation measures that will be implemented during the construction, operation and decommissioning phases of each project to avoid, manage, mitigate and/or monitor potential impacts identified within the EIS.

Additional work has been undertaken by the Hume Coal Project team and technical specialists as part of the RTS process to respond to the submissions received and questions raised by peer reviewers, particularly in the areas of groundwater and the mine design.

The overall outcome is that no changes to the Hume Coal Project or the Berrima Rail Project to that described in the EIS, are proposed. The project description as described in Chapter 2 of the Hume Coal Project and Chapter 2 of the Berrima Rail Project EIS remains an accurate description of each project, as does the project evaluation and justification.

Consequently, there are minimal changes to the mitigation and management measures proposed. The summary of commitments, mitigation and management measures, as presented in each EIS, are reproduced in the sub-sections below, with the minimal changes highlighted in grey.

28.2 Hume Coal Project

A summary of the key management and mitigation measures for addressing the potential residual environmental impacts of the Hume Coal Project is provided in this section. The construction and operation of the project will be generally in accordance with the management and mitigation measures outlined in Table 28.1. A summary of the key commitments as outlined in the EIS are presented in Table 28.2.

Table 28.1 Summary of management and mitigation measures – Hume Coal Project

Water resources
• Monitoring data will be collected from a surface water and groundwater monitoring network, as described in the water management plan. This network may be expanded or amended, pending outcomes of ongoing data review. • If analysis of monitoring results shows that the potential impacts as described in Chapter 5 of the RTS (and in Appendix 2 Revised Water Assessment) occur, the corresponding management measures will be implemented. The groundwater model will be validated regularly. Significant deviations from the predicted impacts will be investigated, and results reported in the Annual Review.
Soil and land resources
Erosion and sediment control • During construction, sediment dams will be constructed generally in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1 4th Edition* (Landcom 2004) and *Managing Urban Stormwater Volume 2E: Mines and Quarries* (DECC 2008). *Topsoil* • Disturbance areas will generally be stripped (refer to Table 7.3 of Appendix F of the EIS), except for soil stockpiling areas and areas of minimal disturbance. *Topsoil stripping procedures* • Topsoil will be stripped, stockpiled and stored in accordance with the procedures outlined in the CEMP. *Topsoil application* • During rehabilitation works, topsoil will be re-applied to achieve the land capability classes specified in Chapter 8 and illustrated in Figure 8.4 where feasible.

Table 28.1 Summary of management and mitigation measures – Hume Coal Project

Agricultural resources
• Management plans relevant to agriculture will include the water management plan (including sub-plans), subsidence management plan, biodiversity management plan, bushfire management plan and rehabilitation management plan. • Relevant management plans will include monitoring programs for assessing impacts of the project on agricultural resources and, where appropriate, establishment of triggers and their appropriate responses.
Biodiversity
• Vegetation clearing will be undertaken in accordance with a two-stage tree clearing procedure, as outlined in the CEMP. • The required waterway crossings and culverts will be designed and constructed generally in accordance with the guidelines entitled *'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings'* (Fairfull and Witheridge 2003), *Policy and Guidelines for fish habitat conservation and management* (DPI 2013b) and *Guidelines for watercourse crossings on waterfront land (NOW 2012c)*. • Hume Coal will prepare a Biodiversity Offset Package in consultation with OEH and DPE, and will submit the draft to the Secretary for approval within 12 months of development consent being granted.
Noise
• Noise and vibration will be managed during construction and operation in accordance with the relevant measures in the CEMP and OEMP respectively. • A noise management plan will be developed as part of the OEMP, which will: o identify noise-affected properties consistent with the noise and vibration assessment and any subsequent assessments; o outline mitigation measures to achieve the noise limits established; o outline measures to reduce the impact of intermittent, low frequency and tonal noise where practicable; o specify measures to quantify, document and ameliorate impacts that are greater than predicted, if they occur; o specify protocols for routine, regular attended and unattended noise monitoring of the project, including provision for regular low-frequency noise monitoring; o outline the procedure to notify property owners and occupiers that could be unduly affected by noise from the mine; o establish a protocol to handle noise complaints that includes recording, reporting and acting on complaints; and o specify procedures for undertaking independent noise investigations.
Air quality monitoring
• Air quality will be managed during construction and operation in accordance with the relevant measures in the CEMP and OEMP respectively. • An air quality management plan will be developed as part of the OEMP, which will include a description of monitoring locations, monitoring methods and reporting responsibilities. • Real-time air quality and meteorological monitoring will be undertaken during construction and operations, at locations which are adjacent to the majority of the surface infrastructure, as described in the air quality management plan. • Ventilation shaft emissions will be measured once the project is at full operation to verify the assumptions used in modelling.
Subsidence
General surface monitoring for verification purposes will be undertaken, as outlined in Appendix 2 of the RTS.
Traffic and transport
A construction traffic management plan will be prepared and implemented if temporary construction stage access is required for any project worksite not on Mereworth Road.
Hazard and risk
Bushfire A bushfire management plan will be prepared in consultation with the RFS and will contain measures to manage and mitigate bushfire risks and prevent ignition and spread of fire during operation of the project. *Dangerous goods* Measures to manage and mitigate hazards and risks during construction and operation of the project will be outlined in the OEMP, including identification of the relevant Australian standards for the transport, handling and storage of dangerous goods used at the mine. A social impact management plan will be prepared and implemented which will document actions to be undertaken during the construction, operation, and closure phases of the project to monitor, report, evaluate, review and proactively respond to social change. It will also contain responsibilities of various parties in relation to the management of social impacts.

Table 28.1 Summary of management and mitigation measures – Hume Coal Project

Aboriginal heritage
An Aboriginal cultural heritage management plan will be prepared in consultation with the RAPs and OEH, which will detail management of Aboriginal heritage items during construction and operation of the project generally in accordance with the measures outlined in Chapter 21 and Appendix S of the EIS.
Management of newly identified site HC_181
Newly recorded Aboriginal grinding groove site HC_181 will also be subject to subsidence monitoring in order to be consistent with the management measures proposed for sandstone type sites of moderate significance elsewhere above the underground mining footprint, as outlined in Section 11.2.7 of the Hume Coal Project ACHA (EMM 2017d, p.190).
Transfer of objects and care agreement
The final location of the proposed keeping place for Aboriginal objects recovered as part of investigation and salvage measures will be determined in consultation with the RAPs as part of the preparation of the AHMP. The objects already recovered from test excavation will remain secure in the EMM office during the interim.
Historic heritage
A historic heritage management plan will be prepared in consultation with DPE and the Heritage Division, and will describe the measures to manage and mitigate historic heritage impacts during construction and operation of the project.
As part of the historic heritage management plan, a conservation management plan for Mereworth house and garden will be prepared and implemented.

The Hume Coal Project will be undertaken in accordance with the key commitments summarised in Table 23.2.

Table 28.2 Summary of commitments – Hume Coal Project

Commitment
Water resources
• Impacts greater than the minimal AIP impact criteria will be subject to make good provisions. The make good provisions proposed are described in Appendix M of the Revised Water Assessment Report (refer to Appendix 2 of the RTS). Hume Coal will make reasonable endeavours to negotiate make good strategies, in accordance with the measures documented in the make good report, with each of the affected landowners prior to any project-related impact occurring which exceeds the AIP minimal impact criteria.
• The make good strategies will be determined on a case by case basis, and will be dependent on the existing infrastructure, usage patterns, water licence allocation and the degree of impact at each site, and the landowner's preferred method of mitigation or compensation, within reasonable limits.
Groundwater model validation
• The groundwater model will be validated regularly. Significant deviations from the predicted impacts will be investigated, and results reported in the Annual Review. Model recalibration will be considered every two years or as required, pending the outcomes of model validation over time as physical monitoring data is incorporated.
Water balance model validation
• The water balance model will be validated regularly. Significant deviations from the predicted impacts will be investigated, and results reported in the Annual Review.
Water quality
• Vegetation protection zones will be implemented within the project area on the Evandale and Mereworth properties.
Biodiversity
Construction
• A ground disturbance permit system will be developed that will be implemented for all clearing activities.
• The boundaries of vegetation to be cleared will be clearly delineated.
• A pre-clearance survey will be completed by a suitably qualified and trained ecologist to identify and mark hollow-bearing trees, hollow logs, burrows and nests that require management during clearing.
• All Paddys River Box trees in the construction disturbance footprint will be identified and clearly marked or fenced.
• Hollow-bearing trees removed will be replaced with salvaged hollows or nest boxes, which will be placed in general proximity to the removed hollow-bearing tree where possible.

Table 28.2 Summary of commitments – Hume Coal Project

Commitment
Operations
• The surface infrastructure area will be managed for weeds.
• Fencing will be maintained to separate the CPP from adjacent grazing areas and threatened species habitat along Oldbury Creek.
• Terrestrial vegetation along Belanglo Creek and south of Wells Creek will be monitored during extended periods of drought. An appropriate response will be determined if the condition of the EEC is observed to be in decline and the decline is attributable to Hume Coal operations.
Noise and vibration
Construction
• Construction noise levels will be monitored to validate the predicted construction noise levels, and subsequently re-evaluate the predicted construction noise levels at assessment locations if required.
• Where required, noise management and mitigation measures will be amended to reduce noise levels below the NMLs.
• Affected landholders will be consulted where possible before and during construction where exceedance of NMLs are predicted, and will be notified of proposed mitigation measures that will be used to manage construction noise levels to below ICNG NMLs.
• If the safe working distances in Section 11.4.8 of the EIS are encroached, vibration monitoring will be carried out at nearby structures.
Operations
The following noise mitigation measures will be implemented:
• Low-noise conveyor idlers will be used on open sided surface conveyors to minimise conveyor noise impacts.
• The CPP building, conveyor transfer stations, crushing plant, tertiary screens and the paste plant will be enclosed to minimise noise and dust impacts.
• Low noise conveyor drives or enclosures will be used for surface conveyors.
• The CPP design will include the use of VVVF drives to minimise the potential for low-frequency noise.
• Silencers will be used on the main ventilation fans to minimise noise impacts.
• Dozer operation will be limited to the day-time only.
Air quality and greenhouse gas
• The CPP building, conveyor transfer stations, crushing plant and tertiary screens will be enclosed to minimise noise and dust impacts.
• Product stockpiles will be orientated parallel to the prevailing westerly wind as much as possible to minimise potential for dust generation.
• Once sufficient room is available in the mined-out voids, rejects will be emplaced underground to remove the need for a permanent surface reject emplacement.
• Coal stockpiles will be designed using stackers and reclaimers to avoid the need to use dozers.
• Water sprays will be fitted to the ROM and product stockpiles and the temporary reject storage area to maintain surface moisture levels. Water spray intensity will be adjusted in real-time based on meteorological observations.
The following measures will be implemented to reduce GHG emissions from the project:
• materials will be sourced locally where feasible to minimise emissions generated from upstream activities;
• energy efficient lighting technologies and hot water and air conditioning systems will be used wherever practical;and
• awareness on energy efficiency measures will be included in site induction training packages.
Traffic
Construction
• The cross-section of Mereworth Road will be widened and upgraded to an appropriate standard for the anticipated peak hour and daily traffic volumes the project will generate, with marked road centre and edge lines and gravel road shoulders.
• The non-local component of the construction workforce will be housed in the onsite accommodation village to mitigate project-related traffic impacts during the construction phase.

