



Hume Coal and Berrima Rail Project

Response to the Independent Planning Commission Assessment Report dated 27 May 2019

Prepared for Hume Coal Pty Ltd
April 2020

EMM Sydney
Ground floor, 20 Chandos Street
St Leonards NSW 2065

T 02 9493 9500
E info@emmconsulting.com.au

www.emmconsulting.com.au

Hume Coal and Berrima Rail Project

Response to the Independent Planning Commission Assessment Report dated 27 May 2019

Report Number

J12055 RP1

Client

Hume Coal Pty Ltd

Date

8 April 2020

Version

v1 Final

Prepared by**Approved by**



Dylan Falconer
Project Manager
8 April 2020



Brett McLennan
Director
8 April 2020

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

© Reproduction of this report for educational or other non-commercial purposes is authorised without prior written permission from EMM provided the source is fully acknowledged. Reproduction of this report for resale or other commercial purposes is prohibited without EMM's prior written permission.

Executive Summary

This report has been prepared in response to the Independent Planning Commission's (IPC) Independent Planning Assessment Report (the IPC assessment report), dated 27 May 2019, on the Hume Coal Project (SSD 7172) and associated Berrima Rail Project (SSD 7171). In doing so this response to the IPC's assessment report analyses, addresses and responds to the findings and recommendations within the report with the aid of updated and supplementary technical studies.

Approval for both the Hume Coal Project and the Berrima Rail Project is sought under Part 4 Division 4.1 (State significant development) of the EP&A Act. The Hume Coal Project and the Berrima Rail Project are adjacent to each other and are linked. Hume Coal has submitted two separate applications; however, the two projects are collectively referred to as 'the Project' in this IPC response report.

Hume Coal commissioned extensive work in addition to the work already performed to deliver the EIS and RTS to specifically address all the recommendations directed to the applicant. This included further independent peer reviews of the groundwater and economics assessments and the mine design. Hume Coal has also summary responses and findings of these updated and supplementary technical studies, in the context of the IPC recommendations, are provided in Table ES1 below.

It should be noted that the IPC assessment report contains findings and recommendations that the IPC requests both Hume Coal and the NSW Department of Planning, Industry and Environment (DPIE) respond to. In some cases, the IPC assessment report suggests that Hume Coal and DPIE could jointly engage independent experts to peer review studies and assessments undertaken in relation to the proposed mining method and groundwater modelling, that both entities undertake a review of the market conditions for coking coal, and that a peer review of the economic impact assessment be undertaken.

Following the release of the IPC assessment report, Hume Coal met with DPIE to discuss IPC assessment report and to coordinate responses to the findings and recommendations where the IPC suggested a coordinated approach between the two entities. However, DPIE advised Hume Coal at the meeting that the Department would not undertake this work either separately or jointly. Accordingly, Hume Coal has separately engaged independent experts to address the findings and recommendations of the IPC, including independent experts to review the proposed mining method, groundwater modelling and economic impact assessment. Hume Coal has also separately engaged an independent expert to provide an update on the current and forecast market for coking coal.

It is reiterated that great care has been taken in planning the Project so that its design and operation minimises and mitigates potential environmental and social impacts. The Project's design includes features that exceed the normal practices used in Australian coal mines and go beyond minimum regulatory standards.

A range of physical, economic and environmental attributes combine to make the Project area suitable for the proposed underground mine and associated infrastructure. The Project area is close to rail infrastructure that links directly to the Port Kembla coal terminal, currently an under-utilised asset that is ready to accept coal from the Hume Coal Project delivered via the Berrima Rail Project. It is also partly within the Moss Vale Enterprise Corridor, an area established by the Wingecarribee Council to encourage an increase in industrial, employment generating land uses in the area. Furthermore, 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.

The Hume Coal Project and associated Berrima Rail Project will enable the orderly and efficient development of a dormant publicly owned resource – Wongawilli Seam coal – which will be of significant benefit to the local and broader NSW communities. While the two projects have the potential to cause some adverse impacts, mitigation and/or compensation measures have been developed to address all of these and the net result is that residual impacts are considered to be minor. With all relevant factors considered, the associated benefits are considered to outweigh costs and the proposed Hume Coal Project and Berrima Rail Project are strongly justified.

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R1	Because the Applicant and Department remain a considerable distance apart regarding their positions on the safety of the pine feather method of mining, the Commission suggests that one of the Applicant or the Department, or both of them jointly, engage a new independent expert with experience in innovative coal mining technology with a view to resolving ongoing differences of opinion. This investigation would involve taking into account new information from the Resources Regulator.	<p>Hume Coal engaged Russell Howarth, an expert with over 45 years in the underground coal industry and experience in innovative coal mining technologies, to independently review the proposed mining method.</p> <p>The review states ‘the proposed mining technique was found to be technically feasible’ and that ‘it cannot be inferred that the proposed mining system is unsafe on the basis that it has not been used before in NSW’. The proposed technique would utilise advances in technology in the form of remote-controlled mining equipment and use of high-precision inertial navigation systems, which would provide a level of surety that the mine was developed as designed and also enable coal mine workers to operate machinery remote from the coal cutting and coal face hazards.</p>
R2	As a result of the outcomes of R1, the Applicant needs to advise if there are consequences that would arise in relation to mine design and economics (resource recovery).	Russell Howarth’s review states ‘the mine layout maximizes recovery of the resource and results in a long-term stable pillar system that keeps mining induced surface subsidence impacts to an imperceptible level, minimizes hydrogeological impacts on subsurface strata above the Wongawilli Seam, and provides an ability to store mining wastes and excess water underground’ (Russell Howarth & Associates, 2020).
R3	The Applicant should provide the Project Risk Assessment to the Department, and any other relevant Government agencies, if necessary on a confidential basis, for consideration in any further Department or other Government assessment or response in the next stage of the assessment process.	This recommendation has been addressed through a separate, but parallel, submission to DPIE from Hume Coal, submitted at the same time as this IPC response report.

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R4	That the Department review the advice of Department of Industry - Water dated 24 April 2019 and the Applicant's correspondence of the 17 May 2019 and gives consideration to requesting the completion of the revised groundwater flow model, taking into consideration the advice provided.	<p>Following the correspondence referred to in R4, a meeting was held on 30 July 2019 between DPIE Water hydrogeologists, DPIE Planning and Assessment personnel, Hume Coal personnel, EMM and HydroSimulations/SLR Consulting hydrogeologists. Seven actions were discussed and agreed out of that meeting. The minutes were recorded by Hume Coal and distributed to all parties on 15 August 2019. The seven actions are:</p> <ol style="list-style-type: none"> 1. Cross sections – Hume Coal to provide additional north-south and east-west sections to assist DPIE with making their assessment on impacts. 2. Hydraulic data with depth and spatially – Hume Coal is to re-evaluate original data from EIS and RTS graphs showing hydraulic conductivity with depth (Coffey's EIS graphs and refined HydroSimulations graphs in the RTS). The data is to be reproduced and charted spatially on a map or series of maps. 3. Berrima mine comparison – Hume Coal to provide an enhanced discussion of the similarities and differences between the existing Berrima Colliery and the proposed Hume Coal Project. 4. Calibration statistics – Hume Coal to provide more information on model calibration statistics. DPIE Water requested if the model predicts 70% of the monitoring bores hydrograph history match is in excess of 2 m, then what are the impacts of the 2 m drawdown on landowner bores. Hume Coal will provide information and discussion on this. 5. Uncertainty analysis – Hume Coal to describe the range of parameters explored and map them. 6. Packer tests – Hume Coal to provide raw data from the packer tests conducted for the Project. 7. DPIE Water report – Hume Coal to reference the original submission from Dol Water to the EIS (and subsequent submissions) and consider the data and information requests from the original submission. This is to include data and information requested in the Appendix from the response to the IPC. <p>Annexure A of Appendix B to this report provides a detailed response to these seven actions.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R5	<p>Because the Applicant and Department of Industry - Water remain a considerable distance apart regarding their positions on the groundwater modelling, the Commission suggests that the Department or the Applicant, or both of them jointly (and in any case in consultation with Department of Industry - Water), engage a new independent expert (or alternatively a small technical group with Chair) with experience in groundwater modelling with a view to resolving ongoing differences of opinion. The independent expert/Chair should consider:</p> <ul style="list-style-type: none"> • what practical steps, if any, can be taken to make the model a class 2 model or seek agreement on the class of the model; • what additional work is required to establish the extent to which the emplacement of water in mined-out voids will reduce the level of drawdown in the later years of the project; • the range used for the input parameters in the modelling sensitivity/uncertainty analysis and recommend if a wider range is required so that there is no unreasonable truncation of results; and • if additional geological information is required. 	<p>Hume Coal engaged Dr Lloyd Townley of GW-SW Pty Ltd to conduct an independent review of the groundwater modelling.</p> <p>Townley (2020) concluded that modelling undertaken for the Hume Coal Project is fit for purpose, for the purpose of predicting groundwater inflows to the proposed mine and drawdown of the water table within and near the Project area. This conclusion is consistent with the previous expert reviews by HydroAlgorithmics Pty Ltd (2016), Kalf and Associates Pty Ltd (2016) and HydroGeoLogic (2017, 2018) on behalf of DPE that concluded the original EIS model and subsequently the Modified EIS Model (RTS model) were fit for purpose. Townley (2020) concludes that the model is a Class 2 model, and has some elements of a Class 3 model.</p>
R6	<p>That the Department give close attention to the practical adequacy of make good provisions during the final assessment process, with an independent review if necessary. This should include the practical aspects such as dispute resolution and economics as well as the technical.</p>	<p>Hume Coal realise that there remains ongoing concern from the community and the NSW Government about the total number of bores that are predicted to experience drawdown as a result of the Project.</p> <p>Further work has also been undertaken on the make good strategy presented in the RTS 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. By applying the concept of make good for landholder bores, the drawdown effects are mitigated, and a landholder's access to water for farming and other purposes are not compromised.</p> <p>A flowchart has been prepared (Figure 5.2) which outlines the make good process and allocates the key actions and decisions into the three categories of being technically feasible, able to be implemented practically, and being able to identify pathways for conflict resolution.</p>
R7	<p>The Applicant is to confirm whether the provisional Water Treatment Plant does form part of the Project – and if so, provide suitable information to permit an appropriate assessment of its impacts.</p>	<p>The WTP no longer forms part of the Project.</p> <p>Excess water will be managed by storing it in the PWD and pumping to the void/underground behind the sealed bulkheads. A WTP was included in the RTS assessment as a provisional item only. However, as the water balance work has assessed that PWD has adequate capacity to store excess water under all 107 climate scenarios, the WTP will not be required. Therefore, this item (R7) has not been assessed further.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R8	Should underground emplacement and water impounded have to cease for any reason, the Applicant is to confirm how long under normal mining operations it would take for the reject emplacement stockpile and Primary Water Dam to reach capacity.	<p>Details on the reject emplacement stockpile are provided in the response to R9 below.</p> <p>Site water management for the Hume Coal Project relies on a number of water storages, including the Primary Water Dam (PWD) which is a balancing storage designed to buffer periods when water is in deficit or excess.</p> <p>The void spaces behind the bulkheads in the mine can be used to store excess mine water if required. If also required, this water can be pumped to the PWD to meet operational demands. If the voids behind the bulkheads cannot receive excess water, the PWD is the only storage that can be utilised to store this water. Therefore, more details about the potential risk of the PWD reaching its maximum capacity during the life of mining operations has been requested by the IPC.</p> <p>Accordingly, the RTS Goldsim water balance model was used to estimate the length of time it would take for the PWD to reach its capacity if the option of storing excess water in the voids is prevented or unavailable at any time during the 19-year mine life.</p> <p>The water balance assessment applied 107 climate scenarios to each scenario where storage is unavailable from first day of each year of mining of the mine life. For example, the first scenario looked at how long it would take for the PWD to reach capacity if storage was unavailable from the first day of Year 1, under 107 climate scenarios. The modelling shows:</p> <ul style="list-style-type: none"> • The average duration (over the 107 data sequences) for the PWD to reach capacity (without storage in the voids) decreases throughout the life of the mining operation. For example, if storage were to cease in the first year (Year 1) of mining operations and water collected in the underground mine sump is diverted to the PWD, the average time to fill the PWD is estimated to be 14 years. This average duration to fill the PWD reduces to approximately 8 years if storage in the voids ceases in the seventh year of mining, and declines further to approximately 0.8 years if storage is ceased in the final year of the 19-year period of operations. • The longest duration for the PWD to reach capacity is estimated to be 16.5 years, if storage in the voids were to cease in the first mining year. • The shortest duration for the PWD to reach capacity is estimated to be 0.5 years, if storage in the voids ceases at the start of the last year (Year 19) of mining. <p>The average duration for the PWD to reach capacity is largely dependent on the year in which surplus water storage in the voids ceases. In the early stages of mine operations, the average duration for the PWD to reach capacity is longer than in the later stages of mining. This is a function of several factors, but generally reflects a net water deficit in the early stages of mining and a water surplus in the later stages.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R9	The Applicant is to provide greater detail on its surface level reject emplacement process, including the use of the temporary coal reject stockpile (as discussed in paragraph 188) once underground emplacement has been commenced.	<p>Additional mine planning has resulted in improvements to the mine schedule and therefore review of the requirements of the temporary coal reject stockpiles. Refinement of the requirements of temporary coal reject stockpiles included updates to the designed angles of repose and a slight (4 m) increase in height to the main (eastern reject stockpile) requiring a total height of 19 m, giving the reject stockpile 29 months of capacity should the underground reject emplacement process cease for any reason. The footprint of the main (eastern reject) remains unchanged as presented in the EIS and RTS. The secondary (western reject) temporary stockpile would be removed from the proposed project. The design of the main temporary coal reject stockpile takes into account the capacity of the now removed western stockpile. The temporary rejects stockpile would be placed back underground at the end of the operational phase of the mine's life.</p> <p>In respect to other elements of the surface level reject emplacement process, it is intended to form the main temporary reject stockpile utilising an automated stacker during the daytime and night-time, combined with a D9 bulldozer pushing out to the extents of the main temporary reject stockpile footprint during daylight hours only.</p>
R10	The Department is to consider and advise if Assessment Location No 7 should be afforded mitigation rights under the application of the Noise Policy for Industry.	The updated noise assessment performed as part of this IPC response has resulted in a change in the significance of the predicted residual impact from negligible to marginal at assessment location 7, and hence this means that location is entitled to voluntary mitigation in the form of mechanical ventilation/comfort condition systems.
R11	The Applicant and Department should explore opportunities to further mitigate noise impacts. Such opportunities may include more extensive noise monitoring, closer attention to atmospheric conditions, incorporation of any recently developed rail and rolling stock modifications, construction of noise bunds and physical barriers and stop-work when exceedances are observed.	The update noise assessment confirmed that no further mitigation measures are recommended. Notwithstanding, Hume Coal commits to investigating further noise mitigation post-approval in consultation with landholders.

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R12	The Department's Final Assessment Report should confirm the suitability of the assumptions in the Applicant's modelling in relation to the prevailing wind data utilised as this was questioned by members of the public in submissions.	<p>Analysis of annual wind roses for the four monitoring stations showed the consistency and similarity in recorded wind speed and direction profiles over a four-year basis. The analysed data supported the use of the 2013 meteorological monitoring datasets used for the AQIA undertaken for the EIS. The use of the different meteorological datasets addresses any potential uncertainty relating to the suitability of wind speed or directions applied in the dispersion modelling.</p> <p>It is repeated that the wind speeds recorded at the BoM Moss Vale dataset in the modelling are the highest of the four reviewed monitoring resources. The use of elevated wind speeds (average and gust conditions) from BoM Moss Vale AWS in the emission calculations returns the highest potential for dust emission generation. Consequently, the use of the BoM Moss Vale AWS provides an upper bound estimate of emissions from the Project.</p> <p>As demonstrated in the AQIA and within this chapter, the dispersion modelling is based on two meteorological datasets that are representative of the range of dispersion conditions likely to be experienced in the local area. Therefore, it is considered that the likely impacts from the Project at surrounding residences and community centres have been robustly quantified.</p> <p>It is noted that in the submission from the EPA to DPIE, dated 30 June 2017, the EPA review comments relating to the AQIA "did not identify any issues that have the potential to alter the overall conclusions and outcomes of this assessment".</p>
R13	The Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.	<p>Further investigations undertaken during this IPC response phase used in-situ gas values from Hume Coal's exploration boreholes to determine a more appropriate site-specific emission factor than was used for the EIS. These investigations identified the site as being a 'low gas' situation and therefore the Scope 1 results were considered more realistic and were significantly reduced from those presented in the EIS and RTS. Emission calculations were revised based on the latest national GHG emission factors and a more conservative 45/55 thermal/coking coal split for Scope 3 emissions. The Project is very low in Scope 1 GHG emissions intensity relative to the Australian coal mining industry facility average and these are lower than the NGER Act threshold level, therefore would not be classed as a large GHG emitting facility.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R14	The Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.	<p>A brief summary of mitigation measures for the reduction of Scope 1, 2 and 3 GHG emissions include the following measures to be implemented by Hume Coal, where practicable:</p> <ul style="list-style-type: none"> • Scope 1 measures: <ul style="list-style-type: none"> – use of battery-electric powered vehicles for surface activities and underground personnel transport; – use of fuel-efficient locomotive engines and systems; – reduction of engine idling times; and – routine servicing and maintenance. • Scope 2 measures: <ul style="list-style-type: none"> – procure power supply from renewable energy sources; and – establish solar power cells and storage batteries to power administration buildings on site. • Scope 3 measures: <ul style="list-style-type: none"> – only sell coal products to countries (states or organisations) that are signatories of the Paris Agreement.