Table 28.2 Summary of commitments – Hume Coal Project

Commitment
Operations
• The current intersection priority at the Mereworth Road/Hume Highway northbound off-ramp intersection will be reconfigured to realign the future traffic priority to Mereworth Road. This will change the priority at this intersection to a standard 'T' intersection with through-traffic priority, rather than the current right turn priority.
• Oversize vehicle routes will be determined in consultation with RMS on a case by case and in accordance with RMS policy for oversize vehicle movements.
Visual amenity
The tree screens already planted at relevant locations around the project area will be maintained throughout the construction and operational phases of the project as required.
Lighting
The following measures in Australia Standard 4282 (AS4282) *Control of Obtrusive Effects of Outdoor Lighting* will be implemented:
• Mobile lighting will generally be directed away from private receptors.
• Lighting sources will generally be angled below the horizontal to minimise potential light spill.
• Light systems will be designed to minimise wastage.
• Lighting will be screened from viewers external to the project where possible.
• Light coloured (highly reflective) surfaces will not be lit where possible.
Building colours
• Suitable colours will be chosen for project infrastructure during detailed design to minimise visual impacts.
Closure and rehabilitation
The overarching rehabilitation objective of the project is to restore the land to its pre-mining land use; that is, an agricultural land use comprising grazing on improved pasture.
Within five years prior to mine closure, Hume Coal will prepare a detailed mine closure plan with the aim of creating a land use capability compatible with the pre-mining agricultural land use (unless other beneficial uses are pre-determined and agreed).
Hazard and risk
Bushfire
• Vehicle refuelling will be confined to designated refuelling bays (where practicable).
• Fire extinguishers will be provided in buildings, vehicles and refuelling areas.
• Spill response kits will be available.
• Firefighting water reticulation with diesel pump backup will be provided to surface infrastructure facilities, including coal stockpiles.
Social
Population and demographics
• A construction accommodation village will be constructed and operated to accommodate non-local construction workers for the construction phase of the project.
Labour market
• Where possible, preference will be given to local workers and firms for employment opportunities.
• Local contractors will be encouraged to tender for work during the construction, operations and closure phases.
• Training and professional development opportunities will be provided for employees.
Economic change
• Hume Coal will maximise local business opportunities by giving preference to local suppliers where reliability, quality and financial competitiveness criteria can be satisfied.

28.3 Berrima Rail Project

A summary of the key management and mitigation measures for addressing the potential residual environmental impacts of the Berrima Rail Project is provided in Table 28.3.

Table 28.3 Summary of commitments – Berrima Rail Project

Commitment
Noise and vibration
Construction
• Noise and vibration will be managed in accordance with the relevant measures outlined in the CEMP.
• Construction noise levels will be monitored at early stages to validate the predicted construction noise levels, and subsequently re-evaluate the predicted construction noise levels at assessment locations.
• Affected landholders will be consulted prior to and during construction where exceedance of NMLs have been predicted, and will be notified of proposed mitigation measures that will be used to manage construction noise levels. Notification procedures will be documented in the CEMP.
Operation
• Operation of the rail line will be in accordance with management measures documented in a noise management plan, to be prepared for the project.
• Use by Hume Coal of the latest generation (at the time of development consent) AC locomotives and wagons with electronically controlled pneumatic brakes.
• Construction of a noise attenuation barrier to the north of the rail loop and a shed at the northern provisioning point.
Air Quality
• All Hume Coal train coal wagons (full and empty) will be covered during transport.
• Air quality will be managed during construction in accordance with the procedures documented in the CEMP.
Traffic and transport
• An improved intersection incorporating turning lane and shoulder widening on both sides of the Old Hume Highway will be constructed to provide safe left and right turning vehicle access to the rail infrastructure worksites on either side of the Old Hume Highway.
• For longer term operations access, the initial temporary turning lane and shoulder widening of the Old Hume Highway will be reconfigured to provide a type CHR(S) intersection for access to the rail maintenance sidings.
Aboriginal heritage
• The grinding groove site (HC_138) adjacent to the rail loop footprint will be fenced and signage erected for the duration of the project.
• Two sites (HC_176 and HC_177) and will be subject to archaeological excavation. Subsequent assessment will be made as to whether avoidance of the surrounding landscape around these sites (currently identified as PAD) is required.
• An Aboriginal Heritage Management Plan will be prepared and implemented for the project, including: o procedures that will apply in the event that known or suspected human skeletal remains are encountered during construction; o procedures that will apply in the event of discovery of new Aboriginal sites in the project area; and o identified Aboriginal artefacts in the project direct footprint will be managed generally in accordance with the management measures outlined in the EIS, subject to consultation with the RAPs.
• *Management of archaeological resource at alternate rail option* o If the alternative rail option of the Berrima Rail Project is pursued for development, test excavation will be completed within the proposed disturbance footprint. Salvage excavation may continue subsequent to test excavation, but is dependent on the outcomes of the test excavation in accordance with the method outlined in Section 7.4.5 of the Berrima Rail Project ACHA (EMM 2017q).
Historic heritage
• Archival recording of heritage items identified in the EIS in the area prior to change will be undertaken.
• The Remembrance Driveway trees will be avoided during construction works. These trees will be fenced and clearly identified.
• Historic heritage items will be managed in accordance with the procedures documented in the CEMP.

Table 28.3 Summary of commitments – Berrima Rail Project

Commitment
• The Southern Highlands Branch of the Australian Garden History Society will be consulted regarding the trees to be removed in the Boral cement garden prior to construction works commencing in the garden.
Biodiversity
• Biodiversity will be managed generally in accordance with the measures outlined in the EIS and CEMP.
• Appropriate weed management control measures will be implemented during the construction phase of the project.
• Paddy's River Box trees in the project construction footprint will be identified and marked for their protection during construction, except for the one tree to be removed under the preferred option.
• Appropriate drainage infrastructure (such as culverts) will be installed within the rail loop embankment to ensure that existing overland flow paths through the rail loop area are maintained throughout the life of the project to Paddy's River Box inside the rail loop.
• Hume Coal will prepare a Biodiversity Offset Package in consultation with OEH and DPE, and will submit the draft to the Secretary for approval within 12 months of development consent being granted.
Flooding and drainage
• An erosion and sedimentation control plan, developed in accordance with the guidance provided in *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, and Volume 2E Mines and Quarries* (the Blue Book) (Landcom 2004), will be prepared and implemented as part of the CEMP to ensure the erosion and sedimentation induced by construction activities will not adversely affect the surrounding environment.
Soils and land resources
• The CEMP will detail the soil stripping, stockpiling and reapplication procedures so that rehabilitated surfaces are capable of supporting grazing.
Visual
The following measures will be implemented to mitigate visual impacts of the project: • appropriate colour selection for the noise wall, buildings and sheds; • minimisation of night lighting at the rail maintenance facility in accordance with the relevant Australian Standards; and • once established, an effective tree screen will be maintained along Medway Road and the Hume Highway as described in the EIS.

29 Project evaluation and conclusion

29.1 Overview

This RTS report responds to submissions received on the Hume Coal Project and the Berrima Rail Project, following public exhibition of the EIS for each project.

The submissions received by Hume Coal in response to the two EIS's have been reviewed. Reponses to matters raised have been prepared by EMM and the Hume Coal Project team, with input from the relevant technical specialists who undertook assessments for the EIS, as well as some additional specialists engaged in relation to water resources, mine design, tourism and property values.

A total of more than 12,600 submissions were received on the two projects; however 11,241 of these were form letter submissions, objecting to the two projects. Of the submissions received from individual community members on both projects (ie excluding form letter submissions), approximately 31% of the submissions were in support of the Hume Coal and Berrima Rail Projects and 69% objected. When form letters are included, of the total (12,666) submissions received 12,212 objected, and 436 were in support. A further 18 submissions (including 12 from government agencies) provided comment on the two projects.

The most commonly raised issue for the Hume Coal Project related to water resources, and in particular the potential impacts to groundwater and privately owned bores. Impacts to surface water resources were also commonly raised, as well as matters related to the local economy, potential noise impacts, social impacts, and the potential impacts to the tourism industry in the region. General objections to the coal industry in general and climate change related impacts were also broadly raised.

The most common issues raised relating to the Berrima Rail Project were about traffic and transport. The concerns in this regard mostly related to the proposed additional trains and the implications of this increase on waiting times at rail/road crossings. Dust and noise emissions were the next most common technical aspect raised, followed by health, generally also relating to dust and noise emissions.

29.2 Water resources and revised impact assessment

To respond to questions raised in both community and government submissions relating to the potential impacts on groundwater, substantial additional groundwater modelling and impact assessment work has been undertaken.

The additional groundwater modelling was undertaken by HydroSimulations, and included model revision using upgraded software and solvers, a range of additional sensitivity analyses, and a detailed uncertainty analysis. The numerical model was designed in accordance with the Australian Modelling Guidelines (Barnett et. al 2012), and the NSW Government independent peer reviewer, Hugh Middlemis, concluded that the model software, design, extent, grid, boundaries and parameters form a good example of best practice in design and execution.

The outcomes of the updated groundwater model generally provide support to the predictions of water impacts presented in the EIS. The number of privately owned bores that are predicted to experience drawdown as a result of the project by 2 m or more is now 94 (compared with 93 bores reported in the Hume Coal Project EIS) on 72 properties.

Further work has also been undertaken on the make good strategy (included in Appendix 2 of this report), to address the issues and concerns raised in this regard, and to demonstrate that a credible pathway exists to 'make good' each bore that is predicted to be influenced by the project. The strategy outlines the proposed staged approach to the implementation of make good measures.

All bores predicted to experience 2 m or greater drawdown will be subject to 'make good' measures from Hume Coal to account for the potential impacts on these bores. About a third of bores may incur additional operational costs associated with a lower groundwater level and will not require any further measures (ie will not require bore pump intake deepening or replacement). Another third are assessed as potentially needing submersible pump intake depths repositioned for a certain period of time depending on the duration of drawdown. The final third are assessed as potentially requiring bore replacement or an alternative source of supply. Ultimately, consultation will be required on an individual level with each landowner in order to agree on suitable, appropriate and tailored make good measures based on individual circumstances and technical details.

The revised aspects of the surface water assessment demonstrate that the project will meet the Neutral or Beneficial Effect criteria for surface water quality across all aspects of the project.

Hume Coal has already secured 93% of the peak water licence volume required over the life of the project. The current groundwater licences that have been secured by Hume Coal include an allowance for 10% carryover of unused volume. The small amount of residual water licences required by the project will be purchased on the market or via controlled allocation.

29.3 Project justification and evaluation

Extensive work has been undertaken to respond to the submissions received on the Hume Coal Project EIS and the associated Berrima Rail Project EIS, particularly in relation to groundwater and the mine design. The overall outcome is that no major changes to the two projects were required as a result of any of the submissions or the additional groundwater modelling work undertaken. In addition, the peer reviews conducted by the independent expert reviewers on behalf of DPE in the key areas of groundwater, economics, noise and the mine design have resulted in responses and additional work by Hume Coal that have broadly reaffirmed the outcomes of the EIS. Therefore, the description of the project, and the project evaluation and justification, as presented in the EIS, remains a true and accurate reflection of the project for which approval is sought.

Notwithstanding, the justification and evaluation of the Hume Coal Project and Berrima Rail Project is re-presented below.

29.3.1 Significance of the resource

The Southern Coalfield is the only significant source of quality hard metallurgical or coking coal in NSW. Within the project area, coal deposits have been extensively explored and analysed for well over 60 years and particularly since 2011 by Hume Coal. The results show the coal has all the necessary characteristics to meet export coking coal specifications.

The remaining unallocated prime coking coal resources in the Southern Coalfield are in the Bulli and Balgownie Seams underlying the Campbelltown-Camden-Picton region, and in the Wongawilli Seam in the southern part of the coalfield. Further mine development in much of the Campbelltown-Camden-Picton area is constrained by its closeness to existing and planned urban areas. Conversely, the project area is in a rural area and has the substantial advantage of closeness to rail infrastructure that links directly to the Port Kembla coal terminal. The coal project seeks to draw on these positive features.

Other matters that can be used to determine the resource's importance for NSW are: employment generation, expenditure, including capital investment, and royalty payments to the state government. The resource's importance in light of these factors can be summarised as follows:

- Employment generation: at its peak the mine will provide 300 jobs, whilst the rail project will create 16 full time equivalent positions during operations. Although not all of these will be additional because some will replace employment in other industries, the project's job creation effects will still be notable, especially as local residents will fill most operations jobs.

- Expenditure: capital expenditure will be around $860 million and operating expenditure will be around $1.4 billion over the life of the mine.

- Royalties: payments to the NSW government will total around $266 million over the life of the project or $114 million at today's value.

It is evident the project, which will develop a dormant publically owned resource – Wongawilli Seam coal – will be of significant benefit to the local and broader NSW communities.

29.3.2 Economic justification

The Hume Coal Project and Berrima Rail Project are justified economically due to the net economic benefits and the economic stimulus they will provide locally and to NSW, as discussed below.

i Benefits and costs

A project is economically beneficial if its benefits exceed its costs measured in today's values (known as net present value or NPV). The total direct economic benefit of the project for NSW is estimated at $316 million in NPV terms, comprised as follows:

- royalty payments, which are estimated at $114 million in NPV terms;

- net employment benefits being the additional disposable income that NSW residents will receive, as well as the shares of personal and company income taxes that will go to NSW, that is:

    - $134 million of net disposable income benefits;

    - $21 million of the NSW share of personal income taxes;

    - $27 million of the NSW share of company income taxes; and

- incremental payroll taxes, council rates and various levies, amounting to around $20 million.

To determine the net or after cost benefit, costs associated with GHG emissions, and the foregone agricultural value added due to land being removed from agricultural production, estimated at $21 million, need to be deducted, giving a net figure of $295 million.

For the Wingecarribee LGA, the net benefits of the project are expected to amount to approximately $84 million in NPV terms.

Further, train operations on the Berrima Branch Line associated with existing rail users represents 59% of the practical operating capacity of the line, or 38% of the maximum line capacity. The additional Hume Coal trains will increase the line's operations to 77% of the practical operating capacity (50% of the maximum line capacity) on the busiest days. The upgrade to the Berrima Junction will enable this increased use of the existing rail infrastructure, including the ARTC-controlled sections of railway, resulting in a higher financial return from this infrastructure.

ii Economic stimulus

A number of flow-on effects will occur as a result of the project's capital and operating expenditure, and job creation. At the NSW level an additional $73 million in value added, in today's values, will occur. There will also be an average of 62 full-time jobs added in each year of the life of the mine. Locally, at the Wingecarribee LGA level, an additional $44 million in disposal income and an average 34 FTE jobs each year will be added.

29.3.3 Social justification

The project's social impacts have been addressed for all four phases of its development and operations.

The first phase covers planning, feasibility and approvals. During this phase positive social impacts outweigh negative ones. There has been a modest increase in local job opportunities of about 17 positions, and some strengthening of the skills base of the local workforce from Hume's apprenticeship and traineeship programs. Up to $450,000 a year has been spent during the planning and approvals phase on the Hume Coal apprenticeship program and the Hume Coal charitable foundation.

In relation to the potential negative social impacts associated with this initial phase, Chapter 22 (health) of this RTS addresses the generation of stress and anxiety in relation to the project raised in some submissions. Hume Coal acknowledges the extended approval process that has been, and continues to be, undertaken in seeking development consent for the Hume Coal Project, and the long period of uncertainty necessitated by this process. Hume Coal is seeking approval through the required legal process pursuant to the provisions of the EP&A Act and associated regulations and supporting guidelines. Considerable time has been spent analysing baseline monitoring results and preparing detailed technical studies so as to present a robust and comprehensive EIS for consideration by relevant stakeholders and government agencies. This process is unavoidable and is the same process that the proponent of any development requiring consent under the EP&A Act has to go through.

During the construction phase positive impacts will also outweigh negative ones. About 414 FTE positions will be created at the mine when the construction workforce is at its peak (in just under a year from the start), and the rail project will create approximately 40 additional FTE positions. Although this will be generally beneficial, the specialised nature of the jobs means that most will not be filled by locals. The potential adverse impacts associated with the influx of construction workers, such as the crowding out of tourist and other short-term accommodation, will be avoided by building an on-site accommodation village for all construction workers.

The operations phase will be the longest and of greatest consequence. The main benefit will be the provision of about 300 FTE long-term jobs at the mine and 16 associated with rail operations, most of which will be filled by locals, and the economic stimulus which will be injected into the area from greater local expenditure on goods and services. Other benefits will be skills improvements through training and continued investments in community facilities from funding provided by Hume Coal through a VPA or similar mechanism. The residual environmental impacts that have not been able to be avoided will be managed and mitigated to achieve the standards specified by regulators and, as such, none will be unacceptable. Notably, and as discussed above, a detailed make good strategy has been prepared and included in this RTS report (Appendix 2) which demonstrates that a credible pathway exists to 'make good' each bore that is predicted to be influenced by the project. Further discussion on environmental impacts and mitigation measures is provided below.

The final closure and relinquishment phase is the only one where there will be net social costs overall. This outcome will be caused by the loss of jobs and reduced economic activity in the area, although the project will leave a legacy of a more skilled workforce and substantially upgraded community facilities as a result of funding via the VPA or similar mechanism.

In summary, the Hume Coal Project and Berrima Rail Project has social merit. For three of its four phases, there will be significant net positive social outcomes largely due to four management measures: local procurement and workforce recruitment; a social impact management plan to ensure effective implementation; a VPA or similar mechanism; and a construction accommodation village for non-local all workers during construction.

29.3.4 Environmental justification

Great care has gone into planning the Hume Coal Project and Berrima Rail Project so that its design achieves leading practice in most respects. From an environmental perspective, the design avoids most potential environmental impacts. The Hume Coal Project's design has features that exceed the normal practices used in Australian coal mines and go beyond minimum regulatory standards, particularly:

- A low impact underground coal mine that employs a mining method resulting in negligible subsidence. This has the dual benefits of avoiding both surface disturbance and impacts to the groundwater system that are typically associated with underground mining systems that induce caving of the overburden. It thus greatly reduces surface impacts and the volumes of groundwater that would otherwise be intercepted in the active mine workings.
- Progressively sealing panels with bulkheads after extraction and reject backfilling, which allows water to be injected and the early recovery of groundwater levels.
- Rejects will be placed underground, removing the need for a permanent surface emplacement.
- Full and empty coal wagons travelling to and from the mine will be covered.

A summary of the key findings of the environmental assessment is provided in Table 29.1. Hume Coal has committed to implementing appropriate mitigation measures where residual impacts have been identified, so that the residual impacts of the project are all within acceptable criteria, standards and guidelines.

Table 29.1 Summary of environmental impacts

Aspect	Key findings of environmental assessment
Water	• All potential impacts to surface water users and stream environments have been assessed as insignificant in accordance with the *Significant impact guidelines* (DoE 2013). • A temporary 0.8% reduction in the catchment area of Medway Rivulet will occur during the construction and operation phases, where the surface infrastructure area will be located, producing negligible impacts downstream in the substantially larger Lower Wingecarribee Management Zone. • Total releases for the entire 19 year operational mine life from SB03 are expected to be in the range of 112 ML to 277 ML, with a maximum annual release of 31 ML/yr; and 87 ML to 302 ML in SB04, with a maximum annual release of 41 ML/yr. • With constant low flow discharges from the Moss Vale STP, the flow regimes in Medway Rivulet for the existing and operation cases are similar; and alteration of the flow regime in Oldbury Creek during operation of the mine will be minor when compared to pre-mining conditions. • MUSIC modelling assessed the potential impacts of runoff from the two mine access roads outside the water management system. With appropriate vegetated swales and constructed wetlands used as a treatment measure, the neutral or beneficial effect (NorBE) criteria will be met. Potential TSS and nutrient loads and concentrations in Oldbury Creek show releases from stormwater basins will be in accordance with NorBE criteria. • Vegetation protection zones are proposed on the Mereworth and Evandale properties (total protection are of 42.5 ha) to offset potential water quality impacts as a result of baseflow reduction. Clearing, farming and industrial activities (such as roads) will be restricted within these proposed zones. • A minor change in the 100 year ARI flood extents is predicted for the operational phase of the mine compared to the existing situation. Changes in flood extents following mine rehabilitation, compared to the existing situation, are only predicted in the area where SB02 will be located during mine operation. • The flood levels during the operation of the mine are within the assigned assessment criteria, except for a localised flood level of up to 340 mm in Oldbury Creek on land owned by Hume Coal between the PWD and SB02. This flood height has been considered in the design of the surface infrastructure area and water management system so that flood levels will be effectively managed without any impact from the project infrastructure. • 94 private landholder bores on 72 properties are predicted to experience a groundwater level drawdown of 2 m or more as a result of the project. • Make good provisions have been proposed with reference to the AIP for these 94 bores. • The median project drawdown is predicted to be 6 m and the median duration of drawdown on the 94 affected bores is 46 years, with the maximum duration being 65 years; however, most of the recovery will occur in a far shorter time period. On average, a bore will recover by 75% within 20 years since it was first impacted. • Predicted impacts to other groundwater users (GDEs, watercourses, drainage lines, and swamps that receive baseflow) have been assessed as insignificant. • Hume Coal has already secured in excess of approximately 93% of the total licence requirement for the project, with a clear pathway for how the remaining licence volume is to be secured so that all water taken is adequately licensed.