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R15	<p>Further visual impact assessment should be completed for assessment and should include at a minimum:</p> <ul style="list-style-type: none"> dimensioned plans of the project area and the railway extension. The plans should include a survey with contours and the location and size of all works as well as the relative heights above ground level of significant structures, including the coal stockpiles, the coal loader and primary water dam walls; views of the project area and railway extension from sensitive properties within and in the vicinity of the Project area (including heritage items), from the Hume Highway and Medway Road or any likely affected property. The distance and heights of the viewing points should be provided; views should be without mitigation measures (screen planting) and with mitigation measures in place after 5 years and 15 years; any findings in relation to groundwater impacts on gardens, plantings and landscape settings; and further assessment of the impacts of night-time lighting. <p>Any photomontages of the view impacts should be certified in accordance with the Land and Environment Court's Direction on use of photomontages http://www.lec.justice.nsw.gov.au/Pages/practice_procedure/directions.aspx</p>	<p>EMM has prepared an updated Visual Impact Assessment (UVIA) to address matters raised by the IPC, to holistically respond to matters of significance of visual impact, and to lay the framework and justification for additional viewpoints, photomontages and additional mitigation measures if required to address areas of moderate to significant visual effect.</p> <p>There are no Australian Federal, NSW State Government or Local Government Authority planning policies, guidelines or standards applicable to this assessment. The UVIA was therefore assessed with regard to industry standards included within the UK document <i>Guidelines for Landscape and Visual Impact Assessment</i> (GLVIA) Third Edition (Landscape Institute 2013) prepared by the Landscape Institute and Institute of Environmental Management and Assessment, and <i>Guidance Note for Landscape and Visual Assessment</i> (AILA 2018). The UVIA was also prepared with regard to Standards Australia (AS4282) <i>Control of Obtrusive Effects of Outdoor Lighting</i> and photomontages developed in accordance with the Land and Environment Court's 2013 direction on the use of photomontages http://www.lec.justice.nsw.gov.au/Pages/practice_procedure/directions.aspx</p> <p>The assessment now contains tabulated dimensions of all major elements in the Surface Infrastructure Area (SIA), labelled plans showing their locations (and spatial arrangement), and an oblique aerial rendering from the north-west showing their relative heights and relationship to Mount Gingenbullen and the Moss Vale Industrial Enterprise Zone to the east of the Hume Motorway.</p> <p>The assessment of visual effects and sensitivity identified that there was some residual impact that should be mitigated. The resultant mitigation strategy was developed through collaboration with the Heritage Consultant.</p> <p>The visual assessment contains photography from 21 key viewpoints representative of the landscape character within the significant potential view zone of the project, sensitive receptors or locations where views of the SIA may be possible. A further 13 viewpoints have been established within the Mereworth Garden area to represent significant views from locations identified by the Heritage Council of NSW.</p> <p>A total of 10 viewpoints from the significant potential view zone and six from Mereworth were subjected to photomontages treatments to demonstrate visual impacts and mitigation progression. Views for existing, practical completion, year 5 and year 15 were prepared and presented.</p> <p>The assessment of groundwater impacts has shown there will be little impacts on vegetation within the landscape as a result of groundwater drawdown.</p> <p>Night-time lighting has been assessed in the context of cumulative impacts and mitigatable effects.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R16	Further information should be provided to allow the assessment of the potential impact of water table drawdown on heritage items (including gardens, plantings and landscape settings) within or in the vicinity of the Project area. The information should include confirmation of the existing level of the water table and the anticipated drawdown at both the 67th percentile and the 90th percentile.	<p>A detailed groundwater impact assessment quantifying impacts at the 50th, 67th and 90th percentile for cultural heritage landscapes and gardens was performed to respond directly to this recommendation.</p> <p>All heritage gardens occur where the Wianamatta Group shale outcrops, including Mereworth House and Garden. Due to the low hydraulic conductivity of the Wianamatta Group shale, predicted impacts to groundwater resources will not result in impacts to heritage items (including gardens, plantings and landscape settings) within or in the vicinity of the Project area.</p>
R17	The Applicant should address the recommendations of the Heritage Council of NSW's correspondence to the Department dated 17 August 2018 as referenced in paragraph 283.	<p>Heritage Council of NSW's correspondence has been responded to in the following updated and new studies undertaken for this IPC response:</p> <ul style="list-style-type: none"> • updated visual impact assessment (Appendix E of this report); • groundwater dependence assessment for cultural heritage landscapes (Appendix F, Annexure A of this report); • cultural landscape assessment (Appendix F, Annexure B of this report); • Sorensen and Mereworth gardens analysis (Appendix F, Annexure C of this report); and • supplementary historical archaeology assessment analysis (Appendix F, Annexure D of this report).
R18	The Statement of Heritage Impact Assessment should be updated in response to recommendations R16 and R17, and the visual impact of the project on the significance of the above items and the cultural landscape in accordance with an updated visual impact assessment. (see R15 in Visual Impact recommendations).	<p>The Statement of Heritage Impact has been updated in response to the responses to recommendations R15, R16 and R17 and draws on information from the following updated and new studies undertaken for this IPC response:</p> <ul style="list-style-type: none"> • updated visual impact assessment (Appendix E of this report); • groundwater dependence assessment for cultural heritage landscapes (Appendix F, Annexure A of this report); • cultural landscape assessment (Appendix F, Annexure B of this report); • Sorensen and Mereworth gardens analysis (Appendix F, Annexure C of this report); and • supplementary historical archaeology assessment analysis (Appendix F, Annexure D of this report).

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R19	The Applicant is to undertake further technical assessment on the impacts on private gardens, exotic trees and native vegetation from a declining water table	<p>Potential impacts to terrestrial vegetation associated with creeks, rivers and swamps were assessed within a revised GDE assessment in Section 13.3 of the RTS Main Report. This assessment was prepared to the satisfaction of the Department, former OEH and the IPC. No further assessment of native vegetation is required.</p> <p>Additional information relating to rooting depths demonstrates that other native tree species will also not be significantly impacted by a drawdown of up to 10 mbgl in the two areas of terrestrial vegetation identified as high risk during prolonged periods of drought.</p> <p>A 'Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens' has been undertaken to address concerns relating to the impacts of water table decline on planted exotic garden and trees. The report is included as Appendix G to this report.</p>
R20	<p>The additional information provided by the Applicant, including the Updated Economic Impact Assessment prepared by BA Economics in October 2018, should be peer reviewed to determine:</p> <ul style="list-style-type: none"> i) whether the concerns and recommendations in the Economic Impact Assessment Review dated December 2017 prepared by BIS Oxford Economics (BISOE 2017) have been adequately justified, including concerns about transparency in relation to project costs, revenues and externalities; and ii) the implications and reasonableness of changes/assumptions in the Updated Economic Impact Assessment including the change to the project description from that in the Hume Coal Environmental Impact Statement and any cost implications. <p>Following the peer review, if the net economic benefit of the project remains uncertain and there are outstanding concerns about the assumptions and/or information, a further Economic Impact Assessment should be prepared that is consistent with the recommendations in BISOE 2017 (as set out in pages 1-3 of the Executive summary of BISOE 2017) and any further recommendations of the peer review.</p>	<p>BAEconomics have prepared a revised EIA (BAE 2020) to address the recommendations and concerns of BISOE and the IPC.</p> <p>The revised EIA (BAE 2020) provides a revised estimate of net economic benefit to NSW of \$192 million per strict application of the 2015 guidelines (or \$290 million, if employment benefits and taxes are included).</p> <p>Honorary Professor Andrew Stoeckel, of the Centre for Applied Macroeconomic Analysis at the Australian National University undertook an independent peer review of the BAE economic impact assessment update undertaken in October 2018. This peer review was undertaken in response to recommendation R20, its purpose to determine whether the concerns and recommendations raised in BISOE 2017 had been adequately addressed. This report is included as Appendix H.2. Hon. Prof. Stoeckel concluded that the 2018 update of the Project had satisfactorily addressed the concerns and recommendations of the review by BISOE, and that the requirements of recommendation R20 had been met.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R21	The Department should address whether assumptions in the Updated Economic Impact Assessment in regard to employment numbers and percentage of unskilled workers and whether these come from outside the local area are consistent with the assumptions used in the Social Impact Assessment	<p>The underlying assumptions used in both the revised EIA and the updated SIA are the same. The assumptions in the revised EIA with respect to employment numbers, percentage of unskilled workers and whether these come from outside the local area are consistent with the updated SIA, and also the original SIA presented in the EIS.</p> <p>While there are some similarities in the SIA and the revised EIA, they serve a different purpose. The SIA uses LGA as its primary data source as this dataset best represents those most likely to be impacted (directly and indirectly) from the project. The reason is most people will reside, socialise, interact and access services within the LGA and those services are most likely provided within that geographic location. Additionally, Hume will be adopting a policy where workers need to reside 45 minutes from site, which further requires the SIA to assess the impacts using LGA level data. Conversely, the revised EIA necessitates a broader geographic area due to:</p> <ol style="list-style-type: none"> relevant guidelines; and to more accurately gauge the economic activity as a result of the project. <p>This is particularly important in terms of the supply chain. The SIA refers to the revised EIA, the same as other technical reports, when assessing the regional procurement ie SA3 level data.</p>
R22	The Applicant is to address the residual economic uncertainties, regardless of the strict interpretation of the 2015 Guidelines and Treasury Guidelines.	<p>The revised EIA follows the approach set out in the 2015 guidelines and seeks to provide a greater degree of transparency across all aspects of the EIA.</p> <p>An additional 11 tables contain information on royalty calculation, income tax calculation, net producer surplus calculation, predicted external effects, costs incurred to date to mitigate external effects, groundwater licences required and held, recorded prices for groundwater licence transfers within the Sydney Nepean Groundwater Source Zones 1 and 2, project emissions valuations, direct labour inputs (FTE averages of operational workforce, FY2023 to FY 2042), net income increase (annual), analysis of direct expenditures (excluding labour), predicted external effects and a LEA summary.</p> <p>The CBA has been presented excluding employee benefits and additional information to outline costs, revenues and externalities is provided. The estimated net benefit to NSW from the Hume Coal Project (including the Berrima Rail Project) would be \$192 NPV.</p>
R23	The Applicant or the Department, or both of them, should review the market for coking coal, including the most recent forecasts by the Australian Government.	<p>The market for metallurgical coal is driven by the demand for steel. Globally, the demand for steel is forecast to increase, driven in particular by increased urbanisation in South and South-east Asian countries.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R24	The Applicant should consider updating its Social Impact Assessment in accordance with the Department's 'Social Impact Assessment Guidelines – September 2017' and ensure consistency with the assumptions of the revised Economic Impact Assessment.	<p>The underlying assumptions used in both the updated SIA and the revised EIA are the same.</p> <p>The updated SIA identifies the Social Impact Assessment Guideline – 2017 as the primary assessment guideline with which this SIA was conducted. It demonstrates the definitions and matters presented in the SIA guideline and their application in the creation of an SIA framework and identifies the primary SIA principles, and assists in the determination of the level of social risk posed by social impacts based on the consequence and likelihood of the potential impacts, as outlined in Section C3 of the Social Impact Assessment Guideline – 2017.</p> <p>The linkages between the issues raised in submissions/consultation and in analysis of the updated social baseline and the SIA matters presented in the Social Impact Assessment Guideline – 2017 are considered throughout the updated SIA report. The updated SIA applies a wide range of engagement techniques implemented throughout the assessment process and justifies their purpose in social impact assessment as outlined in Section 2.3 of the Social Impact Assessment Guideline – 2017. Additional evidence from relevant stakeholders has also been included.</p> <p>The updated SIA modified the assessment to demonstrate the potential impacts based on the key links to social impact definition and the SIA matters outlined within the Social Impact Assessment Guidelines – 2017 and demonstrates the opportunity to promote better development outcomes through a focus on minimising negative social impacts and enhancing positive social impacts.</p>
R25	The Department, regardless of any further assessment provided by the Applicant, should assess the Project in accordance with its 'Social Impact Assessment Guidelines – September 2017' and report on the findings of this assessment in its Final Assessment Report.	As above.
R26	The Department should provide an updated and detailed assessment of all relevant components under Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report.	Recommendation R26 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.1 of this report.
R27	The Applicant should update its consideration of the objects of the Environmental Planning and Assessment Act 1979 and utilise the definition of 'Ecologically Sustainable Development' from the Protection of the Environment Administration Act 1991.	<p>An assessment of the project against the principles of ESD is provided in section 24.6 of the EIS.</p> <p>This is based upon the definition of ESD noted in the Commonwealth's 1992 National Strategy for Ecologically Sustainable Development and the EP&A Act.</p> <p>Consideration of the project against the principles of ESD, as defined in the NSW <i>Protection of the Environment Administration Act 1991</i> is provided in Appendix K.2 of this report.</p>

Table ES1 **Summary responses to IPC recommendations**

Reference number	IPC recommendations	Summary response
R28	The Department should provide an updated and detailed assessment of the public interest, the objects of the Environmental Planning and Assessment Act 1979 and 'Ecologically Sustainable Development' with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report, including the further information recommended in this report by the Commission.	Recommendation R28 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.2 of this report
R29	<p>The Department should include in its Final Assessment Report to the Commission an assessment of the public benefits of the Project which give consideration of whether:</p> <ul style="list-style-type: none"> iii) the economic benefits of the Project outweigh its costs to the local community (section 4.15(1)(b) of the Environmental Planning and Assessment Act 1979); and iv) the public benefits of the Project outweigh the public benefits of other land uses (clause 12 (b) of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007). 	Recommendation R29 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.1 of this report.
R30	The Department should invite relevant Government agencies to review and provide comment on any new information provided by the Applicant since the Department's Preliminary Assessment Report was published, including the content of this report. In its Final Assessment Report to the Commission, the Department should consider any further Agency feedback as well as the content of this report, the Materials, and any additional information produced in response to this Report and its recommendations.	Hume Coal invites Government agencies to review and provide comment on the additional work undertaken in support of this IPC response.

Table of Contents

Executive Summary	ES.1
1 Introduction	1
1.1 Background	1
1.2 Purpose of this report and document structure	1
2 Project description	6
2.1 Overview	6
2.2 Hume Coal Project	6
2.3 Berrima Rail Project	8
2.4 The applicant	13
3 Environmental assessment timeline and process	14
3.1 Background	14
3.2 Secretary's environmental assessment requirements	15
3.3 Controlled action declaration	15
3.4 Environmental impact statements	15
3.5 Response to submissions	16
3.6 DPIE preliminary assessment report	16
3.7 Independent Planning Commission	18
3.7.1 Approach to responding to the Independent Planning Commission	19
3.8 Existing and proposed commitments	19
3.8.1 Summary of management and mitigation measures	20
3.8.2 Summary of commitments	23
4 Mining method and safety (R1, R2, R3)	28
4.1 Introduction and background	28
4.2 Independent Planning Commission recommendations	28
4.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations	28
4.4 Analysis and response to Independent Planning Commission's findings	29
4.5 Analysis and response to Independent Planning Commission recommendations R1, R2 and R3	30
4.5.1 Detailed response to R1	30
4.5.2 Detailed response to R2	31
4.5.3 Detailed response to R3	32
5 Groundwater (R4, R5, R6)	33

5.1	Introduction and background	33
5.1.1	EIS	33
5.1.2	RTS	33
5.1.3	IPC response	33
5.2	IPC recommendations	34
5.3	Approach for responding to IPC assessment, findings and recommendations	34
5.4	Analysis and response to Commission's findings	35
5.4.1	Detailed response to groundwater model related items	39
5.4.2	Detailed response to make good items	45
5.5	Analysis and response to recommendations R4, R5 and R6	49
5.5.1	Detailed response to R4	49
5.5.2	Detailed response to R5	52
5.5.3	Detailed response to R6	55
6	Surface water (R7 and R8)	60
6.1	Introduction and background	60
6.1.1	EIS	60
6.1.2	RTS	60
6.1.3	IPC response	60
6.2	IPC recommendations	60
6.3	Approach for responding to IPC assessment, findings and recommendations	60
6.4	Analysis and response to Commission's findings	61
6.4.1	Response to item 185	61
6.5	Analysis and response to Commission's recommendations	61
6.5.1	Detailed response to R8 (PWD)	62
7	Surface level reject emplacement (R9)	64
7.1	Introduction and background	64
7.2	Independent Planning Commission recommendation	64
7.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	64
7.4	Analysis and response to Independent Planning Commission's findings	64
7.5	Analysis and response to recommendation R9	65
7.5.1	Detailed response to R9	65
8	Noise impacts (R10, R11)	66
8.1	Introduction and background	66
8.1.1	Environmental impact statements	66

8.1.2	Response to submissions	66
8.1.3	Independent Planning Commission response	66
8.2	Independent Planning Commission recommendations	67
8.3	Approach for responding to IPC assessment, findings and recommendations	67
8.3.1	R10 – Assessment Location 7	67
8.3.2	R11 – mitigation measures	67
8.4	Analysis and response to Independent Planning Commission's findings	67
8.5	Analysis and response to Independent Planning Commission's recommendations	68
8.5.1	Detailed response to R10	68
8.5.2	Detailed response to R11	69
9	Air quality (R12)	70
9.1	Introduction	70
9.1.1	Environmental impact statements	70
9.1.2	Response to submissions	70
9.1.3	Independent Planning Commission response	70
9.2	Independent Planning Commission recommendations	70
9.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	70
9.4	Analysis and response to Independent Planning Commission's findings	71
9.5	Analysis and response to Independent Planning Commission's recommendations	71
9.5.1	Detailed response to R12	71
10	Greenhouse gas emissions (R13, R14)	82
10.1	Introduction	82
10.1.1	Environmental impact statements	82
10.1.2	Response to submissions	82
10.1.3	Independent Planning Commission response	82
10.2	Independent Planning Commission recommendations	82
10.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	82
10.4	Analysis and response to Independent Planning Commission's findings	83
10.5	Analysis and response to Independent Planning Commission's recommendations	83
10.5.1	Detailed response to R13	84
10.5.2	Detailed response to R14	84
11	Visual impact (R15)	86
11.1	Introduction	86