Table 29.1 Summary of environmental impacts

Aspect	Key findings of environmental assessment
Soils	• There is no BSAL present within the project area, as confirmed by the issuing of a SVC in 2016. • Due to the underground nature of the mine and using the first workings coal extraction method, impacts on soil resources will not be significant as a result of the project, as only localised land clearing will occur and subsidence will be negligible. • There will be a change in the Hume Coal Project area to the land and soil capability class post-mining over 58 ha disturbed by the surface infrastructure area. • The original land class of these areas (3 ha of Class 3, 37 ha of Class 4 and 18 ha of Class 5) will change to Class 6, due mainly to a change in soil depth. However, Class 6 land will still be suitable for grazing and improved pasture, allowing agricultural land use to continue post-mining. • Approximately 24 ha within the Berrima Rail Project area will be reduced to Class 7 along the footprint of the rail line.
Agricultural resources	• The potential disturbance of agricultural land from the Hume Coal Project is limited to the temporary disturbance of the surface infrastructure area, which will occur wholly on Hume Coal affiliated land (with the exception of a downcast shaft, which will be in Belanglo State Forest). Disturbed land will be returned to its pre-mining land use upon completion of mining; that is, agriculture comprising grazing on improved pasture. • There will be minor temporary foregone agricultural production values during the construction and operation of the project. However, this will be offset by the increase in productivity achieved on Hume Coal affiliated properties by applying leading practice management techniques when compared to the pre-Hume Coal affiliated property management regime.
Biodiversity	• Residual biodiversity impacts include the removal of 64 paddock trees for the Hume Coal Project. • Offsets have been calculated using the BioBanking Calculator. The Hume Coal Project requires 152 ecosystem credits for the removal of vegetation and ecosystem credit species habitats, and a total of 573 species credits. The Berrima Rail Project requires 7 ecosystem credits 58 species credits. • A biodiversity offset strategy has been proposed to source offset areas containing the required ecosystem and species credits; which will be finalised into a biodiversity offset package and submitted to DPE within 12 months of the date of development consent. • Areas of terrestrial vegetation along Belanglo Creek and Wells Creek were identified as having a higher risk of drawdown impact from underground mining. However, these areas have a facultative (opportunistic) dependence on groundwater, and will be able to respond to changes in the water table outside of periods of prolonged drought. Monitoring strategies have been proposed to manage these ecosystems in the event of prolonged drought. • Assessments of significance were completed for threatened species and communities. The project is not predicted to result in significant impacts for any of these species and communities.

Table 29.1 Summary of environmental impacts

Aspect	Key findings of environmental assessment
Noise and vibration	• The operational noise assessment has identified that during adverse weather conditions and with all the feasible mitigations applied: o eight assessment locations (nine dwellings) within the area modelled are predicted to experience residual noise levels between 3 dB and 5 dB above project-specific noise levels (PSNL) as a result of the coal project and are therefore entitled to voluntary mitigation upon request; o two assessment locations within the area modelled are predicted to experience residual noise levels greater than 5 dB above PSNLs as a result of the coal project and are therefore entitled to voluntary acquisition upon request; o one residential location is predicted to be impacted by noise from the operation of trains on the Berrima Branch Line, above the trigger level for voluntary mitigation rights in accordance with VLAMP. • Alternatively, Hume Coal may enter into amenity agreements with these landholders. • No privately owned land parcels are predicted to exceed the 25% area voluntary land acquisition criteria as defined in the Voluntary Land and Mitigation Policy. • The predicted internal noise levels at assessed privately owned residences will be well below those likely to cause sleep disturbance. • Construction noise levels during standard Interim Construction Noise Guideline construction hours will exceed the noise affected NML (noise management level) at several assessment locations. The 'highly affected' noise limit of 75 dB will not be exceeded at any time. • This is not uncommon for construction projects, and it is important to note that the NML is not a criterion (as are operational noise limits), but a trigger for when construction noise management is to be considered and implemented. It will be managed by limiting construction to standard hours only. • Underground mine construction will occur at around 110 m under the Hume Highway. Based on the structural vibration screening criteria of 7.5 mm/s and the identified vibration levels from similar construction activities (typically 0.1 mm/s at such distances), it is highly unlikely vibration levels will cause structural vibration impacts to the Hume Highway.
Air quality	• The underground nature of the project is a significant avoidance measure in relation to potential air quality impacts. • Accounting for the combination of project and neighbouring emission sources with ambient background levels, the potential to exceed applicable NSW EPA impact assessment criteria as a result of both the Hume Coal Project and Berrima Rail Project is very low, beyond those that would occur in the absence of the project (eg days influenced by bushfires, dust storms). • A review of best practice dust control measures found the measures incorporated into the project design are in accordance with or above accepted industry best practice dust control standards. Proposed mitigation measures will effectively control emissions to minimise impacts on the surrounding environment, and to levels that are within the applicable criteria.
Greenhouse gas	• Greenhouse gas (GHG) emissions from the Hume Coal Project are predicted to be minimal and make only minor contributions to the total GHG emissions for NSW and Australia. • A total of 1,795,965 t $CO_{2\text{-}e}$ (scope 1 and 2) GHG emissions will be emitted over the life of the project, and 111,346,132 t $CO_{2\text{-}e}$ of Scope 3 (including the end use of coal). The annual average scope 1, 2 and 3 emissions (excluding the end use of coal) from the project represent about 0.068% and 0.017% of total GHG emissions for NSW and Australia, respectively, based on the latest National Greenhouse Gas Inventory for 2014.
Subsidence	• The adopted non-caving mining method and associated mine layout for the project will reduce the levels of surface and sub-surface subsidence from mining to the lowest practical impact level, while still allowing the productive and economic recovery of the coal. • The predicted maximum values of associated subsidence parameters are low enough that subsidence-related impacts on surface features will be imperceptible. • Construction of mine workings will need to comply with the layout presented in Chapter 2 of the Hume Coal Project EIS and the design parameters adopted in the subsidence assessment so that the long-term stability of the workings is not inadvertently compromised. • In addition to the mine layout and the coal pillars being left in place, long-term stability will be assisted by placing rejects back into the mined-out voids, and the post-mining flooding of the mined workings and associated re-establishment of full hydrostatic water pressures.

Table 29.1 Summary of environmental impacts

Aspect	Key findings of environmental assessment
Traffic and transport	• No significant adverse traffic impacts on the local and regional road network have been identified as a result of traffic movements the project will generate during both the construction and operation phases, based on: o the road network traffic capacity; o current intersection traffic operations; or o the prevailing levels of traffic safety on the road network. • Traffic delays caused by additional coal trains (four trains daily in each direction) as a result of the Berrima Rail Project at the major level crossings on the route, such as on the Illawarra Highway at Robertson, will be up to an extra 24 minutes in total each day. On a daily average, the added delays would increase the total time each day by 1.5% when the level crossings would be closed to road traffic.
Visual amenity	• The Hume Coal Project and Berrima Rail Project will not have significant adverse visual impacts on the locality. Due to existing mature vegetation in the landscape and the area's topography, the project will be relatively shielded from view. • Two viewpoints were assessed as having the potential to experience a moderate to high unmitigated visual impact as a result of the project; viewpoint 3 (private residence along Medway Road) and viewpoint 4 (also along Medway Road). • Vegetation screens have already been planted around the surface infrastructure area. These will take time to become established and fully effective but, once established, the measures will mitigate visual impacts for both residents in the locality and motorists.
Closure and rehabilitation	• The disturbance footprint of the mine will be rehabilitated once mining is complete, with the overarching goal of rehabilitation to restore the land to its pre-mining land use; that is, an agricultural land use comprising grazing on improved pasture. • Being an underground mine, disturbed areas on the surface requiring rehabilitation at the mine's closure will be limited, with the disturbance footprint comprising about 2% of the entire project area. • Underground voids will be progressively partially backfilled as mining progresses. This will assist in groundwater recovery, as well as eliminating the need for large surface reject emplacements that would otherwise require rehabilitation at mine closure. • The risk of subsidence-related impacts occurring above the underground mine is negligible, so it is expected there will be no requirement to remediate areas above the underground workings. However, regular inspections will monitor sensitive features above the underground mining area where land access can be reasonably obtained and identify remedial actions at the time, if required.
Aboriginal heritage	• The Hume Coal Project and Berrima Rail Project will have the following combined impacts: • The mine surface infrastructure area will directly impact 20 sites, of which there are: o no sites of high significance; o six sites of moderate significance, two of which are of higher moderate significance (HC_135 and HC_151); and o 14 sites of low significance. • Eight sites will be directly impacted by the rail project, of which there are: o no sites of high significance; o two sites of higher moderate significance (HC_176 and HC_177); and o six sites of low significance. • Eighty-nine sites are above the project's underground mine area, but no subsidence impacts are predicted to occur. • One hundred and two sites are outside the project's surface infrastructure disturbance footprint and underground mine area and the rail disturbance footprint. These sites will be avoided. • Taking the very low risk of subsidence impacts into account, it is very likely that 191 of the 219 sites (87%) assessed will not be impacted by either project.

Table 29.1 Summary of environmental impacts

Aspect	Key findings of environmental assessment
Historic heritage	• Eight listed heritage items are, either wholly or partially, in the Hume Coal Project area. • One occurs within the surface infrastructure area and the rest are over the underground mining area. All are listed on the Wingecarribee LEP. • In addition to the listed heritage items, there are two potential archaeological sites that (if present) may reach the threshold of 'relics' (HC_127 and Mereworth 1). • The project's design avoids physical impacts to most of the listed heritage items, with the exception of part of the listed LEP curtilage of Mereworth. However, Mereworth's actual house and garden will not be subject to physical impacts, nor will any significant structures in the project area be affected. • A construction management plan will be prepared and implemented for Mereworth's house and garden. The plan will record the significance of the house site in more detail than is now available and will identify areas that require immediate repairs, which will guide the property's maintenance and management, leading to a positive transformation.

In summary, the project design adopts leading practice and avoids most potential environmental impacts, and where unavoidable (or residual) impacts occur they will be effectively managed to meet the applicable regulatory standards. It then follows that no impact deemed unacceptable by a regulatory agency will occur, meaning the project is justified from an environmental perspective.

29.3.5 Ecologically sustainable development

The Commonwealth's *National Strategy for Ecologically Sustainable Development* defines ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. The NSW EP&A Act adds to this by providing a set of ESD principles. The project's compatibility with each of the above principles is considered below.

i Precautionary principle

The precautionary principle holds that where there are threats of serious or irreversible environmental damage, a lack of full scientific certainty should not be used as a reason for postponing measures to prevent such damage.

The proposed mine plan and overall project design were progressively devised over several years and based on detailed investigations of geological, environmental, engineering and financial considerations. The baseline environmental investigations began in 2011 and included groundwater, surface water, ecology, air quality, noise, soils, heritage, visual, social and economic conditions, and geologic factors relating to potential subsidence. All potential risks were identified and taken into account in the project design.

Project planning included multiple rounds of design, assessment and refinement to avoid impacts or, if unavoidable, minimise or offset them. A number of leading practice innovations have been incorporated into the proposal to either avoid or minimise impacts, including non-caving coal extraction, placing rejects underground and covering coal wagons to minimise dust generation.

The result is that for all potential impacts no serious or irreversible harm will occur. Unavoidable impacts will meet applicable regulatory criteria, such as for noise, air quality and water quality. In instances where no regulatory criteria exist, such as for social or land subsidence impacts, the project has been designed to avoid adverse impacts and in many instances will have a positive outcome. Therefore, the project fully addresses the precautionary principle because there will be no serious or irreversible environmental damage. A detailed analysis of the precautionary principle is also provided in Chapter 6 of this RTS report.

ii Inter-generational equity

Inter-generational equity is the concept that the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The only beneficial land use that could be affected is agriculture. In this regard the inherent agricultural capability of the land will either be maintained in areas where no surface disturbance will occur, or be reinstated at the end of the mine life in those areas where surface mine support infrastructure will be developed. More broadly, the area's agricultural potential will be improved by consolidating land ownership and introducing better management techniques, which has already begun on land owned by Hume Coal. Potential impacts to groundwater bores as a result of the mine will be mitigated through the implementation of appropriate make good measures.