11.1.1	Environmental impact statements	86
11.1.2	Response to submissions	86
11.1.3	Independent Planning Commission response	86
11.2	Independent Planning Commission recommendations	86
11.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	87
11.4	Analysis and response to Independent Planning Commission's findings	87
11.4.1	Summary	87
11.4.2	Response to item 268	88
11.5	Analysis and response to Independent Planning Commission's recommendations	88
11.5.1	Response to recommendation R15	89
12	Historical Heritage (R16, R17, R18)	93
12.1	Introduction	93
12.1.1	Environmental Impact Statement	93
12.1.2	Response to submissions	93
12.1.3	Response to the Independent Planning Commission	93
12.2	Independent Planning Commission recommendations	94
12.3	Approach for responding to the Independent Planning Commission's assessment, findings and recommendations	94
12.4	Analysis and response to Independent Planning Commission's findings	94
12.4.1	Response to item 285	95
12.5	Analysis and response to Independent Planning Commission's recommendations	97
12.5.1	Detailed response to R17	98
13	Biodiversity (R19)	106
13.1	Introduction and background	106
13.1.1	Environmental impact statement	106
13.1.2	Response to submissions	106
13.1.3	Response to Independent Planning Commission	107
13.2	Independent Planning Commission recommendations	107
13.3	Approach for responding to the Independent Planning Commission assessment, findings and recommendations	107
13.4	Analysis and response to the Independent Planning Commission's findings	108
13.5	Analysis and response to Independent Planning Commission's recommendations	108
13.5.1	Detailed response to R19	109
14	Economic (R20, R21, R22)	110
14.1	Introduction and background	110

14.1.1	Environmental impact statement	110
14.1.2	Response to submissions	110
14.1.3	Independent Planning Commission response	111
14.2	Independent Planning Commission recommendations	112
14.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	113
14.4	Analysis and response to Independent Planning Commission's findings	113
14.5	Analysis and response to Independent Planning Commission's recommendations	115
14.5.1	Detailed response to R20	117
14.5.2	Detailed response to R21	118
14.5.3	Detailed response to R22	119
15	Nature of the coal market (R23)	121
15.1	Introduction and background	121
15.2	Independent Planning Commission recommendations	121
15.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	121
15.4	Analysis and response to Independent Planning Commission's findings	121
15.5	Analysis and response to Independent Planning Commission's recommendations	123
15.5.1	Detailed response to R23	123
16	Social impact (R24, R25)	125
16.1	Introduction and background	125
16.1.1	Environmental impact statement	125
16.1.2	Response to submissions	125
16.1.3	Independent Planning Commission response	125
16.2	Independent Planning Commission recommendations	125
16.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	126
16.4	Analysis and response to Independent Planning Commission's findings	126
16.4.1	Detailed response to item 400	126
16.5	Analysis and response to Independent Planning Commission's recommendations	127
16.5.1	Detailed response to R24	127
17	Statutory environmental planning instruments (R26)	129
17.1	Introduction and background	129
17.2	Independent Planning Commission recommendations	129
17.3	Approach for responding to IPC assessment, findings and recommendations	129
17.4	Analysis and response to Independent Planning Commission's findings	129

17.5	Analysis and response to Independent Planning Commission's recommendations	134
18	Ecologically sustainable development (public interest) (R27, R28)	135
18.1	Introduction and background	135
18.2	Independent Planning Commission recommendations	135
18.3	Approach for responding to Independent Planning Commission assessment, findings and recommendations	135
18.4	Analysis and response to Independent Planning Commission's findings	136
18.5	Analysis and response to Independent Planning Commission's recommendations	138
19	Other matters (R29, R30)	139
19.1	Introduction and background	139
19.2	Independent Planning Commission recommendations	139
19.3	Response to Independent Planning Commission's recommendations	139
20	Project evaluation	141
20.1	Overview	141
20.2	Water resources	141
20.3	Project justification and evaluation	142
20.3.1	Significance of the resource	142
20.3.2	Economic justification	143
20.3.3	Social justification	143
20.3.4	Environmental justification	144
20.3.5	Ecologically sustainable development	145
20.4	Conclusion	145
21	References	147

Appendices

Appendix A Independent review of residual issues of disagreement between Hume Coal Pty Ltd and the Department of Planning, Infrastructure and the Environment associated with the Hume Coal Project

Appendix B Updated Water technical assessment

Appendix C Updated noise assessment

Appendix D Supplementary greenhouse gas emissions and mitigations/offset assessment

Appendix E Updated visual impact assessment

Appendix F Updated Statement of Heritage Impact

Appendix G Groundwater dependence assessment for cultural heritage landscapes and gardens

Appendix H Economic Impact Assessment

Appendix I Hume Coal market report

Appendix J Updated social impact assessment

Appendix K Statutory environmental planning instruments and public interest assessment

Tables

Table ES1	Summary responses to IPC recommendations	2
Table 1.1	IPC recommendations and locations where addressed	1
Table 3.1	Key issues raised in DPIE's preliminary assessment report of the Project	17
Table 3.2	Summary of management and mitigation measures – Hume Coal Project	20
Table 3.3	Summary of commitments – Hume Coal Project	23
Table 3.4	Summary of commitments – Berrima Rail Project	26
Table 4.1	Response to Independent Planning Commission findings– mining method and safety	29
Table 4.2	Response to Independent Planning Commission recommendations – mining method and safety	30
Table 5.1	Response to IPC findings – Groundwater	35
Table 5.2	Groundwater model layers	42
Table 5.3	Response to IPC recommendations – Groundwater	49
Table 6.1	Response to IPC findings – Surface water	61
Table 6.2	Response to IPC recommendations – Surface water	62
Table 7.1	Response to Independent Planning Commission findings – Surface level reject emplacement	64
Table 7.2	Response to Independent Planning Commission recommendations – surface level reject emplacement	65
Table 8.1	Response to Independent Planning Commission findings – Noise impacts	67
Table 8.2	Response to Independent Planning Commission recommendations – Noise impacts	68
Table 9.1	Response to Independent Planning Commission findings – Air quality	71
Table 9.2	Response to Independent Planning Commission recommendations – Air quality	71
Table 10.1	Response to Independent Planning Commission findings – Greenhouse gas emissions	83
Table 10.2	Response to Independent Planning Commission recommendations – Greenhouse gas emissions	84
Table 11.1	Response to Independent Planning Commission findings– visual impacts	87
Table 11.2	Response to Independent Planning Commission recommendations – Visual impacts	88
Table 11.3	Heights of key surface mine and rail infrastructure and existing industrial elements	89
Table 11.4	SPV Zone viewshed photographic summary	90
Table 12.1	Response to Independent Planning Commission findings – Historical heritage	95
Table 12.2	Response to Independent Planning Commission recommendations – Historical heritage	97
Table 13.1	Response to Independent Planning Commission findings – Biodiversity	108
Table 13.2	Response to Independent Planning Commission recommendation – Biodiversity	108
Table 14.1	Net economic benefit to NSW and Southern Highlands SA ₃ Region (BAE 2017)	110

Table 14.2	Net economic benefit to NSW and Southern Highlands SA ₃ Region (BAE 2018)	111
Table 14.3	Net economic benefit to NSW (BAE 2020)	112
Table 14.4	Response to Independent Planning Commission findings– Economic	113
Table 14.5	Response to Independent Planning Commission recommendations – Economic	115
Table 15.1	Response to Independent Planning Commission findings– Nature of the market for coal	121
Table 15.2	Response to IPC recommendations – Nature of the market for coal	123
Table 16.1	Response to Independent Planning Commission’s findings– Social impact	126
Table 16.2	Response to Independent Planning Commission’s recommendations – Social impact	127
Table 17.1	Response to Independent Planning Commission findings– Statutory environmental planning instruments	130
Table 17.2	Response to Independent Planning Commission recommendations – Statutory environmental planning instruments	134
Table 18.1	Response to Independent Planning Commission findings – Ecologically sustainable development	136
Table 18.2	Response to Independent Planning Commission recommendations – Ecologically sustainable development	138
Table 19.1	Response to Independent Planning Commission recommendations – Other matters	139

Figures

Figure 2.1	Regional setting	9
Figure 2.2	Local setting	10
Figure 2.3	Indicative project layout	11
Figure 2.4	Surface infrastructure layout	12
Figure 3.1	The assessment process to date	15
Figure 5.1	Hume Coal mine progression, reject emplacement and water injection	44
Figure 5.2	Hydraulic head in bores schematic – pre-mining and during mining	47
Figure 5.3	Make good flow chart	48
Figure 5.4	Groundwater modelling continuous improvement	51
Figure 5.5	Comparison of groundwater model and Hume Coal geological model extents	54
Figure 5.6	Groundwater inflow to open cut or underground workings –comparison between Hume Coal and other projects	56
Figure 5.7	Distance to 2 m drawdown contour–comparison between Hume Coal and other projects	57
Figure 5.8	Predicted time for groundwater recovery – comparison between Hume Coal and other projects	58
Figure 9.1	Annual wind roses – Hume 1 meteorological station – 2013 to 2018	74
Figure 9.2	Annual wind roses – Hume 2 meteorological station – 2013 to 2018	75
Figure 9.3	Annual wind roses – BoM Moss Vale meteorological station – 2013 to 2018	76
Figure 9.4	Annual wind roses – Boral Berrima Cement meteorological station – 2013 to 2018	77
Figure 9.5	Distribution of wind speed and direction – Hume 1 meteorological station – 2013 to 2018	78

Figure 9.6	Distribution of wind speed and direction – Hume 2 meteorological station – 2013 to 2018	79
Figure 9.7	Distribution of wind speed and direction – BoM Moss Vale meteorological station – 2013 to 2018	80
Figure 9.8	Distribution of wind speed and direction – Boral Berrima meteorological station – 2013 to 2018	81

1 Introduction

1.1 Background

This report has been prepared in response to the Independent Planning Commission's (IPC) Independent Planning Assessment Report, dated 27 May 2019, on the Hume Coal Project (SSD 7172) and associated Berrima Rail Project (SSD 7171). The IPC's Independent Planning Assessment Report was prepared following the NSW Minister for Planning's request, dated 4 December 2018, under section 2.9(1)(d) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to conduct a public hearing and assess the merits of the projects.

1.2 Purpose of this report and document structure

The purpose of this report (IPC response report) is to respond directly to the findings and recommendations as published in the Independent Planning Commission Assessment Report (the IPC assessment report). Specifically, this IPC response report:

1. Summarises the statutory assessment process which the projects are subject to under the EP&A Act, including a detailed description of the IPC assessment phase.
2. Provides a summary project description of the Hume Coal Project and associated Berrima Rail Project, which together form 'the Project'.
3. Analyses, and where necessary, responds to the 'Material Considered by the Commission' (as described in Section 7.0 of the IPC assessment report) which was referenced, reported or referred to in the IPC assessment or findings. This includes excerpts of the (former) NSW Department of Planning and Environment, now the NSW Department of Planning Industry and the Environment (DPIE), Preliminary Assessment Report (PAR) and other NSW Government agency submissions and correspondence to the IPC.
4. Addresses and responds, with the aid of updated and revised technical studies (see appendices), to the findings made by the IPC and all the recommendations within the IPC assessment report directed to the Hume Coal Pty Limited (Hume Coal) as the applicant of the projects, as described in Table 1.1.
5. Where necessary, addresses items presented in the IPC assessment report that the applicant feels are erroneous, unsubstantiated or are otherwise worthy of response.

The recommendations by the IPC, and the location(s) in this report where they are addressed are presented in Table 1.1.

Table 1.1 **IPC recommendations and locations where addressed**

Reference number	IPC recommendations	Locations where addressed
R1	Because the Applicant and Department remain a considerable distance apart regarding their positions on the safety of the pine feather method of mining, the Commission suggests that one of the Applicant or the Department, or both of them jointly, engage a new independent expert with experience in innovative coal mining technology with a view to resolving ongoing differences of opinion. This investigation would involve taking into account new information from the Resources Regulator.	This recommendation is addressed in Section 4.5.1 of this report and an independent review of the proposed mining method is provided in Appendix A.
R2	As a result of the outcomes of R1, the Applicant needs to advise if there are consequences that would arise in relation to mine design and economics (resource recovery).	This recommendation is addressed in Section 4.5.2 of this report and an independent review of the proposed mining method is provided in Appendix A.

Table 1.1 IPC recommendations and locations where addressed

Reference number	IPC recommendations	Locations where addressed
R3	The Applicant should provide the Project Risk Assessment to the Department, and any other relevant Government agencies, if necessary on a confidential basis, for consideration in any further Department or other Government assessment or response in the next stage of the assessment process.	A summary response to this recommendation is addressed in Section 4.5.3 of this report. A detailed response to this recommendation has been addressed in separate correspondence from Hume Coal to DPIE.
R4	That the Department review the advice of Department of Industry - Water dated 24 April 2019 and the Applicant's correspondence of the 17 May 2019 and gives consideration to requesting the completion of the revised groundwater flow model, taking into consideration the advice provided.	This recommendation is addressed in Section 5.5.1 of this report and discussed further in Appendix B and Annexure A of Appendix B.
R5	Because the Applicant and Department of Industry - Water remain a considerable distance apart regarding their positions on the groundwater modelling, the Commission suggests that the Department or the Applicant, or both of them jointly (and in any case in consultation with Department of Industry - Water), engage a new independent expert (or alternatively a small technical group with Chair) with experience in groundwater modelling with a view to resolving ongoing differences of opinion. The independent expert/Chair should consider: <ul style="list-style-type: none"> • what practical steps, if any, can be taken to make the model a class 2 model or seek agreement on the class of the model; • what additional work is required to establish the extent to which the emplacement of water in mined-out voids will reduce the level of drawdown in the later years of the project; • the range used for the input parameters in the modelling sensitivity/uncertainty analysis and recommend if a wider range is required so that there is no unreasonable truncation of results; and • if additional geological information is required. 	The response to questions raised in R5 is provided in Section 5.5.2 of this report. A detailed review of groundwater model completed by Dr. Lloyd Townley is provided as Annexure C of Appendix B.
R6	That the Department give close attention to the practical adequacy of make good provisions during the final assessment process, with an independent review if necessary. This should include the practical aspects such as dispute resolution and economics as well as the technical.	This recommendation is addressed in Section 5.5.3 of this report and discussed further in Appendix B.
R7	The Applicant is to confirm whether the provisional Water Treatment Plant does form part of the Project – and if so, provide suitable information to permit an appropriate assessment of its impacts.	The WTP no longer forms part of the Project. A response to this recommendation is provided in Section 6 of this report.
R8	Should underground emplacement and water impounded have to cease for any reason, the Applicant is to confirm how long under normal mining operations it would take for the reject emplacement stockpile and Primary Water Dam to reach capacity.	The surface water aspects of this recommendation are addressed in Section 6.5.1 and discussed further in Appendix B.
R9	The Applicant is to provide greater detail on its surface level reject emplacement process, including the use of the temporary coal reject stockpile (as discussed in paragraph 188) once underground emplacement has been commenced.	This recommendation is addressed in Section 7.5.1 of this report.
R10	The Department is to consider and advise if Assessment Location No 7 should be afforded mitigation rights under the application of the Noise Policy for Industry.	This recommendation is addressed in Section 8.5.1 of this report. An updated noise assessment report is provided in Appendix C.

Table 1.1 **IPC recommendations and locations where addressed**

Reference number	IPC recommendations	Locations where addressed
R11	The Applicant and Department should explore opportunities to further mitigate noise impacts. Such opportunities may include more extensive noise monitoring, closer attention to atmospheric conditions, incorporation of any recently developed rail and rolling stock modifications, construction of noise bunds and physical barriers and stop-work when exceedances are observed.	This recommendation is addressed in Section 8.5.2 of this report. An updated noise assessment report is provided in Appendix C.
R12	The Department's Final Assessment Report should confirm the suitability of the assumptions in the Applicant's modelling in relation to the prevailing wind data utilised as this was questioned by members of the public in submissions.	This recommendation is addressed in Section 9.5.1 of this report.
R13	The Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.	This recommendation is addressed in Section 10.5.1 of this report. An updated assessment of greenhouse gas emissions is provided in Appendix D.
R14	The Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.	This recommendation is addressed in Section 10.5.2 of this report. An updated assessment of greenhouse gas emissions, associated mitigation methods and offsets is provided in Appendix D.
R15	<p>Further visual impact assessment should be completed for assessment and should include at a minimum:</p> <ul style="list-style-type: none"> dimensioned plans of the project area and the railway extension. The plans should include a survey with contours and the location and size of all works as well as the relative heights above ground level of significant structures, including the coal stockpiles, the coal loader and primary water dam walls; views of the project area and railway extension from sensitive properties within and in the vicinity of the Project area (including heritage items), from the Hume Highway and Medway Road or any likely affected property. The distance and heights of the viewing points should be provided; views should be without mitigation measures (screen planting) and with mitigation measures in place after 5 years and 15 years; any findings in relation to groundwater impacts on gardens, plantings and landscape settings; and further assessment of the impacts of night-time lighting. <p>Any photomontages of the view impacts should be certified in accordance with the Land and Environment Court's Direction on use of photomontages http://www.lec.justice.nsw.gov.au/Pages/practice_procedure/directions.aspx</p>	A detailed response to the items requested in R15 is provided in Section 11.5.1. An updated visual impact assessment is provided in Appendix E.
R16	Further information should be provided to allow the assessment of the potential impact of water table drawdown on heritage items (including gardens, plantings and landscape settings) within or in the vicinity of the Project area. The information should include confirmation of the existing level of the water table and the anticipated drawdown at both the 67th percentile and the 90th percentile.	<p>A detailed response to R16 is provided in Section 12.5.1.</p> <p>An updated assessment of the effects of potential groundwater drawdown on heritage items is provided in Annexure A of Appendix F.</p>

Table 1.1 IPC recommendations and locations where addressed

Reference number	IPC recommendations	Locations where addressed
R17	The Applicant should address the recommendations of the Heritage Council of NSW's correspondence to the Department dated 17 August 2018 as referenced in paragraph 283.	<p>A detailed response to the items requested in R17 is provided in Section 12.5.2i, Section 12.5.2ii and Section 12.5.2iii.</p> <p>An assessment of the Berrima, Sutton Forest and Exeter Cultural Landscape is provided in Annexure B of Appendix F.</p> <p>The values of Mereworth House and Garden are assessed in Annexure C of Appendix F.</p> <p>A supplementary Archaeology Assessment is provided in Annexure D of Appendix F.</p>
R18	The Statement of Heritage Impact Assessment should be updated in response to recommendations R16 and R17, and the visual impact of the project on the significance of the above items and the cultural landscape in accordance with an updated visual impact assessment (see R15 in Visual Impact recommendations).	An updated Statement of Heritage Impact is provided in Appendix F.
R19	The Applicant is to undertake further technical assessment on the impacts on private gardens, exotic trees and native vegetation from a declining water table	This recommendation is addressed in Section 13.5.1 of this report. A groundwater dependence assessment for cultural heritage landscapes and gardens is provided in Appendix G.
R20	<p>The additional information provided by the Applicant, including the Updated Economic Impact Assessment prepared by BA Economics in October 2018, should be peer reviewed to determine:</p> <ol style="list-style-type: none"> whether the concerns and recommendations in the Economic Impact Assessment Review dated December 2017 prepared by BIS Oxford Economics (BISOE 2017) have been adequately justified, including concerns about transparency in relation to project costs, revenues and externalities; and the implications and reasonableness of changes/assumptions in the Updated Economic Impact Assessment including the change to the project description from that in the Hume Coal Environmental Impact Statement and any cost implications. <p>Following the peer review, if the net economic benefit of the project remains uncertain and there are outstanding concerns about the assumptions and/or information, a further Economic Impact Assessment should be prepared that is consistent with the recommendations in BISOE 2017 (as set out in pages 1-3 of the Executive summary of BISOE 2017) and any further recommendations of the peer review.</p>	This recommendation is addressed in Section 14.5.1. An updated Economic Impact Assessment supporting the response to R20 is included in Appendix H.1.
R21	The Department should address whether assumptions in the Updated Economic Impact Assessment in regard to employment numbers and percentage of unskilled workers and whether these come from outside the local area are consistent with the assumptions used in the Social Impact Assessment.	<p>This recommendation is addressed in Section 14.5.2. An updated Economic Impact Assessment supporting the response to R21 is included in Appendix H.1.</p> <p>A revised Social Impact Assessment is provided Appendix J.</p>

Table 1.1 **IPC recommendations and locations where addressed**

Reference number	IPC recommendations	Locations where addressed
R22	The Applicant is to address the residual economic uncertainties, regardless of the strict interpretation of the 2015 Guidelines and Treasury Guidelines.	This recommendation is addressed in Section 14.5.3. An updated Economic Impact Assessment supporting the response to R22 is included in Appendix H.1.
R23	The Applicant or the Department, or both of them, should review the market for coking coal, including the most recent forecasts by the Australian Government.	This recommendation is addressed in Section 15.5.1. An updated Economic Impact Assessment supporting the response to R23 is included in Appendix I.
R24	The Applicant should consider updating its Social Impact Assessment in accordance with the Department's 'Social Impact Assessment Guidelines – September 2017' and ensure consistency with the assumptions of the revised Economic Impact Assessment.	This recommendation is addressed in Section 16.5.1. A revised Social Impact Assessment is provided in Appendix J.
R25	The Department, regardless of any further assessment provided by the Applicant, should assess the Project in accordance with its 'Social Impact Assessment Guidelines – September 2017' and report on the findings of this assessment in its Final Assessment Report.	This recommendation is addressed in Section 16 and Appendix J.
R26	The Department should provide an updated and detailed assessment of all relevant components under Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report.	This recommendation is addressed in Section 17.5. Additional information in support of the response to R26 is contained in Appendix K.1.
R27	The Applicant should update its consideration of the objects of the Environmental Planning and Assessment Act 1979 and utilise the definition of 'Ecologically Sustainable Development' from the Protection of the Environment Administration Act 1991.	This recommendation is addressed in Section 18.5. Additional information in support of the response to R26 is contained in Appendix K.2.
R28	The Department should provide an updated and detailed assessment of the public interest, the objects of the Environmental Planning and Assessment Act 1979 and 'Ecologically Sustainable Development' with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report, including the further information recommended in this report by the Commission.	This recommendation is addressed in Section 18. Additional information in support of the response to R26 is contained in Appendix K.2.
R29	The Department should include in its Final Assessment Report to the Commission an assessment of the public benefits of the Project which give consideration of whether: <ul style="list-style-type: none"> i. the economic benefits of the Project outweigh its costs to the local community (section 4.15(1)(b) of the Environmental Planning and Assessment Act 1979); and ii. the public benefits of the Project outweigh the public benefits of other land uses (clause 12 (b) of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007). 	This recommendation is addressed in Section 19.3. Additional information in support of the response to R26 is contained in Appendix K.1.
R30	The Department should invite relevant Government agencies to review and provide comment on any new information provided by the Applicant since the Department's Preliminary Assessment Report was published, including the content of this report. In its Final Assessment Report to the Commission, the Department should consider any further Agency feedback as well as the content of this report, the Materials, and any additional information produced in response to this Report and its recommendations.	This recommendation is addressed in Section 19.3.

2 Project description

2.1 Overview

Hume Coal proposes to construct and operate an underground coal mine and associated mine infrastructure in the Southern Coalfield of NSW (the Hume Coal Project). The mine will produce metallurgical coal with a secondary thermal coal product. Around 50 million tonnes (Mt) of run-of-mine coal (3.5 million tonnes per annum (Mtpa)) will be extracted from the Wongawilli Seam via a non-caving mining system, resulting in approximately 39 Mt of saleable coal over a 23-year project life which encompasses construction, mining and rehabilitation phases.

Hume Coal is also seeking approval in a separate development application for the construction and operation of a new rail spur and loop, known as the Berrima Rail Project. Coal produced by the Hume Coal Project will be transported to port by rail for export or to domestic markets also by rail via this new rail spur and loop.

Approval for both the Hume Coal Project and the Berrima Rail Project is sought under Part 4 Division 4.1 (State significant development) of the EP&A Act.

The Hume Coal Project and the Berrima Rail Project are adjacent to each other and are linked. Hume Coal has submitted two separate applications; however, the two projects are collectively referred to as 'the Project' in this IPC response report.

The Project has been designed from the outset to avoid, where practicable, environmental and social impacts. The concept of 'mitigation by design' is a strategic approach to environmental management, which incorporates the avoidance (rather than management) of environmental impacts in the design of the Project.

While the formal approval process commenced in 2015, the Project design and consultation commenced in 2012. Feedback from initial consultation was included in the Project design to allow potential impacts to be avoided and designed out of the Project, and reducing the need for mitigation and management measures.

2.2 Hume Coal Project

A full description of the Hume Coal Project, as assessed in this report, is provided in Chapter 2 of the Hume Coal Project environmental impact statement (EIS) (EMM 2017a).

Hume Coal holds exploration Authorisation 349 (A349), located to the west of Moss Vale in the Wingecarribee local government area (LGA). Hume Coal is seeking development consent to construct and operate an underground coal mine and associated mine infrastructure within A349 in the Project area shown in Figure 2.1. Up to 3.5 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal will be extracted from the Wongawilli Seam within the Project life of 23 years. The product split will be about 55% metallurgical coal and 45% thermal coal.

A349 covers approximately 8,900 hectares (ha), although mining is not proposed across its full extent. The proposed underground mining area is approximately 3,474 ha. The Hume Coal Project area boundary is illustrated in Figure 2.2, and covers the combined Mining Lease Application (MLA) areas for the Project that have been submitted under the NSW *Mining Act 1992* (MLA 527, MLA 528 and MLA 529; totalling 4,811 ha), as well as the parts of the Project that do not require a mining lease. The Project area is therefore larger than the combined MLA area, at 5,051 ha. Within the Project area, the surface infrastructure area is limited to approximately 117 ha.

Product coal will be transported by rail to Port Kembla for shipment to export markets and by rail to domestic customers. Rail works and rail use are covered by a separate development application for the Berrima Rail Project, which is described further in Section 2.3.

The indicative Project layout, including surface infrastructure locations and the underground mine, is shown in Figure 2.3. The mine surface infrastructure area is shown in further detail in Figure 2.4.

The key components of the Hume Coal Project are:

- Establishment of temporary construction offices and a temporary construction accommodation village.
- Development and operation of an underground coal mine, comprising of approximately two years of construction and 19 years of mining, followed by a closure and rehabilitation phase of up to two years, leading to a total Project life of 23 years. Coal extraction will commence during the second year of construction following excavation of the drifts, and hence there will be some overlap between the construction and operational phases.
- Extraction of approximately 50 Mt of ROM coal from the Wongawilli Seam, at a rate of up to 3.5 Mtpa. Low impact mining methods will be used, which will have negligible subsidence impacts.
- Following processing of ROM coal in the coal handling and preparation plant (CHPP), production of up to 3.5 Mtpa of metallurgical and thermal coal for sale to international and domestic markets.
- Construction and operation of associated mine infrastructure, mostly on cleared land, including:
 - one personnel and materials drift access and one conveyor drift access from the surface to the coal seam;
 - ventilation shafts, comprising one upcast ventilation shaft and fans, and up to two downcast shafts installed over the life of the mine, depending on ventilation requirements as the mine progresses;
 - a surface infrastructure area, including administration, bathhouse, washdown and workshop facilities, fuel and lubrication storage, warehouses, laydown areas, and other facilities. The surface infrastructure area will also comprise the CHPP and ROM coal, product coal and temporary emergency reject stockpiles;
 - surface and groundwater management facilities, including storages, pipelines, pumps and associated infrastructure;
 - overland conveyors;
 - rail load-out facilities;
 - a small explosives magazine;
 - ancillary facilities, including fences, access roads, car parking areas, helipad and communications infrastructure; and
 - environmental management and monitoring equipment.
- Establishment of site access from Mereworth Road, and construction or upgrade of minor internal roads.
- Relocation of some existing utilities, such as part of the existing Wingecarribee Shire Council easement that traverses the Project area containing power and water infrastructure associated with Medway Dam.
- Coal reject emplacement underground, in the mined-out voids.
- Ongoing resource definition activities, along with geotechnical and engineering testing and other fieldwork to facilitate detailed design.
- Peak workforces of approximately 414 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations.
- Decommissioning of mine infrastructure and rehabilitating the area once mining is complete, so that it can support land uses similar to current agricultural land uses.

The Hume Coal Project incorporates design elements that are leading practice; some of which set a new benchmark for underground coal mining in NSW. For example, the rail wagons that will transport product coal will be covered, both when full of coal and on the return route when empty. All coal reject material (the stone that is separated out of the coal during processing) will be returned underground to partially backfill the mined-out voids, reducing potential visual and other environmental impacts that could be associated with a permanent surface emplacement area. A mining system will be used which leaves pillars of coal in place so that the overlying strata is supported, rather than collapsing into the mined-out void, and therefore surface subsidence impacts will be negligible. By minimising disruption to the overlying strata, associated potential groundwater impacts will also be minimised.

2.3 Berrima Rail Project

A full description of the Berrima Rail Project, as assessed in this report is provided in Chapter 2 of the Berrima Rail Project EIS (EMM 2017b) with the proposed 'alternative alignment' now the chosen alignment. All other aspects of the Berrima Rail Project remain as presented in Chapter 2 of the Berrima Rail Project EIS.

Hume Coal is seeking approval for the Berrima Rail Project, which will enable coal produced by the Hume Coal Project to be transported to market. The Hume Coal Project seeks approval for all activities associated with the excavation and processing of coal, and construction and operation of the required coal loading facilities to load the coal into train wagons. The Berrima Rail Project comprises the construction and operation of the new rail line and loop.

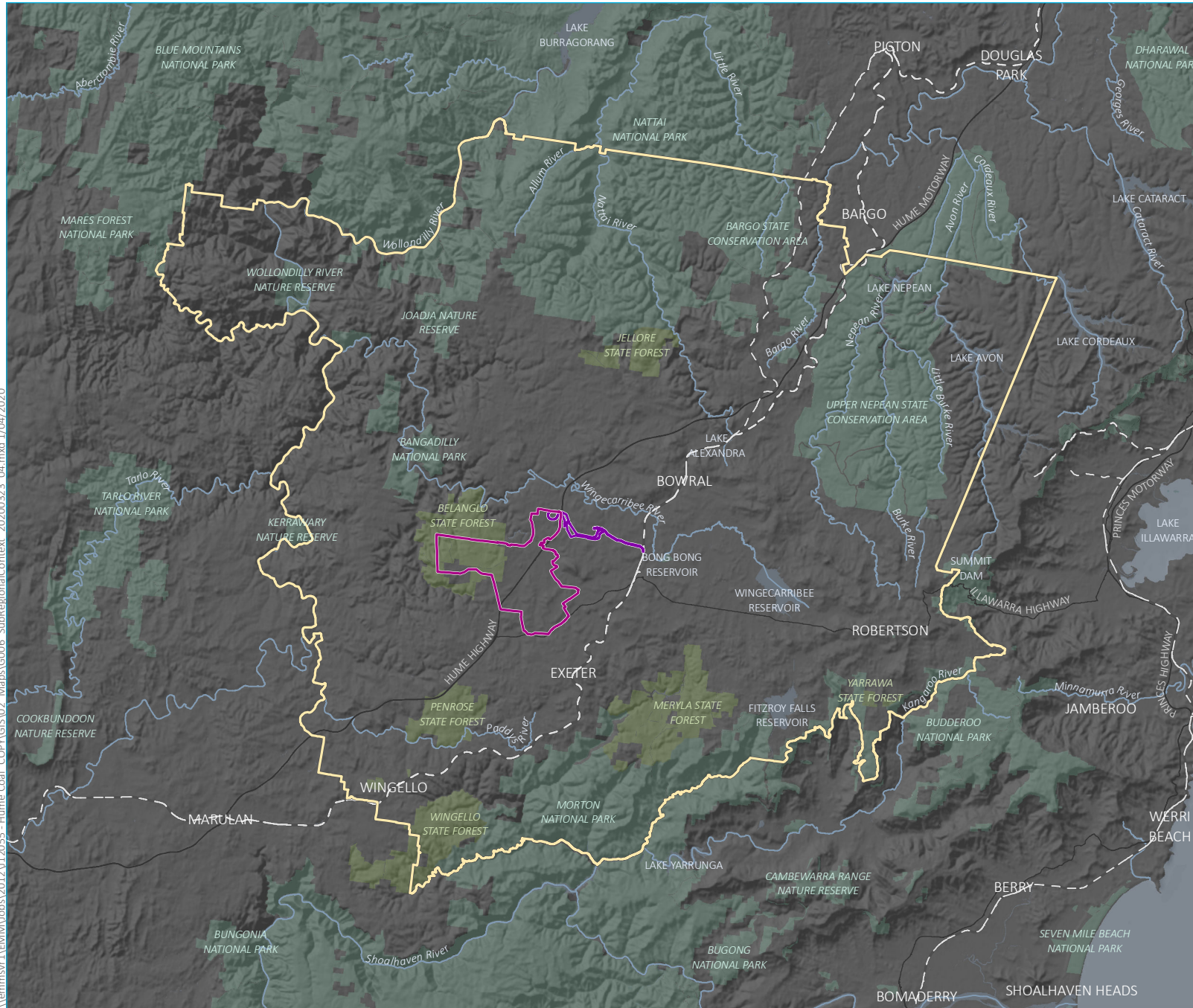
The conceptual layout of the Berrima Rail Project is illustrated in Figure 2.3 and Figure 2.4. This design accounts for a proposal and commenced development by Wingecarribee Shire Council (WSC) to realign approximately 700 m of Berrima Road between Taylor Avenue and Stony Creek, and would replace the T-intersection at Berrima Road and Taylor Avenue with a roundabout, and replace the existing rail level crossing into the Berrima Cement Works with a grade separated (road over rail) crossing. This design replaces the 'preferred option' presented in the Berrima Rail Project EIS.

A summary of the key components of the Berrima Rail Project, as described in Chapter 2 of the Berrima Rail Project EIS, are as follows:

- Upgrades to Berrima Junction (at the eastern end of the Berrima Branch Line) to improve the operational functionality of the junction, including extending the number 1 siding, installation of new turnouts and associated signalling on the branch line. This does not involve any work at or beyond the interface with the Australian Rail Track Corporation (ARTC) - controlled track.
- Installation of a turnout for the new spur line to service the Hume Coal Project on the existing Berrima Branch Line, approximately 1,000 m east of the Berrima Cement Works. A short section of the existing Berrima Branch Line would be shifted north, within the rail corridor on Boral-owned land, to accommodate the spur line.
- The construction of a railway underpass beneath the realigned Berrima Road, constructed through the elevated embankment for the road. No changes would be required to the existing rail connection into the cement works.
- Construction and operation of a new rail spur line from the Berrima Branch Line connection to the Hume Coal Project coal loading facility.
- Construction and operation of a grade separated crossing (railway bridge) over the Old Hume Highway.
- Construction and operation of maintenance sidings, a passing loop and basic provisioning facilities on the western side of the Old Hume Highway, including an associated access road, car parking and buildings.
- Construction and operation of the Hume Coal rail loop within the Hume Coal Project area, adjacent to Medway Road.
- Construction and operation of associated signalling, services (including water and sewerage), access tracks, power and other ancillary infrastructure.

The new rail track will involve construction of approximately 7.6 kilometres (km) of new railway track (excluding sidings). The track will be constructed to accommodate a 30 tonne (t) axle load.