No meaningful loss of cultural resources will occur. The project has been designed to avoid most Aboriginal and historic heritage sites. In the minority of cases where avoidance is not possible, the affected items will be investigated and recorded.

As with cultural resources, most impacts on natural resources will be avoided or mitigated. The project's residual biodiversity impacts include the removal of 64 paddock trees. However, an offset strategy has been developed and, once implemented, will mean a net beneficial gain in biological resources.

Surface waters will be managed to achieve a neutral or better outcome in all creeks and rivers that receive runoff from the project area. There will be some effects on groundwater during and in the immediate years after mining. The impacts will be caused by water flowing into the mined-out voids from adjoining aquifers, resulting in an increase in the depth of the groundwater table. Recovery will be enhanced by capturing groundwater in the voids through sealing the entrances of the mine panels following extraction. While median duration of drawdown on the 94 affected bores is 46 years, no existing user will be disadvantaged because of make good measures that will be implemented.

The only natural resource that will be lost is the in situ coal. About 50 Mt of coal will be removed over the life of the mine. The majority of this will be used to produce steel. Steel is a recyclable metal that can be reused for generations, meaning there will be no disadvantage to future generations from the loss of valuable materials. Further, the revenue generated by the project will be used to employ and up skill the mine workforce and provide more community facilities and other social infrastructure (mainly through a VPA). This will allow natural capital (coal) to be transformed into economic capital (greater personal and public income), social capital (better public facilities) and human capital (a more skilled and wealthier workforce).

iii Conservation of biological diversity and maintenance of ecological integrity

The underground mine method to be used for the project means its surface disturbance will be minimal. The surface infrastructure area will be constructed on land that has been largely cleared for agriculture. Further potential impacts on biological diversity through surface disturbance have also been avoided by including the underground emplacement of rejects in the project design.

Where clearing of vegetation is required (ie 64 paddock trees), offsets will be provided to compensate. The overall outcome will be an increase in the area and quality of land conserved for biodiversity protection, meaning the ecological integrity of the area will be strengthened.

iv Improved valuation and pricing of environmental resources

The EIS (EMM 2017a) provides estimates of the monetary value of all material costs and benefits associated with the Hume Coal and Berrima Rail projects. It includes estimates of the value of intangible (or non-traded) factors, such as air or water quality impacts, that have been derived using current leading practice techniques. The costs and benefits have been compared transparently to provide an estimate of the project's net benefit.

The result is a reliable estimate of the project's economic value that provides useful guidance to decision-makers and other interested parties about the project's overall merit. It has also fully addressed the requirement for "improved valuation and pricing of environmental resources".

29.4 Conclusion

The Hume Coal Project and Berrima Rail Project are justified on economic, social and environmental grounds. This is demonstrated by their consistency with key objectives of the EP&A Act.

The Hume Coal Project will develop a valuable, publically owned natural resource – Wongawilli Seam coal. At the same time valuable environmental and cultural resources will be managed effectively and will be protected. When the economic and social benefits of the project are also taken into account, it is evident that community welfare will increase. This means that the project will achieve "proper management, development and conservation of resources ... and promote social and economic welfare".

The project's design and proposed management procedures are based on a comprehensive understanding of environmental conditions in and around the project area. The design avoids threats of serious or irreversible environmental damage. Further, the project will achieve inter-generational equity by transforming natural capital (coal), into economic and social capital in the form of greater income and employment, and material capital in the form of steel and other products that are essential for everyday life. The project is therefore consistent with the principles of ecologically sustainable development and will, for the reasons given above, serve the public interest.

The Hume Coal Project and the Berrima Rail Project, if approved, would provide a number of benefits including: the provision of a high quality coking coal from the only significant source of quality hard metallurgical or coking coal in NSW (the Southern Coalfields); the generation of employment over a 23 year project life with a peak employment at the mine of about 300 workers, and economic benefits amounting to (in NPV terms) $316 million direct economic benefits for NSW; royalty payments to the NSW government of around $114 million; and a net direct benefit to the Wingecarribee LGA of approximately $84 million.

A range of physical, economic and environmental attributes combine to make the project area suitable for the proposed underground mine. The project area is close to rail infrastructure that links directly to the Port Kembla coal terminal, currently a highly under-utilised asset that is ready to accept coal from the Hume Coal Project. It is also in close proximity to the Moss Vale Enterprise Corridor, an area established by the local council to encourage an increase in industrial, employment generating land uses in the area. The surface infrastructure area has been carefully situated on predominantly cleared land so as to avoid sensitive environmental features, and is in an area with limited neighbouring sensitive receivers. Due to the underground, non-caving nature of the mine, existing land uses will continue across 98% of the project area, without impacts from mine-induced subsidence.

The Hume Coal Project and associated Berrima Rail Project will enable the orderly and efficient development of a dormant publically owned coal resource which will be of significant benefit to the local and broader NSW communities. With all relevant factors considered, the benefits of the project are considered to outweigh its costs and the proposed Hume Coal Project and Berrima Rail Project are strongly justified.

Abbreviations and references

Abbreviations

AAQM	Ambient air quality measure
ABS	Australian Bureau of Statistics
ACHA	Aboriginal cultural heritage assessment
ACHMP	Aboriginal cultural heritage management plan
ACT	Australian Capital Territory
ADWG	Australian Drinking Water Guidelines
AEP	Annual exceedance probability
AERMOD	Atmospheric Dispersion Modelling System
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHMP	Aboriginal Heritage Management Plan
AIP	Aquifer Interference Policy
AIS	Agricultural Impact Statement
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZMEC	Australian and New Zealand Minerals and Energy Council
APZ	Asset protection zone
ARI	Average recurrence interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARMPS	Analysis of Retreat Mining Pillar Stability
ARTC	Australian Rail Track Corporation
AS	Australian Standard
ASC	Australian Soil Classification
ASRIS	Australia Soils Resource Information System
ASLP	Australian Standard Leaching Procedure
ASS	Acid sulphate soil
ASTM	American Society for Testing and Materials
ASX	Australian Stock Exchange
AWD	Available Water Determination
AWBM	Australian Water Balance Model
AWS	Automatic weather station
BAR	Biodiversity Assessment Report
BC Act	Biodiversity Conservation Act 2016
bcm	Bank cubic metres
bgl	Below ground level
BMP	Biodiversity management plan
BNAC	Buru Ngunawal Aboriginal Corporation
BoM	Bureau of Meteorology
Boral	Boral Cement Ltd
BSAL	Biophysical strategic agricultural land
CAV	Construction accommodation village
CBA	Cost/benefit analysis
CCL	Consolidated Coal Lease

CEEC	Critically endangered ecological community
CEMP	Construction Environmental Management Plan
cm	Centimetres
CMP	Conservation management plan
CO	Carbon monoxide
CPP	Coal preparation plant
CWMP	Construction Water Management Plan
dB	Decibels
DEC	NSW Department of Environment and Conservation
DECC	NSW Department of Environment and Climate Change
DECCW	NSW Department of Environment, Climate Change and Water
DLWC	NSW Department of Land and Water Conservation
DoE	Commonwealth Department of the Environment
DoEE	Commonwealth Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DI Water	NSW Department of Industries – Water
DRE	NSW Division of Resources and Energy
Drinking Water SEPP	*State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*
DSE	Dry sheep equivalent
EC	Electrical conductivity
EEC	Endangered ecological community
Eh	Reduction potential
EIS	Environmental impact statement
EMM	EMM Consulting Pty Limited
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EMS	Environmental Management System
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment protection licence
ESD	Ecologically sustainable development
ET	Evapotranspiration
FBA	Framework for Biodiversity Assessment
FoS	Factor of Safety
FTE	Full time equivalent
g	Grams
GAHA	Gundungurra Aboriginal Heritage Association Inc
GDE	Groundwater dependent ecosystem
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic information system
GLVIA	*Guidelines for Landscape and Visual Impact Assessment*
GMMP	Groundwater monitoring and modelling plan

GPa	Gigapascal
GPS	Global positioning system
GSP	Gross state product
ha	Hectares
Heritage Act	NSW *Heritage Act 1977*
HHMP	Historic heritage management plan
HRA	Hazard and risk assessment
Hume Coal	Hume Coal Pty Limited
HWM	Highwall mining
Hz	Hertz
ICNG	*Interim Construction Noise Guideline*
ICOMOS	International Council on Monuments and Sites
IEA	International Energy Agency
IESC	Independent Expert Scientific Committee
ILALC	Illawarra Local Aboriginal Land Council
Inghams	Inghams Enterprises Pty Limited
INP	*NSW Industrial Noise Policy*
Interim Protocol	*Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land*
IPC	Independent Planning Commission
ISO	International Organisation for Standardisation
K	Hydraulic conductivity
k/b	leakage coefficient
kg	Kilograms
kh	Horizontal hydraulic conductivity
KLC	Kinetic leachate columns
km	Kilometres
km^2	Square kilometres
KNAC	Koomurri Ngunawal Aboriginal Corporation
kPa	Kilopascal
kV	Kilovolts
Kv	Vertical hydraulic conductivity
Kx	Lateral hydraulic conductivity
LEAF	Leaching Environmental Assessment Framework
LEA	Local effects analysis
LEP	Local environmental plan
LFN	Low frequency noise
LGA	Local government area
Local Government Act	NSW *Local Government Act 1993*
LoS	Level of service
LPG	Liquefied petroleum gas
LSC	Land and soil capability
LTAAEL	Long-term average annual extraction limit
m	Metres

m^2	Square metres
m^3	Cubic metres
mbgl	Metres below ground level
MCHM	4-methylcyclohexane methanol
MHRDC	Maximum harvestable rights dam capacity
MIBC	Methyl isobutyl carbinol
Metropolitan groundwater WSP	Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011
Metropolitan surface water WSP	Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011
mg	Milligrams
MIC	Maximum instantaneous charge
Mining Act	NSW *Mining Act 1992*
Mining SEPP	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
ML	Megalitres
MLA	Mining Lease Application
mm	Millimetres
MNES	Matters of national environmental significance
MOP	Mining operations plan
MPa	Megapascal
Mt	Million tonnes
Mtce	Metric tonnes carbon equivalent
Mtpa	Million tonnes per annum
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
MWD	Mine water dam
n	Number
NATA	National Association of Testing Authorities
NCA	Noise catchment areas
NEPC	National Environmental Protection Council
NEPM	National Environmental Protection Measures
NGAF	National Greenhouse Accounts Factors
NGERS Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NHL	National Heritage Register
NHMRC	National Health and Medical Research Council
NIAC	Northern Illawarra Aboriginal Collective Inc
NIOSH	National Institute for Occupational Safety and Health
NML	Noise management levels
NMP	Noise management plan
NMZ	Nepean management zone
NO	Nitric oxide
NO_2	Nitrogen dioxide
NorBE	Neutral or beneficial effect
NSW DSC	NSW Dams Safety Committee