\\lemmsvr1\EMM\Jobs\2012\112055 - Hume Coal - COPY\GIS\02 Maps\G006 SubRegionalContext 20200323 04.mxd 1/04/2020

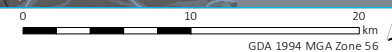


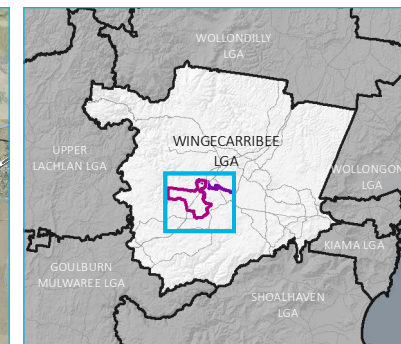
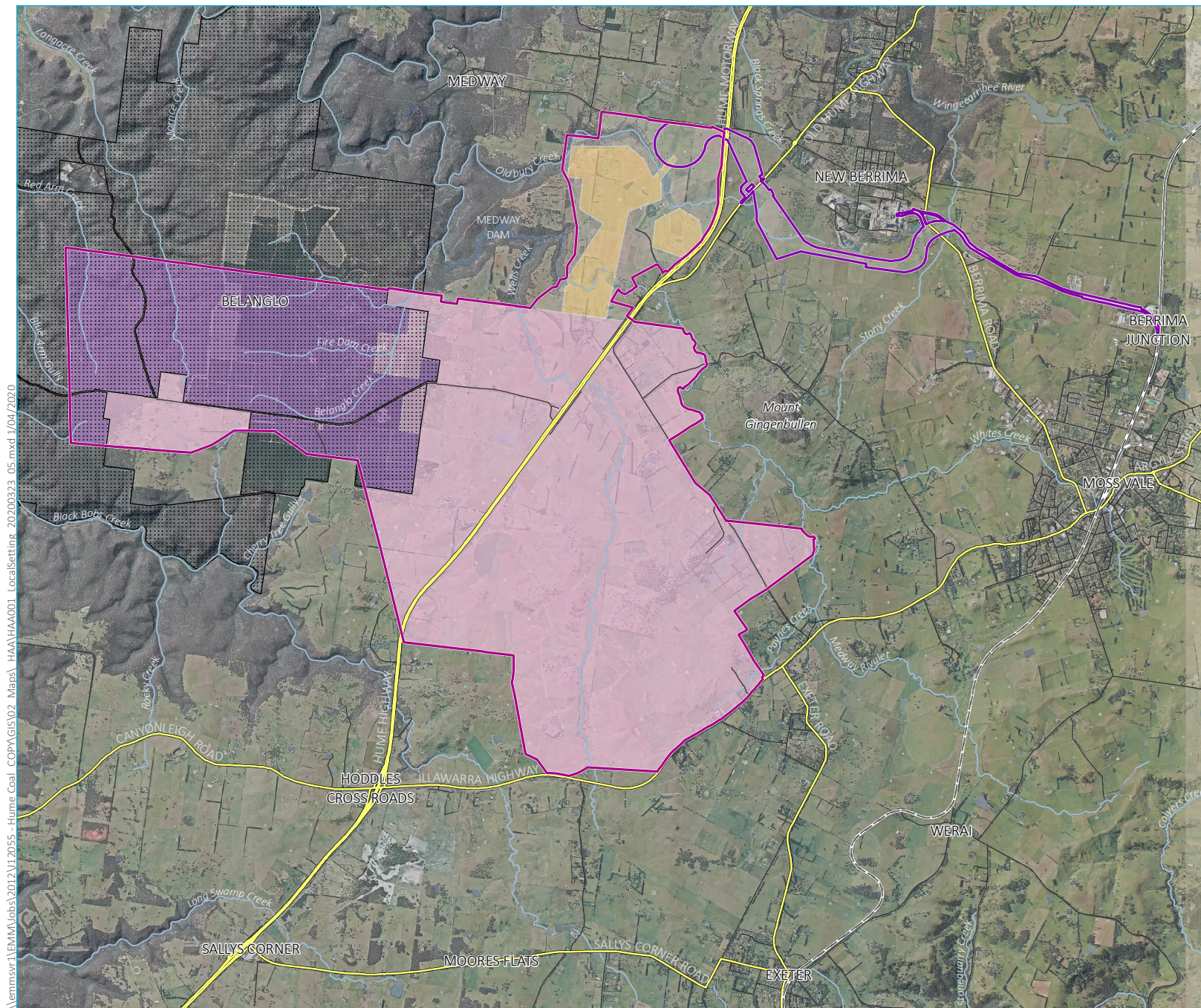
- KEY**
- Hume Coal Project area
 - Berrima Rail Project area
 - Wingecarribee Shire
 - local government area
 - Rail line
 - Motorways and primary roads
 - River
 - Named waterbody
 - NPWS reserve
 - State forest

Regional setting

Hume Coal and Berrima Rail Project
IPC response report
Figure 2.1

Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)



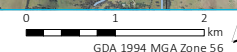


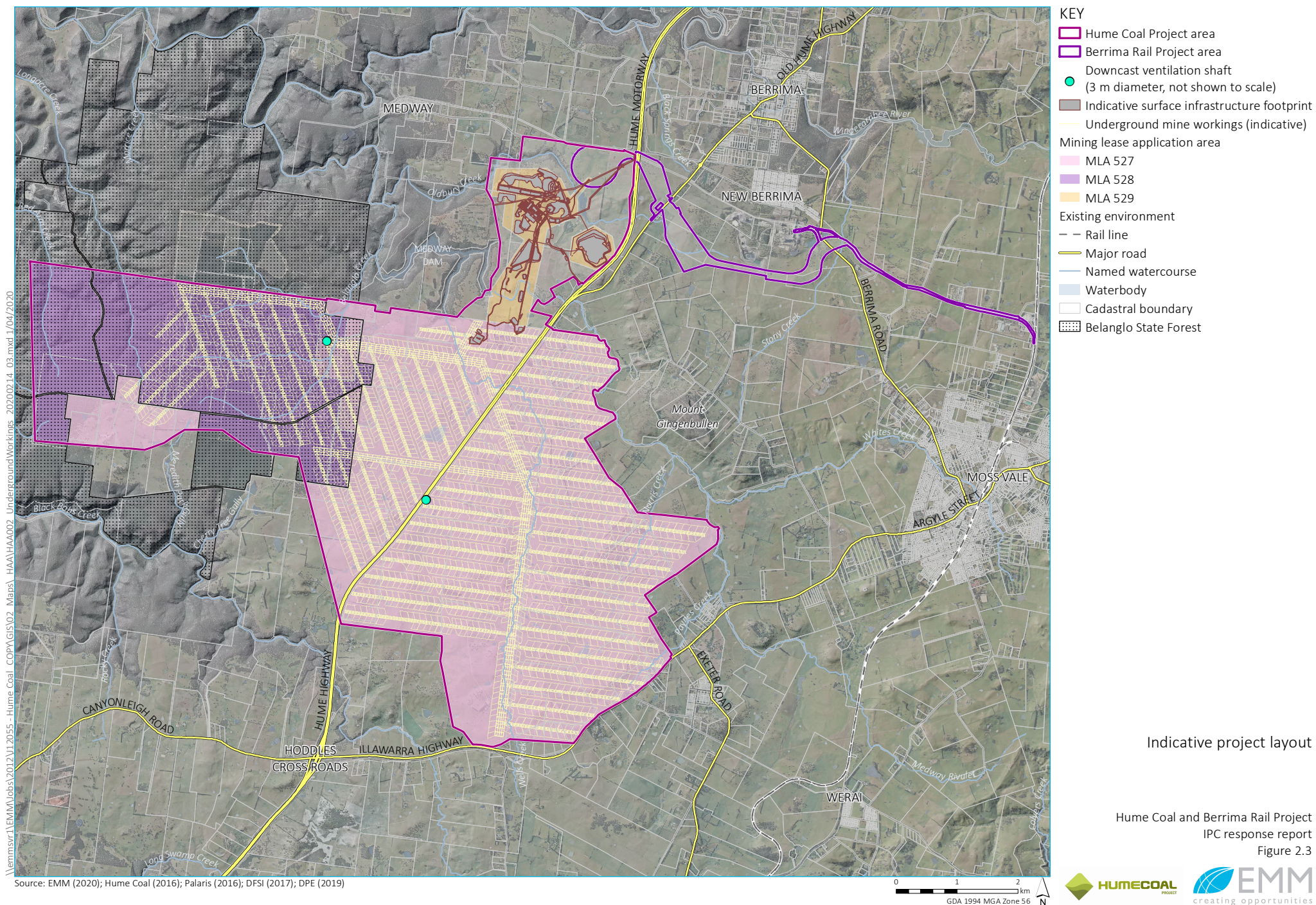
- KEY**
- Hume Coal Project area (5,051 ha, 44,740 m perimeter)
 - Berrima Rail Project area (181 ha, 23,201 m perimeter)
 - Mining lease application area
 - MLA 527
 - MLA 528
 - MLA 529
 - Existing environment
 - Rail line
 - Major road
 - Minor road
 - Named watercourse
 - Waterbody
 - Belanglo State Forest

Local setting

Hume Coal and Berrima Rail Project
IPC response report
Figure 2.2

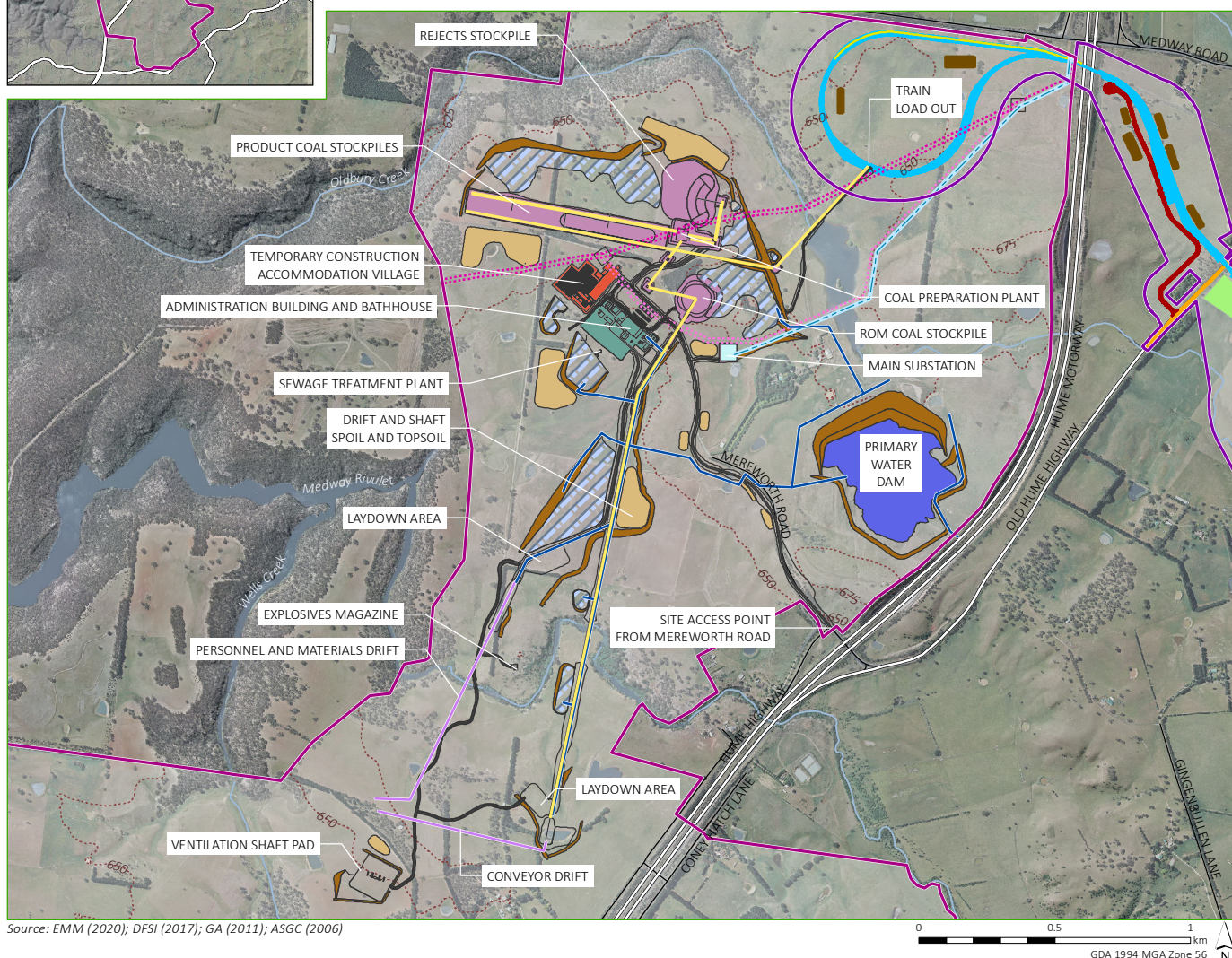
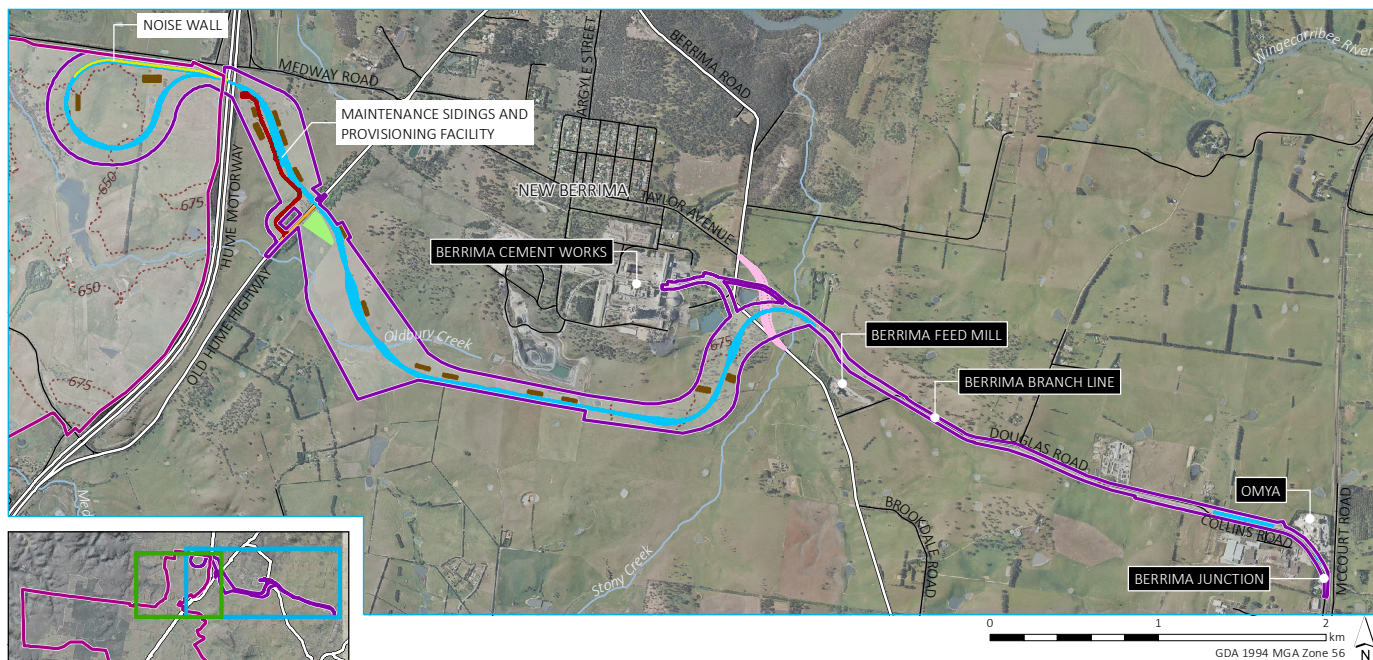
Source: EMM (2020); Hume Coal (2016); DFSI (2017); DPE (2019)





Indicative project layout

Hume Coal and Berrima Rail Project
IPC response report
Figure 2.3



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

KEY

- | | | |
|--|--|--|
| Major road | Topsoil stockpiles | Temporary construction accommodation village |
| Minor road | Rail temporary construction facility | Administration/bathhouse/workshop |
| Contour (25 m increments) | Turning lane/shoulder | Main substation |
| Named watercourse | Hume Coal Project area | Internal road |
| Waterbody | Hume Coal Project elements | CPP and stockpiles |
| Berrima Rail Project area | Conveyor | Topsoil stockpiles |
| Berrima Rail Project elements | Drift (underground) | Stormwater management earthworks |
| Noise wall | Powerline route | Water management area |
| New rail line | Water pipeline | Top water level |
| Rail maintenance facility | Proposed powerline and pipeline easement | |
| Rail access road | Existing WSC easement | |
| Berrima Road relocation (works by Wingecarribee Shire Council) | | |

Surface infrastructure layout

Hume Coal and Berrima Rail Project
IPC response report
Figure 2.4

2.4 The applicant

Hume Coal is a wholly owned subsidiary of POSCO Australia Pty Ltd, the Australian subsidiary of South Korean owned POSCO. POSCO is a leading multi-national steel manufacturer and one of the largest buyers of Australian coal and iron ore, purchasing an average of US\$5.2 billion per annum in the period 2018 to 2019. The exploration licence A349 was acquired from Anglo Coal in December 2010, as a joint venture between POSCO Australia and Cockatoo Coal Limited (ASX: COK) that was formed in 2010. POSCO Australia subsequently acquired Cockatoo Coal's stake and now owns 100% of the Project.

POSCO, through POSCO Australia, has already invested around \$4.6 billion in coal and iron ore projects in NSW, Queensland and Western Australia. POSCO is set to make a substantial investment in the Hume Coal Project and Berrima Rail Project if approved, making it an important part of the company's plans to increase its Australian investment portfolio.