NOW	NSW Office of Water
NPfI	Noise policy for Industry
NPI	National Pollutant Inventory
NPV	Net present value
NPW Act	NSW *National Parks and Wildlife Act 1974*
NRMMC	Natural Resource Management Ministerial Council
NSW	New South Wales
NT	National Trust of Australia
NVA	Noise and vibration assessment
NV Act	NSW *Native Vegetation Act 2003*
NZS	New Zealand Standard
OEH	NSW Office of Environment and Heritage
OEMP	Operational environmental management plan
OWMP	Operational Water Management Plan
Omya	Omya Australia Pty Ltd
OU	Odour unit
PAC	Planning Assessment Commission
PADs	Potential archaeological deposits
PCT	Plant community type
PEA	Preliminary environmental assessment
PHA	Preliminary hazard analysis
PM	Particulate matter
PM_{10}	Fine particulate matter 10 microns in diameter or less
$PM_{2.5}$	Fine particulate matter 2.5 microns in diameter or less
PMF	Probable maximum flood
POEO Act	NSW *Protection of the Environment Operations Act 1997*
POSA	POSCO Australia
ppm	Parts per million
pphm	Parts per hundred million
PPV	Peak particle velocity
PSNL	Project specific noise levels
PWD	Primary water dam
RAP	Registered Aboriginal party
RBL	Rating background level
RFS	NSW Rural Fire Service
RING	*Rail Infrastructure Noise Guideline*
RMP	Rehabilitation Management Plan
RMS	NSW Roads and Maritime Services
rms	Root mean square
RNE	Register of the National Estate
RNP	Road Noise Policy
Roads Act	NSW *Roads Act 1993*
ROM	Run of mine
ROTARP	Rare or Threatened Australian Plants

RTS	Response to submissions
Rural Fires Act	NSW *Rural Fires Act 1997*
S	Storage
SB	Stormwater basin
SBS	Sydney Basin South
SCA	Sydney Catchment Authority
SEARs	Secretary's environmental assessment requirements
SEPP	State Environmental Planning Policy
SEPP 33	*State Environmental Planning Policy No. 33 – Hazardous and Offensive Development*
SEPP 44	*State Environmental Planning Policy No. 44 – Koala Habitat Protection*
SEPP 55	*State Environmental Planning Policy No 55 – Remediation of Land*
SES	State Emergency Services
SH	State highway
SHCAG	Southern Highlands Coal Action Group
SHI	State Heritage Inventory
SHG	Southern Highland Greens
SHR	State heritage register
SIA	Social impact assessment
SIMP	Social Impact Management Plan
SMP	Subsidence management plan
SoHI	Statement of Heritage Impact
SO_2	Sulphur dioxide
SRD SEPP	*State Environmental Planning* Policy *(State and Regional Development) 2011*
SRG	Social reference group
SRLUP	Strategic Regional Land Use Policy
SSD	State significant development
STP	Sewage treatment plant
SVC	Site verification certificate
Sy	Specific yield
t	Tonnes
TARP	Trigger Action Response Plan
TCLP	Toxic Characteristic Leaching Procedure
TDS	Total dissolved solids
TEC	Threatened ecological community
TEOM	Tapered element oscillating microbalance
TfNSW	Transport for NSW
TN	Total nitrogen
TP	Total phosphorus
tph	Tonnes per hour
TSC Act	NSW *Threatened Species Conservation Act 1995*
TSP	Total suspended particles
TSS	Total suspended solids
UCS	Unconfined Compressive Strength
UK	United Kingdom

USA	United States of America
US EPA	United States Environmental Protection Agency
VDV	Vibration dose values
VIA	Visual impact assessment
VIS	NSW Vegetation Information System
VLAMP	Voluntary Land Acquisition and Mitigation Policy (NSW Government 2014)
VOC	Volatile organic compound
VPA	Voluntary planning agreement
VVVF	Variable voltage variable frequency
VWP	Vibrating wire piezometer
WAG	Water advisory group
WAL	Water Access Licence
Water Act	NSW *Water Act 1912*
WHO	World Health Organisation
WLEP	Wingecarribee Local Environmental Plan
WM Act	NSW *Water Management Act 2000*
WMP	Water management plan
WQO	Water quality objective
WSC	Wingecarribee Shire Council
WSP	Water sharing plan
WTP	Water treatment plant
Yamanda	Yamanda Aboriginal Association

References

ABMARC 2016, *Diesel Locomotive Fuel Efficiency & Emissions Testing - Report for the NSW EPA*

ACIL Tasman Pty Ltd 2011, *Maldon-Dombarton Rail Link Feasibility Study Final Report*

Air Quality Professionals 2015, *Boral Cement Berrima Works Use of Solid Waste Derived Fuels in Kiln 6 - Air Quality Impact Assessment*

Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council (ANZECC and ARMCANZ 2000), *Australian and New Zealand guidelines for fresh and marine water quality*.

American Society for Testing and Materials (ASTM) 1992, ASTM Designation: D 3987-85, Standard Test Method for Shake Extraction of Solid Waste with Water*, American Society for Testing and Materials, West Conshohocken, PA, 4p.*

Anderson, D 2017, *Peer review of conceptual and numerical groundwater modelling that predicted likely groundwater impacts, Hume Coal Project SSD 15_7172*. Prepared by the Water Research Laboratory, University of NSW, for the Coal Free Southern Highlands, dated 23 June 2017.

Australian Bureau of Statistics (ABS) 2011a, Census of Population and Housing 2011, Australian Government.

2011b, *Agricultural Commodities, Australia 2010-11* (cat. No. 7121.0) Agricultural Census by the ABS

2011c, *Value of Agricultural Production Data*, 2005-06 & 2010-11 (cat. No. 7503.0) Agricultural Census produced by the ABS

The Australian International Council on Monuments and Sites 2013, *Charter for Places of Cultural Significance* (also known as the *Burra Charter*

Australian Minerals Industry Research Association (AMIRA) 2002, *ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage.* Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

Australian Rail Track Corporation (2011) *Network Management Principles* https://www.artc.com.au/library/AS_HV_Schedule%20C%20Network%20Management%20Principles.pdf

Australasian Railway Association *Freight on rail – the route to improved productivity* https://ara.net.au/sites/default/files/u1/ARA_Freight-on-Rail-REDUCED(1).pdf

The Australasian Institute of Mining and Metallurgy and the Australian Institute of Geoscientists (2015) *Australasian code for public reporting of technical assessments and valuations of mineral assets* (VALMIN Code)

BAEconomics 2017, *Economic Impact Assessment of the Hume Coal Project,* Appendix Q of the Hume Coal Project Environmental Impact Statement, Prepared for Hume Coal Pty Ltd by BAEconomics.

Barnett B, Townley LR, Post V, Evans RE, Hunt RJ, Peeters L, Richardson S, Werner AD, Knapton A, and Boronkay A, 2012, *Australian groundwater modelling guidelines*, Waterlines Report Series, Number 82, National Water Commission, Canberra.

Basutu, L, Hanson, D, & Schulten, C 2015, *Modelling curve gain in NSW, Acoustics Australia 43(3*), pp.245-250.

Brotherhood of St Laurence (March 2018) *An unfair Australia? Mapping youth unemployment hotspots* http://library.bsl.org.au/jspui/bitstream/1/10573/1/BSL_Unfair_Australia_Mapping_youth_unemployment_hotspots_Mar2018.pdf accessed 19 June 2018

Canbulat, I., Zhang, C., Black, K., Johnston, J., & McDonald, S., 2017, *Assessment of Sinkhole Risk in Shallow Coal Mining*, Proceedings of the 10th Triennial Conference on Mine Subsidence, Pokolbin, Institute of Engineers Australia pp. 331-347

Cargill, Colin 1999, *Reducing Dust in Horse Stables and Transporters. Rural Industries Research and Development Corporation*. Publication No. 99/44.

Cliff, D. Brady, D and Watkinson, M. 2014, *Developments in the Management of Spontaneous Combustion in Australian Underground Coal Mines*. 2014 Coal Operators' Conference, University of Wollongong. The Australasian Institute of Mining and Metallurgy & Mine Managers Association of Australia, 2014, 330-338.

COA 2016, *Leading Practice Sustainable Development Program for the Mining Industry, Preventing Acid and Metalliferous Drainage*, Commonwealth of Australia, Canberra ACT, September 2016.

Coffey Geotechnics Pty Ltd 2012, *Groundwater Study - Area 3B Dendrobium Coal Mine: Revised Numerical Modelling*, prepared for Illawarra Coal by Coffey Geotechnics Pty Ltd.

2016a*, Hume Coal Project Groundwater Assessment Volume 1: Data Analysis.* Prepared by Coffey for Hume Coal Pty Ltd

2016b, *Hume Coal Project Groundwater Assessment Volume 2: Numerical Modelling and Impact Assessmen*t. Prepared by Coffey for Hume Coal Pty Ltd.

Commonwealth of Australia 2014. *Subsidence from coal mining activities, Background review*, Department of Environment.

Commonwealth of Australia Department of the Environment (DoE) 2013*, Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources*, Australian Government.

2014, *Temperate Highland Peat Swamps on Sandstone: ecological characteristics, sensitivities to change, and monitoring and reporting techniques*.

2016, National Greenhouse Accounts Factors – Australian National Greenhouse Accounts. August 2016. Published by the Australian Government, Department of the Environment.

Commonwealth Department of Industry, Tourism and Resources 2006, *Leading Practice Sustainable Development Program for the Mining Industry.*

Council of Australian Governments water reform taskforce (COAG) 1995.*Water allocation and entitlements: A national framework for the implementation of property rights in water*. Occasional Paper No.1, Canberra, Agriculture and Resource Management Council of Australia and New Zealand.

Cromer, W C, Gardner, E A and Beavers, PD 2001. An improved viral die-off method for estimating setback distances, in Patterson, R A (ed) On-site '10 – Proceedings of the On-Site '01 Conference: Advancing onsite wastewater systems. Univ. of New England, Armidale, 25-27 Sept. 2001, pp 105-112.

David K 2015, Hydrogeological Assessment for the Closure of the Berrima Colliery. Boral Cement Limited.

Domenico, PA and Schwartz, FW 1990, *Physical and Chemical Hydrogeology 2nd edition*, John Wiley & Sons, Chichester.

Esterhuizen, G.S. 2014, *Extending Empirical Evidence through Numerical Modelling in Rock Engineering Design*. The Journal of The Southern African Institute of Mining and Metallurgy, Vol. 114, October.

EMM Consulting Pty Ltd (EMM) 2015, *Hume Coal Project Biophysical Strategic Agricultural Land Verification Assessment*. Report prepared by EMM for Hume Coal Pty Limited.

EMM Consulting Pty Ltd (EMM) 2017a, *Hume Coal Project Environmental Impact Statement.* Prepared by EMM for Hume Coal Pty Ltd.

2017b, *Berrima Rail Project Environmental Impact Statement.* Prepared by EMM for Hume Coal Pty Ltd

2017c, *Hume Coal Project Water Assessment* report. Appendix E of the *Hume Coal Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017d, *Hume Coal Project Aboriginal Cultural Heritage Assessment*. Appendix S of the *Hume Coal Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017e, *Hume Coal Project Biodiversity Assessment Report.* Appendix H of the *Hume Coal Project Environmental Impact Statement*. Prepared for Hume Coal Pty Ltd by EMM

2017f, *Hume Coal Project Groundwater Monitoring and Modelling Plan.* Prepared by EMM for Hume Coal Pty Ltd.