Hume Coal's head office and community office is located in Berrima. Hume Coal is an active member of the local community and supports and participates in various groups including the Southern Highlands Chamber of Commerce and Industry, Moss Vale Manufacturing Cluster, Goulburn Chamber of Commerce and the Illawarra First Group through the NSW Business Chamber. The Project will last over two decades and the company is committed to making a significant and lasting contribution to the region's prosperity. Hume Coal also owns around 1,306 ha of land within and in the vicinity of the Hume Coal Project area, making it one of the largest landholders in the area. The company has leased the properties to a pastoral company which runs a productive agricultural business and is currently investing in pasture improvement, weed control and other initiatives to improve the land's agricultural productivity. In keeping with the current land use, it is the intention that land outside of the mine and rail infrastructure areas will continue to be farmed during and following mining.

3 Environmental assessment timeline and process

3.1 Background

Approval for the Project is sought under Part 4, Division 4.1 of the EP&A Act.

Hume Coal acquired exploration authorisation A349 from Anglo Coal in 2010, and commenced exploration drilling in 2011. Following this, the Project was developed following detailed geological, engineering, environmental, financial and other technical investigations to define the reserve and resource and to identify and address environmental and other constraints.

Baseline environmental investigations for the environmental approvals process also commenced in 2011, including groundwater, surface water, air quality, noise, meteorological monitoring, ecology, heritage, soil surveys and subsidence monitoring. This extensive baseline dataset has given a comprehensive understanding of the existing environment.

Two consultative groups were set up in the initial stages of the Project, principally made up of community members. The Water Advisory Group (WAG) helped guide the Project's water studies and the Social Reference Group (SRG) discussed local social and economic development matters.

Environmental constraints and sensitivities (including assessment of alternatives) were identified early in the planning process and have been a fundamental consideration in designing the Project. Throughout the Project, community and other interest groups contributed valuable local knowledge that assisted in Project planning.

The Project has been designed to extract coal efficiently within identified environmental constraints, while minimising adverse environmental impacts, potential land use conflicts, and delivering socio-economic benefits to the local and broader communities.

This report represents the culmination of over eight years of rigorous assessment, both by the proponent and the many consultants and expert independent peer reviewers engaged to undertake environmental, social and economic assessments of the Project, and by DPIE and their expert independent peer reviewers.

Figure 3.1 outlines the assessment process to date.

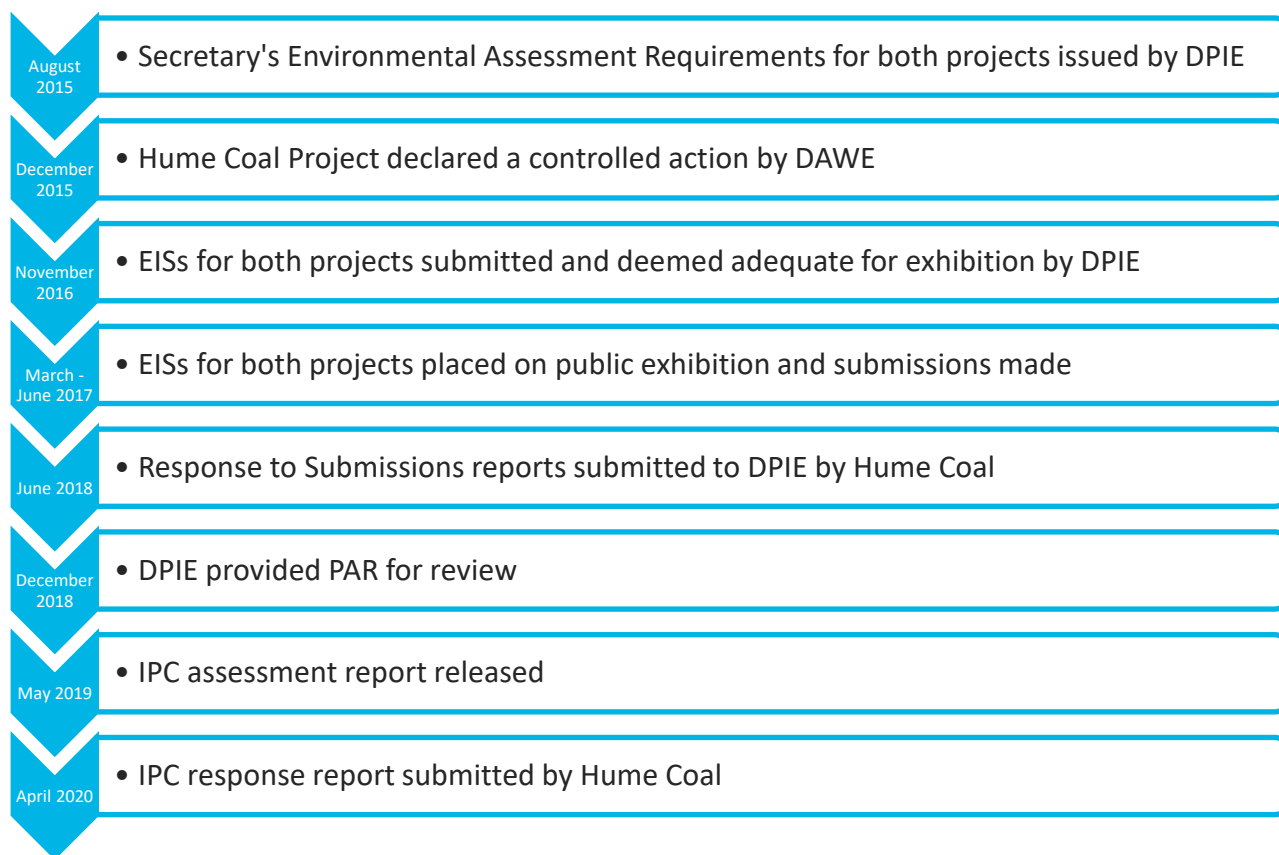


Figure 3.1 The assessment process to date

3.2 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements (SEARs) for the two projects were issued by DPIE on 20 August 2015.

3.3 Controlled action declaration

Approval for the Hume Coal Project is also sought under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Hume Coal Project was declared a controlled action on 1 December 2015 requiring assessment and approval under the EPBC Act. Supplementary environmental assessment requirements (to the SEARs) were subsequently issued on 18 January 2016 by the then Commonwealth Department of the Environment (DoE) (now the Department of Agriculture, Water and the Environment (DAWE)). The Hume Coal Project will be assessed under the bilateral agreement between the Commonwealth and NSW governments in accordance with Part 5 of the EPBC Act.

In correspondence dated 5 November 2015, DAWE confirmed that the Department is satisfied the Berrima Rail Project does not need to be included in the referred action for the Hume Coal Project. Therefore, the Berrima Rail Project is not a controlled action and approval is not required under the EPBC Act.

3.4 Environmental impact statements

The development applications and accompanying EISs for the Hume Coal Project (EMM 2017a) and the Berrima Rail Project (EMM 2017b) were submitted to DPIE on 29 November 2016 for adequacy review. Following feedback and some modification, the two EISs were deemed adequate for exhibition, which occurred between 31 March 2017 and 30 June 2017.

3.5 Response to submissions

Following public exhibition of the EISs, Hume Coal prepared a Response to Submissions (RTS) report, responding to submissions received from government agencies, organisations and the public. A total of 12,667 submissions were received on both projects, the majority of which (89%) were form letter submissions, totalling 11,241. 1,354 individual submissions were received from individual community members, of which 419 were in support and 929 objected. 23 submissions were received from special interest groups, and 37 from businesses. The remaining 12 submissions were from government agencies. Of the total submissions received (including form letters), 12,212 objected to the Project, 436 were in support and 18 provided comment.

The most commonly raised technical issue in submissions on 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.

Of all the individual submissions received, the matters that received the most objections related to access (74%), community (65%) amenity (63%) and impacts on the built environment (63%). The matters that were raised as key objections in the individual submissions were economic (70%), community (67%), water (64%) and amenity (61%). The matters raised in the individual submissions that garnered the most support included community (57%) and economic (45%).

There was a total of 719 individual submissions from within Wingecarribee LGA objecting to the Project. Of those, the key concern was related to fears of the Project contaminating and using groundwater excessively (58%), followed by negative impacts on air quality (46%) then potential negative economic impacts, such as loss of farming land (46%).

Additional technical investigations were commissioned by the Hume Coal Project team in response to submissions received on the Project after the public exhibition of the EIS, and questions from technical experts engaged by DPIE to review the aspects of mine design, noise and vibration, economics and groundwater. Several assessments were also updated in the RTS report to address concerns raised during submissions.

Importantly, the additional work undertaken to respond to submissions did not result in the need to make any changes to the Project design, nor did any of the overall findings as presented in the EIS with regard to potential impacts significantly change.

3.6 DPIE preliminary assessment report

DPIE subsequently prepared a PAR for the Project which was released in December 2018.

In March 2019, Hume Coal provided the IPC with a submission in response to DPIE's PAR maintaining that the PAR contains numerous errors, misinterpretation of the information presented in the EIS and RTS, and statements that were not supported by fact or evidence, as summarised in Table 3.1.

Table 3.1 Key issues raised in DPIE's preliminary assessment report of the Project

DPIE issue	Hume response
Groundwater impacts	
Make good arrangements not suitable	<p>Make good is clearly technically feasible.</p> <p><u>DPIE expert (Hugh Middlemis) response:</u></p> <p>'Depressurisation does not dewater an aquifer unit, it simply lowers the pressure level, which can leave areas of saturated aquifer that can support groundwater pumping'.</p>
Make good arrangements not practical	<p>Make good arrangements are standard administrative practice and implemented elsewhere, including in the Southern Coalfields, and have been for many years. At least, 14 previous mine approvals have standard water compensation clauses, requiring dispute resolution by the DPIE Secretary. To date there are no recorded disputes requiring resolution by DPE.</p> <p>Access arrangements are already in place with 20 landholders (step 1 in the process for make good).</p> <p>'Make Good' is a landholder entitlement. If a landholder does not choose to exercise that right, then there is no dispute. It is an 'opt in' arrangement.</p> <p><u>DPIE expert response:</u></p> <p>'The strategies for make good are reasonable in principle.'</p>
Residual uncertainty	<p>One of the most comprehensive water assessments for a mining project in NSW.</p> <p><u>DPIE expert response:</u></p> <p>'The Hume Coal Model is fundamentally a good example of best practice of design and execution'.</p>
Lack of geological data and modelling of the interburden layer	<p>Over 345 exploration holes have been drilled in the project area, and interburden between Hawkesbury Sandstone and coal correctly represented.</p> <p><u>DPIE expert response:</u></p> <p>'The Hume Coal model has been set up with an appropriate representation of the interburden'.</p>
Significant impacts on highly productive aquifer	<p>Environmental impact of the mine is modest, and not significant or 'unprecedented'.</p> <p>Groundwater impacts from other mines are much greater in terms of drawdown, inflow and time to recover.</p> <p><u>DPIE expert response:</u></p> <p>'Dewatering of one horizon of the aquifer (ie the mined coal seam) does not preclude saturated aquifer conditions above'.</p>
Class 2 status challenged, and therefore uncertainty of model results and adoption of conservative model results	<p>The model is Class 2 and the modelling of uncertainty is world class.</p> <p><u>DPIE expert response:</u></p> <p>'Downgrading of the model by DPI Water (2017) and Anderson (2017) to class 1 is invalid'.</p> <p>'DPI Water have now agreed the model is Class 2'.</p> <p>'Class 2 is justified'.</p> <p>Model is 'fit for purpose'.</p>
Concerns Hume will be able to acquire necessary groundwater licences	<p>Hume Coal easily acquired 93% of required groundwater licences (1,909 ML), which covers inflow up until year 16 of the project. These licences were acquired prior to DPIE's PAR being prepared.</p> <p>Hume Coal very confident that the small remaining amount (150 ML) can be acquired.</p>
Mine design	
'Untested' and 'unconventional' mining method and design	<p>The mine design is based on long established mine design principles. Similar layouts have been, and are, used at numerous other underground mining operations.</p> <p>An innovative mine design does not affect the ability for the project to be approved.</p> <p>Notably, the NSW Resource Regulator published an Innovation Policy in January 2019, which states that: '</p>

Table 3.1 Key issues raised in DPIE's preliminary assessment report of the Project

DPIE issue	Hume response
	<i>We are committed to having a responsive and effective regulatory framework for work health and safety that supports the development, trial and adoption of new technologies, systems and products.'</i>
A substantial degree of uncertainty about the methodology underpinning the geotechnical model, and the level of risk assessment undertaken.	<p>There are no outstanding issues of any substance remaining with regards to the 3D geotechnical model. The model was developed using state of the art software; appropriate material properties with conservative, down-rated values; it was conducted by a leading international expert, Professor Keith Heasley; and it was calibrated against an appropriate case study from the neighbouring Berrima Colliery. DPIE's own experts conceded at the expert's meeting in March 2018 that the model was appropriate.</p> <p>A number of risk assessments have been undertaken for the project and attended by experts in the fields of mine design, geotechnical engineering, geology and hydrogeology. The risk assessments considered the proposed non-caving mining method, and the risk of inrush and inundation, and the outcomes were used to inform the final proposed mine design and layout.</p>
The combination of the 'untested' mining method with the storage of large quantities of mine water underground, claiming this is likely to result in serious operational safety risks.	As mentioned above, the proposed mine design is based on long established mine principles. Many mines also store water underground. Notably, water will be stored <i>downdip</i> of the bulkheads in the majority of the mine workings, with the exception of one area towards the end of mine life where the seam dip flattens out. There is therefore no information to support DPE's claim that the mine design, combined with the storage of water underground, will result in serious safety risks is rejected.
Economics	
The estimated net economic benefits of \$373 million is relatively low in comparison to many other coal mining projects in the Southern Coalfield and across NSW.	This is incorrect. Analysis of a range of other projects recently assessed by DPIE shows that the estimated net economic benefit associated with the project of \$373 million is significant, and on par with or greater than other approved coal mining projects.

3.7 Independent Planning Commission

The NSW Minister for Planning referred the Hume Coal Project (SSD7122) and the Berrima Rail Project (SSD7171) to the IPC on 4 December 2018 in response to public objections. The IPC were requested to carry out the following:

1. Conduct a public hearing into the carrying out of the Hume Coal Project and associated Berrima Rail Project, and:
 - a) consider the following information:
 - i) the EIS for the Projects;
 - ii) all submissions received on the Projects;
 - iii) any relevant expert advice; and
 - iv) any other relevant information.
 - b) assess the merits of the Hume Coal Project and Berrima Rail Project as a whole having regard to all relevant NSW Government policies, and paying particular attention to the:
 - i) impacts on surface water and groundwater resources, including on private bores;
 - ii) social and economic impacts of the Projects on the locality and region; and
 - iii) suitability of the site.

- c) prepare a report summarising the actions taken by the Commission in conducting the public hearing and outlining the Commission's findings on the Projects, including any recommendations.
2. Hold the public hearing as soon as practicable after the Department of Planning and Environment (DPIE) provides its preliminary assessment report to the Commission.
3. Submit its report on the public hearing to DPIE within 8 weeks of holding the public hearing.

The IPC published its IPC assessment report (IPC 2019) on 27 May 2019 and contained 485 comments and 30 recommendations within 18 themes. This IPC response report has been prepared to respond to the IPC's considerations, findings and recommendations.

3.7.1 Approach to responding to the Independent Planning Commission

The IPC assessment report requested targeted supplementary and updated assessments to provide additional detail and clarity on specific matters not included in the SEARs. These assessments helped provide supplementary analysis, clarity and context to existing information presented in the EIS and RTS. The recommendations and the additional investigations undertaken to respond to these recommendations are summarised in Table 1.1 and expanded upon in Section 4 to Section 19 of this report.

The impact assessment methods used for the original assessments undertaken for the EIS were deemed 'fit for purpose' and have been repeatedly endorsed by regulators during the EIS, RTS and IPC process. The findings of these additional assessments have not resulted in any changes to the impact assessment conclusions reached in the EIS or RTS. Where updated and supplementary assessments performed in responding to the IPC recommendations have further defined potential impacts, additional mitigation methods to successfully ameliorate those impacts have been proposed.

3.8 Management, mitigation measures and commitments

The management measures and commitments proposed by Hume Coal during the EIS, RTS and IPC response phases of the Project are presented in Table 3.2, Table 3.4 and Table 3.6.

3.8.1 Summary of management and mitigation measures

Table 3.2 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 of the RTS, 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 of topsoil (refer to Table 7.3 of Appendix F of the EIS), except for soil stockpiling areas and areas of minimal disturbance.
- Topsoil will be stripped, stockpiled and stored in accordance with the procedures outlined in the Construction Environmental Management Plan (CEMP).
- During rehabilitation works, topsoil will be re-applied to achieve the land capability classes specified in Chapter 8 and illustrated in Figure 8.4 of the EIS where feasible.

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 DPIE, 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 Operational Environmental Management Plan (OEMP) respectively.
- A noise management plan will be developed as part of the OEMP, which will:
 - identify noise-affected properties consistent with the noise and vibration assessment and any subsequent assessments;
 - outline mitigation measures to achieve the noise limits established;
 - outline measures to reduce the impact of intermittent, low frequency and tonal noise where practicable;
 - specify measures to quantify, document and ameliorate impacts that are greater than predicted, if they occur;
 - specify protocols for routine, regular attended and unattended noise monitoring of the Project, including provision for regular low-frequency noise monitoring;
 - outline the procedure to notify property owners and occupiers that could be unduly affected by noise from the mine;
 - establish a protocol to handle noise complaints that includes recording, reporting and acting on complaints; and
 - specify procedures for undertaking independent noise investigations.