2017g, *Hume Coal Project Visual Amenity Assessment.* Appendix N of the *Hume Coal Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017h, *Hume Coal Project Social Impact Assessment.* Appendix R of the *Hume Coal Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017i, *Hume Coal Project Hazard and Risk Assessment Report*. Appendix P of the *Hume Coal Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017j, *Hume Coal Project Soil and Land Resource Assessment*. Appendix F of the *Hume Coal Project* Environmental *Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017k, *Hume Coal Project Agricultural Impact Statement*. Appendix G of the *Hume Coal Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017l, *Hume Coal Project Noise and Vibration Assessment*. Appendix I of the *Hume Coal Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017m, *Berrima Rail Project Noise and Vibration Assessment*. Appendix E of the *Berrima Rail Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017n, *Hume Coal Project Traffic and Transport Assessment*. Appendix M of the *Hume Coal Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017o, *Berrima Rail Project Traffic and Transport Assessment*. Appendix G of the *Berrima Rail Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017p, *Berrima Rail Project Visual Amenity Assessment*. Appendix M of the *Berrima Rail Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

2017q, *Berrima Rail Project Aboriginal Cultural Heritage Assessment*. Appendix H of the *Berrima Rail Project Environmental Impact Statement*. Prepared by EMM for Hume Coal Pty Ltd.

2017r, *Hume Coal Project Statement of Heritage Impact*. Appendix T of the *Hume Coal Project Environmental Impact Statement*. Report prepared by EMM for Hume Coal Pty Limited.

EMM 2018a, *Hume Coal Project Revised Water Assessment*. Appendix 2 of the *Hume Coal Project Response to Submissions Report.* Prepared for Hume Coal Pty Ltd by EMM.

2018b, *Critique of Pells Consulting Modelling Studies – Hume Coal Project*. Report prepared by EMM for Hume Coal Pty Ltd.

2018c, *Hume Coal Project and Berrima Rail Project Aboriginal Heritage Archaeological Test Excavation Report*. Report prepared by EMM for Hume Coal Pty Limited.

Fairfull, S. and Witheridge, G , 2003, *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*, NSW Fisheries, Cronulla

Farmer 1993, *The Effects of Dust on Vegetation – A Review. Environmental Pollution*, Volume 17 (1993). pp 63-75.

Federal Office of the Chief Economist, March 2018, "*Resources and Energy Quarterly"* pp. 39-44

Gale, W. Hebblewhite. 2005, *Systems Approach To Pillar Design: Module 1: Pillar Design Procedures. Final Report*, ACARP Project C9018, Volume 1.

Galvin and Associates Pty Ltd (Galvin and Associates), 2017, *Independent Assessment: Hume Coal Project*, prepared for NSW Department of Planning and Environment.

Galvin, J. M. 2016, *Ground Engineering: Principles and Practices for Underground Coal Mining.* Switzerland: Springer.

Geogas 2014, *Memorandum: Hume Coal Gas Content Database*, 27 June 2014.

Geosyntec Consultants Pty Ltd (Geosyntec) 2016. *Hume Coal Project Hydrogeochemical Assessment*. Prepared by Geosyntec for Hume Coal Pty Ltd.

Hanson D, Jiang J, Dowdell B, & Dwight R 2014, *Curve squeal: causes, treatments and results*, paper presented at *Internoise 2014 conference*, 249, pp. 6316-6323, Melbourne, Australia.

Heasley K.A. 2018, *Pillar design analysis using La Model - Hume Coal Project*

HydroAlgorithmics 2016, *Hume Coal Project Groundwater Impact Assessment Peer Review*. Prepared by HydroAlgorithmics Pty Ltd for Hume Coal Pty Ltd.

Hydrogeologic 2017, *Hume Coal Project EIS Independent Expert Review Groundwater Modelling*, prepared for NSW Department of Planning and Environment.

HydroSimulations 2018, *Revised Numerical Groundwater Model*, prepared for Hume Coal Pty Ltd by HydroSimulations.

IARC 1997, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 68 Silica, International Agency for Research on Cancer*, Geneva.

IARC 2017, *Agents Classified by the IARC Monographs, Volumes 1-102, International Agency for Research on Cancer, June 2011*, Geneva, last updated 27 October 2017.

INAP 2009, *Global Acid Rock Drainage Guide (GARD Guide)*, Document prepared for the International Network on Acid Prevention (INAP) by Golder Associates, June 2009, available at http://www.inap.com.au/.

Independent Expert Scientific Committee (IESC) 2015, *Information Guidelines for the Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals, viewed 15 November 2016*, www.iesc.environment.gov.au/system/files/resources/012fa918-ee79-4131-9c8d-02c9b2de65cf/files/iesc-information-guidelines-oct-2015.pdf.

International Energy Agency 2017 https://industry.gov.au/Office-of-the-Chief-Economist/Publications/ResourcesandEnergyQuarterlyDecember2017/documents/Resources-and-Energy-Quarterly-December-2017-Thermal-Coal.pdf

Judith Stubbs & Associates 2017a, *Hume Coal Project - Response to community concerns regarding impacts on tourism*

Judith Stubbs & Associates 2017b *Hume Coal Project - Response to community concerns regarding impacts on land values*

Katestone 2011, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*.

Landcom 2004, *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, and Volume 2E Mines and Quarries* (the Blue Book).

The Landscape Institute and Institute of Environmental Management & Assessment 2013, *Guidelines for Landscape and Visual Impact Assessment* (GLVIA) Third Edition.

Lee T, Springer D & Mills S 2016, *Leaching Environmental Assessment Framework (LEAF) – A Laboratory Perspective,* Envirolab Services (WA) Pty Ltd, 14-16 September 2016.

Li J, Kawashima N, Schumann R, Hughes A, Hutchison B, Kent S, Kaplun K, Ciccarelli JM & Smart RStC 2011, Assessment of Alkaline Cover Performance for Abatement of ARD from Waste Rock Dumps at Savage River Mine. From *Proceedings of the Seventh Australian Workshop on Acid and Metalliferous Drainage* (Eds LC Bell, B and Braddock, B), pp 13-26, 241-253 June 2011, Darwin NT. JKTech/SMI, Queensland, Australia.

Lucas S A, Coombes P J , Planner J, Welchman S, 2009, Rainfall harvesting and coal dust: the potential health impacts of trace elements in coal dust in rainwater, Air Quality and Climate Change Vol 43. No. 2 May 2009 pp23-30.

MacTaggart, B, Bauer, J, Goldney, D, Rawson, A, 2006. The restoration and protection of the swampy meadow within an agricultural landscape. *Australian Farm Business Management Journal* 3, pp. 68–75.

Marchant, T. and Weir, G., 2004, *Earthquake Damage in Underground Roadways.*

Merritt, T.D., Cretikos, M.A., Smith, W. and Durrheim, D.N. 2013, *The health of Hunter Valley communities in proximity to coal mining and power generation, general practice data,* 1998–2010. NSW Health Bulletin 24(2): 57-64. National Environment Protection Council (NEPC) 2003, *National Environment Protection Measures*, Australian Government.

Middlemis, H, Merrick, N, Ross, J, and Rozlapa, K 2001. Groundwater Flow Modelling Guideline. Prepared for Murray–Darling Basin Commission by Aquaterra.

Middlemis H and Peeters LJM 2018, Draft Explanatory Note, Uncertainty Analysis in Groundwater Modelling. A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment and Energy.

Miller S, Schumann R, Smart R & Rusdinar Y 2009, ARD Control by Limestone Induced Armouring and Passivation of Pyrite Mineral Surfaces. From *Proceedings of the Securing the Future and 8th International Conference on Acid Rock Drainage (ICARD)*, June 23-26 2009, Skelleftea, Sweden.

Mine Advice 2016, *Hume Coal Project Subsidence Assessment* Appendix L of the Hume Coal Project Environmental Impact Statement, Prepared for Hume Coal Pty Ltd by Mine Advice.

Mine Advice 2018, *Hume Coal Project - Interpretation of the numerical modelling study of the proposed Hume Project EIS mine layout*.

Moffit, RS 1999, *Southern Coalfield Regional Geology 1:100,000 Geology Map,* First edition, Geological Survey of New South Wales, Sydney.

Moriasi, DN, Arnold, JG, Van Liew, MW, Bingner, RL, Harmel, RD, Veith, TL 2007. Model evaluation guidelines for systematic quantification of accuracy in watershed simulations, *Transactions of the ASABE* 50(3), pp.885-900.

Mould, S & Fryirs, K 2017, The Holocene evolution and geomorphology of a chain of ponds, southeast Australia: Establishing a physical template for river management, CATENA 149(1), pp. 349-362 .

Nash, JE & Sutcliffe, JC 1970, River flow forecasting through conceptual models part I – A discussion of principles, *Journal of Hydrology* 10(3), pp. 282-290.

National Health and Medical Research Council and Natural Resource Management Ministerial Council (NHMRC) 2016, *2011 Australian Drinking Water Guidelines, Version 3.2.*

National Uniform Drillers Licensing Committee (NUDLC) 2012, *Minimum Construction Requirements for Water Bores in Australia Third edition,* Australian Government National Water Commission.

NIOSH 2011, *Coal Mine Dust Exposure and Associated Health Outcomes*, A Review of Information Published Since 1995, Current Intelligence Bulletin 64, Department of Health and Human, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, April 2011.

NSW Chief Scientist in the 2016 report *Independent Review of Rail Coal Dust Emissions Management Practices in the NSW Coal Chain*

NSW Department of Commerce and Sydney Catchment Authority (DoC) 2005. *Metropolitan Water Plan, Priority groundwater investigations for contingency drought relief – area 2: Upper Nepean Catchment*, Report 05-GL31A/2.

2006. *Metropolitan Water Plan, Detailed pilot investigation – Drilling and pumping tests, Upper Nepean Catchment (Kangaloon) Volume 1*, Report 06-GL31A/4.

NSW Department of Employment 2016, *Small Area Labour Markets – December Quarter 2015*, Australian Government.

NSW Department of Environment and Conservation (DEC) 2004. Use of effluent by irrigation – environmental guidelines, NSW Department of Environment and Conservation.

NSW Department of Environment and Conservation (DEC) NSW 2006, *Assessing Vibration: a technical guideline*

NSW Department of Environment and Climate Change (DECC) 2008, Managing Urban Stormwater – Soils and Construction, Volume 2E Mines and quarries. State of NSW and Department of Environment and Climate Change.

NSW Department of Industry Water (DI Water) 2018, *Maximum harvestable right calculator*, retrieved 19 June 2018 from http://www.water.nsw.gov.au/water-licensing/basic-water-rights/harvesting-runoff/calculator

NSW Department of Industry and Investment (NSW DII) 2011, *MDG 1006 – Technical Reference for Spontaneous Combustion Management Guideline.* Document prepared by the Mine Safety Operations Branch, NSW Department of Industry and Investment.

NSW Department of Jobs and Small Business 2017, *Small Area Labour Markets – September Quarter 2017*, Australian Government.

NSW Department of Planning and Environment (DPE) 2017, *Draft Environmental Impact Assessment Guidance Series*

NSW Department of Planning and Environment – Division of Resources and Geoscience (2018) Common Ground, viewed 8 May 2018 *http://commonground.nsw.gov.au/#!/title-map/Show%20All%20Resources/Show%20All%20Stages/Standard/10/-34.491843534372784/150.56419372558594*

NSW Department of Planning (DoP) 2008a. *Impacts of underground coal mining on natural features in the Southern Coalfield: strategic review*, NSW Government.

2008b, *Development near rail corridors and busy roads – Interim Guideline*, NSW Government.

2011a, *Hazardous and Offensive Development Application Guidelines, Applying SEPP 33,* January 2011.

2011b, *Hazardous Industry Planning Advisory Paper No 4: Risk Criteria for Land Use Safety Planning.*

NSW Department of Primary Industries (DPI) 2013, DRAFT Assuring Future Urban Water Security - Assessment and Adaptation guidelines for NSW Local Water Utilities, NSW Office of Water.

2016, *Livestock Gross Margin budgets*, http://www.dpi.nsw.gov.au/content/agriculture/farm-business/budgets/livestockhttp://www and http://www.dpi.nsw.gov.au/agriculture/budgets/livestock/sheep-gross-margins-october-2015/background/dse

NSW Department of Primary Industries 2013 *Agricultural Impact Statement technical notes*

2015, *Dams in NSW – Do you need a licence?,* NSW Government.

NSW Department of Primary Industries, Mine Safety Operations Division 2007 *Mine Design Guideline 1024 - Guideline for Inrush Hazard Management*

NSW Department of Primary Industries Office of Water (NOW) 2012a, *NSW Aquifer Interference Policy, NSW Government Policy for the licensing and assessment of aquifer interference activities*, NSW Government.

2012b, Guidelines for controlled activities on waterfront land, Department of Primary Industries Office of Water.

NSW Government AIP Fact Sheet 3 (NOW 2013a) 2013a, *Aquifer Interference Policy Fact Sheet 3, accounting for water*, NSW Government.

NSW Department of Primary Industries – Water (DPI Water) 2017, *Hume Coal Project (SSD 7172) and related Berrima Rail Project (SSD 7171), comment on the Environmental Impact Statement (EIS)*, dated 16 July 2017.

NSW Environment Protection Authority (EPA) 2000, *NSW Industrial Noise Policy* (INP)

NSW EPA 2016 *Approved Methods for Modelling and Assessment of Air Pollutants*

NSW EPA 2014, *Waste Classification Guidelines – Part 1: Classifying Waste*. NSW Environmental Protection Agency, November 2014.

NSW Government 2005, Floodplain Development Manual: The management of flood liable land, Department of Infrastructure, Planning and Natural Resources.

NSW Government, 2013 *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land*

NSW Government 2014, *Voluntary Land Acquisition and Mitigation Policy* (VLAMP)

NSW Government 2015a, *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*

NSW Government 2015b, *Strategic regional land use policy: Guideline for agricultural impact statements at the exploration stage.*

NSW Government 2017 *Noise Policy for Industry* (NPfI)

NSW Health 2007, *Rainwater Tanks Brochure*, http://www.health.nsw.gov.au/environment/Publications/rainwater-tanks.pdf

NSW Heritage Branch, Department of Planning 2009, *Assessing significance for historical archaeological sites and relics*.

NSW Heritage Office 2001, *Assessing heritage significance. Part of the NSW Heritage Manual*.

NSW Office of Environment and Heritage (OEH) 2011 *Coal Mine Particulate Matter Control Best Practice Site-specific determination*

NSW Office of Environment and Heritage (OEH) 2014, Framework *for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects*, NSW OEH, Sydney.

NSW Office of Environment and Heritage (OEH) 2012, 2nd Edition, *The land and soil capability assessment scheme: second approximation.* Office of Environment and Heritage.

New South Wales Scientific Committee (NSWSC) 2011, *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland occurs in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions endangered ecological community listing*, www.environment.nsw.gov.au, viewed March 2018.

NSW Trade & Investment, Mine Safety, 2015, Code of Practice - WHS (Mines legislation) *Strata Control in Underground Coal Mines*

Parker G & Robertson AM, 1999, *Acid Drainage*. Occasional paper on acid drainage published by the Australian Minerals and Energy Environment Foundation (AMEEF), November 1999, Melbourne, Victoria, Australia.

Parkinson, T and Stimson, R, 2010, Investigation into the quality of water in rainwater tanks at Stratford, Barrington and Copeland villages, November 2010.

Parkhurst DL 1995, User's guide to PHREEQC A computer program for speciation, reaction-path, advective transport, and inverse geochemical calculations: US Geological Survey Water-Resources Investigations Report 95-4227, 143p.

Parsons Brinckerhoff (PB) 2009, Wallacia Pilot Testing Program - Hydrogeological Analysis of Drilling and Testing Programs. Report to Sydney Catchment Authority dated June 2009.

Pells SE & Pells PJNP, 2013 Three dimensional groundwater model of Hume Coal Prospect, Southern Highlands NSW. Draft consultant's report by Pells Consulting for Southern Highlands Coal Action Group. Ref P029.R1 (Draft B) dated 24 September 2013.

Pells SE & Pan L, 2017 Groundwater Modelling of the Hume Coal Project. Consultants report by Pells Consulting for Coal Free Southern Highlands Inc. Ref S025.R1 (Final) dated 22 June 2017.

Perry, K. A., Raffaldi, M. J., & Harris, K. W., 2015, Influence of highwall mining progression on web and barrier pillar stability, *Mining Engineering*, Vol. 67, No. 3. Pp. 59-67

Perry, C. 1990, “Newcastle Earthquake”, EERI Newsletter. May 1990, Volume 24. Number 5

Plateway Pty Ltd (2014) *Rail Logistics Study Report for Hume Coal*

Plateway Pty Ltd (2015) *Berrima Branch Line Open Track Modelling Assumptions*

Platts daily price report, 11 April 2018

Pritchard, S, Russell, G & Hehir, W 2004, A review of the status of the groundwater resources in the Souther Highlands, NSW: ensuring the sustainability of the water source, Department of Infrastructure, Planning and Natural Resources.

Ramboll Environ 2017a, Hume Coal Project *Air Quality Impact and Greenhouse Gas Assessment*. Appendix K of the *Hume Coal Project Environmental Impact Statement*. Report prepared by Ramboll Environ for EMM Consulting Pty Ltd.

2017b, Berrima Rail Project *Air Quality Impact and Greenhouse Gas Assessment*. Appendix F of the *Berrima Rail Project Environmental Impact Statement*. Report prepared by Ramboll Environ for EMM Consulting Pty Ltd

RGS Environmental Pty Ltd (RGS) 2016, Geochemical Assessment of Coal and Mining Waste Materials. Report prepared for Hume Coal Pty Ltd by RGS Environmental Pty Ltd.

2018, Hume Coal Hydrogeochemical Modelling Assessments, prepared for Hume Coal Pty Ltd by RGS.

Ross, J 2014, ‘Groundwater Resource Potential of the Triassic Sandstone of the Southern Sydney Basin: an Improved Understanding’, *Australian Journal of Earth Sciences*, 61, pp. 463–474.

Russell G, McKibbin D, Williams J & Gates G 2009, *A Groundwater Resource Assessment of the Triassic Rocks of the Sydney Basin*. IAH N SW, Groundwater in the Sydney Basin Symposium, Sydney, NSW, Australia, 4-5 Aug 2009, W.A. Milne-Home (Ed), pp 312-328.

Rutherford, I, Jerie, K & Marsh, N 2000, A Rehabilitation Manual for Australian Streams Volume 2.

Serov P, Kuginis L, Williams JP, 2012, *Risk assessment guidelines for groundwater dependent ecosystems,* NSW Department of Primary Industries, Office of Water.

Smart R, St C, Miller S, Stewart W, Rusdinar Y, Schumann R, Kawashima N & Li J 2010, In Situ Calcite Formation in Limestone-Saturated Water Leaching of Acid Rock Waste. *Science of the Total Environment* 408(16), pp. 3392-3402.

Standards Australia 1997, *Australian Standard Leaching Procedure Method AS 4439*. Bottle Leaching Procedure.

Sydney Catchment Authority (SCA) 2012a, Designing and Installing On Site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice.

2012b, Using MUSIC in Sydney's Drinking Water Catchment: A Sydney Catchment Authority Standard.

2015, *Neutral or Beneficial Effect on Water Quality Assessment Guideline*, NSW Government.

Tickell, C, Downing, P, & Jacobsen, C 2014, Rail wheel squeal – some causes and a case study of freight-car wheel squeal reduction, *Proceedings of Acoustics 2004, 3-5 November 2004 Gold Coast, Australia, pp. 239-224.*

URS Australia, 2007 Upper Nepean (Kangaloon) Trial Borefield Segment (Area 2). Drilling and Testing of Production and Monitoring Bores - Completion Report. Report to Sydney Catchment Authority dated 14 May 2007.

2008 Upper Nepean (Kangaloon) Area 3 Trial Borefield Segment. Drilling of Production and Monitoring Bores - Completion Report. Report to Sydney Catchment Authority dated 20 February 2008.

USEPA 1992-1994, *Method 1311: Toxicity Characteristic Leaching Procedure,* part of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*,* United States Environmental Protection Agency, July 1992.

USEPA 2017, *Leaching Environmental Assessment Framework (LEAF) How-To Guide,* United States Environmental Protection Agency, Prepared by Eastern Research Group, Inc. (ERG) for the U.S. EPA Office of Land and Emergency Management and Office of Research and Development, October 2017.

Valuer General (2017?): http://valuergeneral.nsw.gov.au/land_value_summaries/historical_values.php

http://www.valuergeneral.nsw.gov.au/services/lvs.htm?execution=e1s1

Wingecarribee Shire Council Economic Development Strategic Plan 2008-2016

Wood Mackenzie, 22 March 2018, "*Glencore continues coal acquisition spree in $1.7 billion deal with Rio Tinto*"

WSP 2018, *Hume Coal Project Response to Submissions Revised Surface Water Assessment*. Prepared for Hume Coal Pty Ltd by WSP.

WSP Parsons Brinckerhoff (WSP PB) 2017, *Berrima Rail Project EIS Surface Water Assessment*. Appendix K of the *Berrima Rail Project Environmental Impact Statement*. Prepared by WSP PB for Hume Coal Pty Ltd

2016a, *Hume Coal Project Water Balance Assessmen*t. Prepared for Hume Coal Pty Ltd by WSP PB.

2016b, *Hume Coal Project Surface Water Quality Assessment*. Prepared for Hume Coal Pty Ltd by WSP PB.

2016c, *Hume Coal Project Surface Water Flow and Geomorphology Assessment*. Prepared for Hume Coal Pty Ltd by WSP PB.

2016d, *Hume Coal Project Flooding Assessment*. Prepared by WSP PB for Hume Coal Pty Ltd.

2016f, Berrima Rail Project EIS Surface Water Assessment. Prepared for Hume Coal Pty Ltd by WSP PB.

Yuan L & Smith A 2009, CFD modelling of spontaneous heating in a large scale coal chamber, *Journal of Loss Prevention in the Process Industries, Vol. 22 Issue 4, pp. 426-433, July 2009.* Pittsburgh Research Laboratory, National Institute for Occupational Safety and Health.

Zia-Khan, Shamila, Spreer, Wolfram, Pengnian, Yang, Zhao, Xiaoning, Othmanli, Hussein, He, Xingjui and Muller, Joachim. *Effect of Dust Deposition on Stomatal Conductance and Leaf Temperature of Cotton in Northwest China*. Water (2015). Volume 7, pp 116-131.

Project Office

7/8 Clarence House
9 Clarence Street
Moss Vale NSW 2577
Ph: +61 2 4869 8200
E: info@humecoal.com.au

Mailing Address

Hume Coal Pty Limited
PO Box 1226
Moss Vale NSW 2577