Air quality

- Air quality will be managed during construction and operation in accordance with the relevant measures in the CEMP and OEMP respectively.
-

Table 3.2 **Summary of management and mitigation measures – Hume Coal Project**

Water resources

- 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.

Greenhouse gas

- A comprehensive GHG mitigation and monitoring plan for the Project be developed as part of the OEMP. The plan would establish monitoring and reporting requirements, management commitments, site personnel responsibilities and plan review timeframes.

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.
-

Table 3.3 **Summary of management and mitigation measures – Hume Coal Project**

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.
-

Social

- 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.
 - During the first quarter of the life of the mine, Hume Coal will outline its commitment to Ecological Sustainable Development (ESD) for the life of the mine and transitioning to mine closure.
-

Aboriginal heritage

- An Aboriginal cultural heritage management plan (ACHMP) will be prepared in consultation with the registered Aboriginal Parties (RAPs) and DPIE, 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 Aboriginal Cultural Heritage Assessment (ACHA) (EMM 2017a, 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 ACHMP. The objects already recovered from test excavation will remain secure in the EMM office during the interim.
-

Historical heritage

- A historic heritage management plan will be prepared in consultation with DPIE and Heritage NSW, 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.
-

3.8.2 Summary of commitments

i Hume Coal Project

Table 3.4 Summary of commitments – Hume Coal Project

Water resources

- Impacts greater than the minimal Aquifer Interference Policy (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.
-

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 endangered ecological community (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 noise management levels (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 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

Table 3.4 **Summary of commitments – Hume Coal Project**

Water resources

- 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 variable-voltage/variable-frequency (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

- Scope 1 emissions:
 - Offset all fugitive GHG emissions through tree planting.
 - Wherever practicable, will adopt the use of battery-electric powered vehicles for surface activities and underground personnel transportation.
 - Reducing engine idling times wherever practicable to reduce diesel use.
 - Routine servicing of equipment to achieve manufacturer's emission specifications and efficiency.
 - 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.
 - Awareness on energy efficiency measures will be included in site induction training packages.
- Scope 2 emissions:
 - Enter into arrangements with electrical suppliers to purchase as much of the Project power requirements from renewable energy sources as can be sourced.
 - Establishing solar power cells and storage batteries to provide power to the Administration Block.
- Scope 3 emissions
 - Only sell its coal products to countries, (states or organisations) that are signatories to the Paris Agreement (2015).

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.

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.

Table 3.5 **Summary of commitments – Hume Coal Project**

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.
- Where feasible and subject to engineering and safety constraints, additional vegetation plantings will be used to screen mining infrastructure:
- within the surface infrastructure area, close to and amongst the structures and infrastructure;
- between the surface infrastructure and the Project area property boundaries; and
- alongside the existing natural waterways, augmenting existing, remnant riparian vegetation and/or reinstating a native vegetation corridor and with woodland extensions into the adjacent lands.
- Where feasible and subject to engineering and safety constraints locate power and other service/supply lines underground.

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; and
 - 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.

Table 3.6 Summary of commitments – Berrima Rail Project

Noise and vibration
<i>Construction</i>
<ul style="list-style-type: none"> 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.
<i>Operations</i>
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> 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.
Greenhouse gas
<ul style="list-style-type: none"> Purchase of the most fuel-efficient locomotive engines currently available in the Australian market at the time of development consent. Reducing engine idling times wherever practicable to reduce diesel use. Routine servicing of equipment to achieve manufacturer's emission specifications and efficiency.
Traffic and transport
<ul style="list-style-type: none"> 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.
Visual amenity
<ul style="list-style-type: none"> The following measures will be implemented to mitigate visual impacts of the Project: <ul style="list-style-type: none"> 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.
Aboriginal heritage
<ul style="list-style-type: none"> 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) 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 potential archaeological deposit (PAD)) is required. An ACHMP will be prepared and implemented for the Project, including: <ul style="list-style-type: none"> procedures that will apply in the event that known or suspected human skeletal remains are encountered during construction; procedures that will apply in the event of discovery of new Aboriginal sites in the Project area; and 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. 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 2017b).

Table 3.6 **Summary of commitments – Berrima Rail Project**

Historical heritage
<ul style="list-style-type: none"> • 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.
Biodiversity
<ul style="list-style-type: none"> • 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. • 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 DPIE, and will submit the draft to the Secretary for approval within 12 months of development consent being granted.
Flooding and drainage
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • The CEMP will detail the soil stripping, stockpiling and reapplication procedures so that rehabilitated surfaces are capable of supporting grazing.

4 Mining method and safety (R1, R2, R3)

4.1 Introduction and background

The underground mine has been designed to minimise mining and subsidence impacts on surface features as well as surface water features and groundwater resources by using a non-caving mining method, which is based on proven geotechnical design principles. The design leaves coal pillars in place, providing long-term support for the overlying rock strata, therefore causing negligible surface subsidence, and affording protection to aquifers and surface water features. Details of the proposed mining method were presented in Section 2 of the EIS. Further details and clarifications were added for the RTS, including discussion on mine design, safety, resource recovery, subsidence and other matters.

Meetings between Hume Coal and DPIE were able to resolve some issues and concerns, however other issues remained unresolved. Accordingly, and in response to the IPC's recommendations, Hume Coal engaged an independent expert with experience in innovative coal mining technology, to review the feasibility and safety of the proposed mining technique.

4.2 Independent Planning Commission recommendations

90. *The Commission makes the following recommendations that will require further information and/or assessment:*

- **R1** - *Because the Applicant and Department remain a considerable distance apart regarding their positions on the safety of the pine feather method of mining, the Commission suggests that one of the Applicant or the Department, or both of them jointly, engage a new independent expert with experience in innovative coal mining technology with a view to resolving ongoing differences of opinion. This investigation would involve taking into account new information from the Resources Regulator.*
- **R2** - *As a result of the outcomes of R1, the Applicant needs to advise if there are consequences that would arise in relation to mine design and economics (resource recovery).*
- **R3** - *The Applicant should provide the Project Risk Assessment to the Department, and any other relevant Government agencies, if necessary, on a confidential basis, for consideration in any further Department or other Government assessment or response in the next stage of the assessment process.*

4.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

To respond to recommendations R1 and R2, Hume Coal engaged Russell Howarth and Associates Pty Limited, as an independent expert with experience in innovative coal mining technology, to review the feasibility and safety of the proposed mining technique and the Project's consequent ability to store mining wastes and excess mine water underground, with a view to resolving ongoing differences of opinion.

This review, contained in full within Appendix A was conducted by Russell Howarth B.E. (Mining). Mr Howarth has over 45 years of experience in the underground coal industry and has held senior operating positions in the Illawarra District, Burragorang Valley, Newcastle District, Western District, Hunter Valley, Tasmania and the Queensland Bowen Basin.

To respond to recommendation R3, Hume Coal will provide the risk assessment of the pine feather mining system directly to DPIE, on a 'Commercial in Confidence' basis, as a separate submission.

4.4 Analysis and response to Independent Planning Commission's findings

Table 4.1 Response to Independent Planning Commission findings– mining method and safety

Reference number	IPC's findings	Hume Coal analysis and response
85	The Commission understands that this Project is unique and generates a number of challenges. The Project is in an area which has not been subjected to mining, however coal mining has occurred in a nearby area until recently. The population density is quite high by rural standards, with many properties having significant improvements. According to the Hume Coal EIS, some are heritage items and much of the landscape in the area has been classified by the National Trust. All experts, both for the Applicant and the Department, agree that the mining method chosen will lead to minimal subsidence.	All experts, both for Hume Coal and DPIE agree that the proposed mining method would lead to minimal subsidence. Addressed in Key Issue #2 in Appendix A, with the new independent expert also stating that subsidence impacts would be negligible.
86	Submissions, speakers at the public hearing and experts have raised concerns regarding the lack of geological information and the Commission agrees with those reservations. Extrapolating some geological data from the Berrima coal mine, some five km away, carries with it uncertainty. More closely spaced geological information is desirable to improve the geological confidence in the conceptual mine plan. When the Applicant has been questioned about this the reply has been that a detailed mine plan is not usually prepared this stage of a mining project. This is a problem that will have to be addressed and resolved. The Commission also notes the view of some adjoining landowners that access would not be provided to enable geological investigation. The implications of this will need to be considered.	It is false that the proposed mine plan has been developed based only on 'some geological data from the Berrima coal mine', as suggested in the wording of this finding, or that insufficient information has been collected due to the approvals stage of the project or access to private landholdings. Russell Howarth & Associates, 2020 (Appendix A) states in Key Issue #6 that geological exploration undertaken so far is typical and what would be expected within the industry. Exploration techniques used so far include: surface mapping, bore core logging from hundreds of boreholes, geological testing of core, acoustic scanner interpretation of boreholes, 2D seismic surveys, aerial photography and LiDAR mapping, aerial and ground based magnetic surveys. Where surface access is not available, due to landowner constraints, in-seam drilling (exploration) can be undertaken to delineate geological structures, intrusions and even take core samples, if required.
87	The Commission notes that the Department contends that there remain residual issues, such as the issue of pillar stability, yet to be resolved by this 3D numerical modelling and the reliability of 3D geotechnical modelling. These residual issues may result in the changes to the mine design such as widening the pillars. The implications of such a change would need to be investigated.	The independent reviewer 'accepts the geotechnical case for long term stability of the pillar system', Appendix A. The long-term stability of the proposed mine layout was tested against 3D numerical modelling by expert Dr Keith Heasley; providing a complementary assessment of pillar stability using a different, independent methodology, see Key Issue #2 in Appendix A. Residual issues are understood to be minor, as DPIE's own experts conceded at the expert's meeting in March 2018 that the 3D geotechnical model was appropriate. The current geological information, modelling and independent review do not require the mine design to be changed to widen pillars, also indicating a lack of residual issues.
88	The Risk Assessment document viewed by the Commission on 12 March 2019 appears to identify and evaluate a number of the issues indicated by the Department's expert reviewers and discusses how they will be handled. However, this document was not made available for peer review during the assessment process on the basis of the Applicant's position that it was "Commercial in Confidence".	This is addressed in Section 4.5.3 of this report.

Table 4.1 Response to Independent Planning Commission findings– mining method and safety

Reference number	IPC's findings	Hume Coal analysis and response
89	At this stage of its assessment, the Commission finds that it is generally satisfied with the information provided up to this point regarding mine design and safety which has been assisted by the information from the Resources Regulator. However, the Commission notes the residual disagreement between the Applicant and the Department.	This is addressed in Section 4.5.1 of this report.

4.5 Analysis and response to Independent Planning Commission recommendations R1, R2 and R3

Table 4.2 Response to Independent Planning Commission recommendations – mining method and safety

Reference number	IPC's finding	Hume Coal response
R1	Because the Applicant and Department remain a considerable distance apart regarding their positions on the safety of the pine feather method of mining, the Commission suggests that one of the Applicant or the Department, or both of them jointly, engage a new independent expert with experience in innovative coal mining technology with a view to resolving ongoing differences of opinion. This investigation would involve taking into account new information from the Resources Regulator.	This is addressed in Section 4.5.1, and an independent review provided in Appendix A.
R2	As a result of the outcomes of R1, the Applicant needs to advise if there are consequences that would arise in relation to mine design and economics (resource recovery).	This is addressed in Section 4.5.2, and an independent review provided in Appendix A.
R3	The Applicant should provide the Project Risk Assessment to the Department, and any other relevant Government agencies, if necessary on a confidential basis, for consideration in any further Department or other Government assessment or response in the next stage of the assessment process.	This is addressed in Section 4.5.3.

4.5.1 Detailed response to R1

As previously stated, Hume Coal engaged Russell Howarth, an expert with over 45 years in the underground coal industry and experience in innovative coal mining technologies, to independently review the proposed mining method. The experience and qualifications of the reviewer are summarised by way of curriculum vitae (CV) in Appendix A of his review. The full review is contained in Appendix A of this report (Russell Howarth & Associates, 2020).

DPIE advised Hume Coal, following the release of the IPC report, that they would not be willing to jointly engage an independent expert.

With a view to resolving ongoing differences of opinion between DPIE and Hume Coal on the safety of the pine feather method of mining, Russell Howarth & Associates (2020) conducted an independent and systematic review focusing on eight key issues:

1. Stability of development roadway after breakaway;
2. Intra-panel pillar formation and the effect of unmined webs on potential impacts on subsidence (focusing on subsidence, drivage and panel design);

3. Goaf gas;
4. Strata failure of a web or plunges expels irrespirable atmosphere;
5. Alignment of plunges (focusing on supply and integration of technologies);
6. Flexibility of the pine feather system;
7. The proposed pine feather mining system's ability to store mining reject and excess mining water underground (focusing on emplacement methodology, environmental impact considerations and safe systems of work); and
8. Principal hazards common to underground coal mining (focusing on how each hazard would apply to the project).

The review also takes into account new information from the Resources Regulator dated 17 May 2019.

In summary, the review states 'the proposed mining technique was found to be technically feasible' and that 'it cannot be inferred that the proposed mining system is unsafe on the basis that it has not been used before in NSW'. The proposed technique would utilise advances in technology in the form of remote-controlled mining equipment and use of high-precision inertial navigation systems, which would provide a level of surety that the mine was developed as designed and also enable coal mine workers to operate machinery remote from the coal cutting and coal face hazards (Russell Howarth & Associates, 2020).

The review states 'the mine layout maximizes recovery of the resource and results in a long-term stable pillar system that keeps mining induced surface subsidence impacts to an imperceptible level, minimizes hydrogeological impacts on subsurface strata above the Wongawilli Seam, and provides an ability to store mining wastes and excess water underground' (Russell Howarth & Associates, 2020).

4.5.2 Detailed response to R2

Hume Coal acknowledge the position of the NSW Resources Regulator in its response to the IPC on 17 May 2019, stating that 'parallel drives, or plunges, are considered secondary extraction'. This categorisation of the mining method as 'secondary extraction' is not challenged by Russell Howarth & Associates in Appendix A, stating:

"The pine feather mining system will not create open goaf areas like traditional mining systems. The pine feather system plunges, considered by the Regulator to be secondary workings, are a component of a long term stable pillar system".

Categorisation as 'secondary extraction' (rather than 'first workings') does not raise the need to amend the mine design, nor does it have an economic impact. Hume Coal would follow legislation and all requirements of the NSW Resources Regulator, to ensure a safe operation.

The stability of the roadway after breakaway was an issue raised by DPI experts, and has been reviewed by Russell Howarth & Associates in Appendix A. Due to the rigidity of the body of a continuous miner, the width of a roadway at the point of breakaway is wider than other parts of the roadway, and concerns were raised about stability of these sections without additional roof support.

The expert review concluded (Appendix A, Key Issue #1) that 'the added roadway width resulting from the breakaways did not reduce the overall stability of the pillar system. Local support alternatives at the plunge breakaway could be designed and installed to suit the cutting and support erection system for the continuous miner specified and selected for the mine'. Additional advice from Palaris and Mine Advice were considered and taken into account by the reviewer, and are listed as references to the review.

Widening and support of the roadways at breakaways are a minor change (safety improvement) to the mine design. The cost of installing additional roof supports have been factored into the revised economic model, along with the minor increase in the tonnage of coal recovered and available for market.

4.5.3 Detailed response to R3

A risk assessment was undertaken during the conceptual design phase to determine risks and controls involving the pine feather mining system, in order to determine if the method can be considered practicable, economic and safe. It would be used to inform further assessments in the post-approval phase, e.g. detail design stage and associated operational risk assessments.

The risk assessment has continually been updated since it was first prepared. Over a number of sessions between 2015 and 2020, a total of thirteen consultants, engineers and Hume Coal personnel consulted with a view to assess the risks and identify controls. No catastrophic risks were identified, and the review focused on controls required to manage all other hazards and risks to a tolerable/acceptable level.

The risk assessment report was provided to the IPC on 12 March 2019. It was provided 'Commercial in Confidence' because it is not typically required at this stage of the approval process. The further updated risk assessment report will be submitted as 'Commercial in Confidence' to DPIE in parallel with the submission of this IPC response report.

5 Groundwater (R4, R5, R6)

5.1 Introduction and background

5.1.1 EIS

A groundwater assessment was conducted as part of the EIS for the Hume Coal Project and Berrima Rail Project and reported in an overarching water assessment (EMM 2017c). The groundwater related technical studies included development of a numerical groundwater model for the Project, and assessments of groundwater and hydrogeochemistry. The assessments were completed in accordance with the appropriate guidelines, policies and industry requirements, the SEARs and in consultation with relevant government agencies.

The findings of the assessments were:

- the groundwater model used to assess the impacts was independently reviewed and determined fit for purpose;
- the project is predicted to result in groundwater level drawdown greater than 2 m at 93 landholder bores on 71 properties, at varying times through the Project;
- predicted impacts to other groundwater users (groundwater dependent ecosystems, watercourses, drainage lines and swamps that receive baseflow) will be insignificant; and
- the Project is predicted to reduce the beneficial use category of the groundwater source and no cumulative water quality impacts are predicted.

5.1.2 RTS

Given the focus on groundwater in the submissions, substantial additional groundwater modelling and impact assessment work was undertaken as part of the RTS. This included a revised groundwater model (RTS model) and an additional independent review of the groundwater model by DPE's expert Mr Hugh Middlemis of HydroGeoLogic Pty Ltd.

The groundwater modelling work in the RTS included Monte Carlo style uncertainty analysis, in line with the IESC guideline. It is noted that this work was very complex, time consuming and onerous, and the results of the work provide an exceptional example of how to apply the IESC guidelines to undertake very detailed uncertainty analysis and reporting of results. The results of the revised groundwater modelling predict 94 landholder bores on 72 properties (one additional bore and property from that modelled in the EIS) will observe groundwater level drawdown greater than 2 m as a result of the Project, and the uncertainty analysis suggests the model has a narrow uncertainty range in regards to inflow and drawdown predictions.

5.1.3 IPC response

Additional independent reviews and analysis of the RTS groundwater model has been undertaken for the response to the IPC report, as detailed in Section 5.4 of this report.

Section 5.5 presents the findings of the additional work and responses to IPC recommendations.

5.2 IPC recommendations

The IPC made three recommendations in relation to groundwater, these are:

- **R4** - *That the Department review the advice of Department of Industry - Water dated 24 April 2019 and the Applicant's correspondence of the 17 May 2019 and gives consideration to requesting the completion of the revised groundwater flow model, taking into consideration the advice provided.*
- **R5** - *Because the Applicant and Department of Industry - Water remain a considerable distance apart regarding their positions on the groundwater modelling, the Commission suggests that the Department or the Applicant, or both of them jointly (and in any case in consultation with Department of Industry - Water), engage a new independent expert (or alternatively a small technical group with Chair) with experience in groundwater modelling with a view to resolving ongoing differences of opinion. The independent expert/Chair should consider:*
 - *what practical steps, if any, can be taken to make the model a class 2 model or seek agreement on the class of the model;*
 - *what additional work is required to establish the extent to which the emplacement of water in mined-out voids will reduce the level of drawdown in the later years of the project;*
 - *the range used for the input parameters in the modelling sensitivity/uncertainty analysis and recommend if a wider range is required so that there is no unreasonable truncation of results; and*
 - *if additional geological information is required.*
- **R6** - *That the Department give close attention to the practical adequacy of make good provisions during the final assessment process, with an independent review if necessary. This should include the practical aspects such as dispute resolution and economics as well as the technical.*

5.3 Approach for responding to IPC assessment, findings and recommendations

The following work has been undertaken for the response to the IPC report, as detailed in Section 5.5 of this report:

- additional independent review of the numerical groundwater model by Dr Lloyd Townley of GW-SW Pty Ltd;
- independent review of Hume Coal's geological information (including investigation of core photographs and examination of geological outcrop in the area) by Professor Brian Jones of University of Wollongong to describe the characteristics of the lithology between the Wongawilli Coal seam and the lower Hawkesbury Sandstone in the Project area; and
- extraction of additional information from the RTS groundwater modelling and groundwater assessments to provide detailed responses to the IPC and DPIE Water.

It is worth noting that since submission of the RTS report, HydroSimulations have been acquired by SLR Consulting (SLR). However, the same modelling team (lead by Dr Noel Merrick), has continued to undertake and lead the modelling work for the Project and to support Hume Coal with various groundwater modelling and conceptualisation related tasks.

In addition to the work listed above, Hume Coal and SLR have conducted additional groundwater modelling verification and review as more information becomes available post the RTS modelling work. This is consistent with industry standard approach and consistent with overall continuous improvement strategies across technical disciplines and industries. This work is hereafter referred to as the 'post-RTS modelling'.

An updated water assessment is included as Appendix B to this report which provides further detailed response to the IPC findings and recommendations, as well as addressing queries by DPIE Water. Appendix B (Water technical report) includes the following Annexures:

- Annexure A DPIE Water report providing responses to seven actions from a meeting held between Hume Coal (with EMM and SLR personnel), DPIE Planning and Assessment, and DPIE Water on 30 July 2019;
- Annexure B Hume Coal detailed geology report; and
- Annexure C Groundwater model independent expert review by Dr Townley.

5.4 Analysis and response to Commission's findings

The summary of the IPC findings relating to groundwater, and Hume Coal's responses are presented in Table 5.1 below. Detailed responses to items related to the robustness and accuracy of the numerical groundwater model, is provided in Section 5.4.1. A detailed response items related to the make good strategy is provided in Section 5.5.3.

Table 5.1 Response to IPC findings – Groundwater

Reference number	IPC's findings	Hume Coal response
134	<p>The Commission in its assessment of merits of the Project has had regard to groundwater impacts. The Commission has had regard to the Material before it and given consideration to the issues raised in public submissions. Relevant excerpts from the submissions included:</p> <p>groundwater impacts are the first and foremost issue;</p> <p>there are strong community objections to the groundwater model predictions;</p> <p>there are concerns that the water impacts are uncertain due to inaccurate baseline data being used in modelling studies; such as incorrect static water levels in private bores. In addition, there was considered to be a selective use of model input parameters;</p> <p>the privately funded groundwater model shows much greater mine inflows and impacts to private bores;</p> <p>reducing the impacts by placing water underground is new and untested and therefore high risk;</p> <p>there is considered to be a high risk of groundwater contamination from the additives introduced to the slurry being placed underground;</p> <p>there is a need for clarity on the make good provisions so that landholders can make business decisions prior to any mining approval;</p> <p>the drop-in water levels will cause private plantings of trees to die;</p> <p>Hume Coal faces serious licensing constraints, in obtaining sufficient entitlement; and</p> <p>deepening bores into the underlying Shoalhaven Group of strata is not feasible as there is no water there of any significance.</p>	<p>This is addressed in Section 5.4 below and discussed further in Section 2, 3, 4 and Annexure C of Appendix B.</p> <p>Impacts on private plantings is discussed in Section 13.</p>
135	The Commission has also made a number of observations around the predicted groundwater related impacts which include:	(see responses to issues 136 to 157 below)
136	There is significant Agency and public concern relating to the accuracy and robustness of the Applicant's groundwater modelling.	This is addressed in Section 5.4.1 below and discussed further in Section 3 and Annexure C of Appendix B.
137	It is noted that the groundwater flow model is a semi-regional model and as such it does not contain local	<p>This is addressed in Section 5.4.1 below.</p> <p>This is discussed further in Section 3 and 4 of Appendix B.</p>

Table 5.1 Response to IPC findings – Groundwater

Reference number	IPC's findings	Hume Coal response
	geological data such as faults, fracture zones, basalt intrusions (sills and dykes) and that local geological conditions will have an effect on groundwater flow conditions, including both mine inflow predictions and drawdown impacts on private bores.	
138	There is a thin interburden layer of coal, shale, siltstone and sandstone separating the HS from the Wongawilli seam. There has been considerable contention and technical debate as to whether this interburden material is properly represented in the groundwater flow model. Middlemis (2018) stated that it has been appropriately handled. Advice from Dol-Water (2019) is that there is still considerable uncertainty on how this layer has been handled in the model.	This is addressed in Section 5.4.1 below. This is discussed further in Section 2 and 3 of Appendix B.
139	Middlemis (2018) has declared that the revised model is a class 2 Model and is fit for purpose under the Australian Modelling Guidelines (2012) and best practice due in part to the fact that it is calibrated against four separate data sources (groundwater levels, stream flows, hydraulic conductivity and Berrima Mine inflows) and has included an uncertainty analysis. Advice from Dol-Water (2019) stated that the calibration of the model against four data sets does not necessarily reflect the quality of the model in replicating the existing environment or predicting future impacts. They point out that a visual analysis of the groundwater calibration hydrographs concludes that the vast majority of bores are uncalibrated with only 21% of all the calibration bores having a residual that is less than 2 m and 50 % of the bores exceed 10 m residual between the observed and modelled results. They conclude that there is an insufficient number of calibrated bores to provide confidence in the model predictions.	This is addressed in Section 5.4.1 below. Further discussion is provided in Section 4 and Annexure C of Appendix B.
140	Of particular interest to the Commission is the possibility that the Hawkesbury Sandstone hydraulic conductivity (Kh and Kv) is highest immediately above the coal seam to be mined. There was no representation of this in the model realizations, despite apparently being requested by Dol-Water at a previous modelling meeting. This work would have been useful to check the possibility of larger water inflows to the mine. Likewise, a larger range of drainage conductance values could have been modelled to eliminate the speculation about the interburden layer acting as a bottleneck to flow.	This is addressed in Section 5.4.1 and discussed further in Section 2 and Annexure A, B and C of Appendix B.
141	The Commission notes that water balance errors associated with the revised (Merrick, 2018) model are now at an acceptable level of 0.2%. The model calibration performance for predicted versus measured groundwater levels remains higher than desirable (SRMS = 10.7%) with only 30% of the uncertainty realisations achieving less than 10% SRMS. Advice from Dol-Water (2019) considers that the SRMS modelling error statistic should be less than 5% for a model to be used for such an important water resource. For this and other reasons Dol-Water does not consider the revised model to be fit for the purpose of assessing drawdown impacts resulting from mining, to an adequate level of certainty. Dol-Water considers that	This is addressed in Section 5.4.1 and discussed further in Section 3 and Annexure C of Appendix B.

Table 5.1 Response to IPC findings – Groundwater

Reference number	IPC's findings	Hume Coal response
	revised model resembles a Level 1 model which incorporates some Level 2 and Level 3 elements.	
142	The Applicant's groundwater model shows the impacts on groundwater resources to be significant (94 to 118 bores affected) but not irreversible and full recovery should occur some decades after mining ceases.	Noted
143	The Commission notes the disagreement between the comments of the Department's expert and those of DoI-Water in terms of the level of model and the accuracy of prediction of groundwater drawdown. The level of groundwater model and the effectiveness of its predictions need to be resolved.	This is addressed in Section 5.4.1 and discussed further in Section 3 and Annexure C of Appendix B.
Make good strategy		
144	The AIP requires that where the water level in a private bore is impacted (>2 m) by a proposed development, then make good arrangements should be entered into. Based on the 67th percentile model results, there are predicted to be 94 private bores impacted by a 2 m or more decline in groundwater level. The make good strategy is staged in five-year lots and is said to be flexible to the needs of private landholders. The 90th percentile modelled results predict 118 bores will require make good arrangements.	Noted.
145	Whilst several reviewers have labelled the strategy as technically feasible there are some residual risks for irrigation bore owners as constructing deeper bores, or even multiple bores of larger diameter may not equate to losing a high yielding bore in the HS.	This is addressed in Section 5.4.2 and discussed further in Section 4 of Appendix B.
146	DoI-Water consider that the make good arrangements for irrigation bore owners is uncertain as there is little knowledge about the water supply quality and yields from deeper formations.	This is addressed in Section 5.4.2 and discussed further in Section 3 and 4 of Appendix B.
147	The Department's PAR considers that given the significant opposition to this Project the make good strategy would inevitably lead to a large number of disputes requiring resolution and causing disruption to the community.	This is addressed in Section 5.4.2 and discussed further in Section 4 of Appendix B.
Risk of groundwater contamination		
148	There is significant public concern relating to the impacts to groundwater quality that will occur if coal rejects are returned into underground voids.	Item 150 acknowledges that the DoI-Water (now DPIE-Water) have assessed that the potential impacts of the proposed project on groundwater quality are Level 1 (non-significant) impact in accordance with the AIP. The Hume Coal EIS and RTS have adequately assessed the potential impacts of the project on groundwater and surface water quality from coal rejects and other potential contaminant sources.
149	The Applicant has undertaken studies using Wongawilli coal and PWD simulated water to determine the likely changes in water quality through the oxidation processes that occur when the coal is exposed to oxygen. Also researched was the treatment of coal rejects with limestone to control the pH.	Noted.

Table 5.1 Response to IPC findings – Groundwater

Reference number	IPC's findings	Hume Coal response
150	Dol-Water's submission on the Hume Coal EIS stated that the impacts on groundwater quality are considered to be a Level 1 impact in the AIP and not considered significant.	Noted.
151	Hume Coal EIS and Hume Coal RTS stated that, from the studies the impact on groundwater quality from the storage of treated coal rejects is not considered significant. This is consistent with the EPA requirement that "There must be no statistically significant change in the beneficial use category of groundwater from background levels further than 40m downgradient of voids used for emplacement of coal reject and waste water".	Noted.
152	The Commission finds that that the Applicant and Department have not adequately assessed or considered the potential impacts of the Project on groundwater because of the uncertainty around the modelling undertaken to date and the associated uncertainty this might create in understanding the potential groundwater impacts, and the lack of certainty around the practical application of the Applicant's make good proposal.	This is addressed in Section 5.4.1 and 5.4.2. Further discussion is provided in Section 3 and 4, and Annexure C of Appendix B.
153	The Commission notes the advice of Dol-Water (2019) that the revised model has significant uncertainties in its predictive capabilities.	This is addressed in Section 5.4.1. Further discussion is provided in Section 3 and Annexure C of Appendix B
154	In addition to the mixing of limestone to the coal rejects before placement underground the Applicant discusses briefly the lining of the underground mine with limestone dust as having an overall beneficial effect on the quality of recovering groundwater in the Hume Coal RTS. The Commission agrees that this would be an additional safety factor in preventing the movement of desorbed metals in groundwater.	Noted
155	The Commission considers that speculation about the conservatism of the revised model can only be tested by appropriate sensitivity and uncertainty analysis on a fit for purpose model, and the Commission considers that it is possible that the current model might underestimate mine water inflow and impacts to existing groundwater users. The extent of any underprediction is unknown. Balanced against this is the conservative effect of not considering the positive influence of the return of water and waste materials to the mined-out sections of the mine.	This is addressed in Section 5.4.1. Further discussion is provided in Section 4 and Annexure C of Appendix B
156	The Commission is also aware that any significant drawdown in groundwater levels could have an adverse impact on deeply rooted native and introduced flora which is discussed further in Section 8.12.	This is addressed in Section 13.
157	At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding groundwater impacts because of the uncertainty about the extent of groundwater drawdown and the capability of 'making good'.	This is addressed in Section 3 and 4, and Annexure C of Appendix B.

5.4.1 Detailed response to groundwater model related items

DPIE (previously DPE), DPIE Water (previously DoI Water) and community groups have been openly opposed to the Hume Coal Project and have criticised the accuracy and appropriateness of the Hume Coal groundwater model, stating that it is not fit for purpose and cannot be used to assess impacts of the Project. The groundwater modelling, uncertainty analysis and overall assessment of water resources for the Hume Coal Project is world class, and has been undertaken by world class modellers. The NSW Government's own independent peer reviewer, Mr Hugh Middlemis of HydroGeoLogic Pty Ltd (HydroGeoLogic), has also deemed it to be fit for purpose.

The ongoing criticism of the model is underpinned by a privately funded groundwater model (by Pells Consulting) referred to in item 134. EMM (2018c) completed a review of this privately funded Pells model and the review determined that the Pells model:

- is a Class 1 model under the Australian Groundwater Modelling Guidelines (Barnett et al 2012);
- the conceptualisation is flawed and the groundwater model is poorly calibrated;
- is not fit for purpose for the assessment of mining impacts and is therefore not suitable for predicting drawdown impacts on bores, inflow volumes to the mine or general impacts on the different groundwater systems and surface water resources across the modelled area; and
- due to above, it cannot be used as a comparison to the Hume Coal groundwater model developed as part of the EIS and RTS.

As presented in earlier submissions, the Hume Coal groundwater model has undergone numerous reviews by many leading experts in groundwater modelling in Australia, including a review by the then DPE's expert Mr Hugh Middlemis.

As outlined by EMM (2018b) and Dr Townley (2020), the groundwater model has undergone greater than 10 reviews and include:

- on behalf of Hume Coal: Dr Noel Merrick, Dr Frans Kalf, Neil Manewell, Liz Webb and Dr Lloyd Townley;
- on behalf of regulators: Hugh Middlemis (HydroGeoLogic; twice), representatives of IESC, DoI – Water hydrogeologists and WaterNSW hydrogeologists; and
- on behalf of the community: Dr Steven Pells, Doug Anderson, Chris Jewell and John Lee.

The following reviewers found that the groundwater model is fit for purpose and appropriate for assessing the impacts of the Hume Coal Project:

- Dr Noel Merrick, acting as independent reviewer of the Coffey (2016) work and prior to taking ownership of the RTS groundwater model;
- Dr Frans Kalf, independent reviewer of the EIS and RTS groundwater model;
- Neil Manewell who conducted an audit of the EIS groundwater model;
- HydroGeoLogic, acting as an expert reviewer for the then DPE and conducted reviews of the EIS and RTS groundwater model versions; and
- Dr Townley (2020) who conducted an expert review of the groundwater modelling work conducted as part of the EIS and RTS.

Hume Coal engaged Dr Lloyd Townley of GW-SW Pty Ltd, an expert with over 40 years of experience in groundwater modelling, to independently review the groundwater model. The full review is contained in Annexure C of Appendix B to this report (Townley 2020).

DPIE advised Hume Coal, following the release of the IPC report, that they would not be willing to jointly engage an independent expert as suggested by recommendation R5. Despite DPIE's stated position, Hume proceeded to engage Dr Lloyd Townley for that role in order to respond to the IPC.

Dr Townley's review finds that the modelling undertaken for the Project is fit for purpose, which is predicting groundwater inflows to the proposed mine and drawdown of the watertable within and near the Project area (Townley 2020).

As an author of the Australian Groundwater Modelling Guidelines (Barnett et al 2012), Dr Townley (2020) provides the following comments:

- The authors (of the Australia Modelling Guidelines) did not intend to imply that uncertainty in values of model parameters and uncertainty in predictions are so great that models are not useful. On the contrary, the authors hoped to explain that professional groundwater modellers gain skills through training and experience to develop models that can be used to make useful predictions. Modellers endeavour to develop the best possible model, given available resources (modelling effort and budget), taking into account all available information. They set out to develop models that have low uncertainty, so that stakeholders can have more confidence in the predictions.
- The authors did not intend the concept of “confidence level classification” to be prescriptive. The Australian Groundwater Modelling Guidelines do not state that a model must have any specific “Class” for any specific purpose. This notion seems to have been adopted by some stakeholders, but this practice was not anticipated by the authors. Table 2-1 of the Australian Groundwater Modelling Guidelines lists “key indicators” characteristic of models with different confidence level classifications. The **length of time for which predictions are made, relative to the period for which calibration has been possible, is one key indicator. The maximum stress experienced during the prediction period, relative to the maximum during the calibration period, is another.** Most “greenfields” mining projects do not have extensive data sets and tend to have a short calibration period with stresses much lower than during future proposed mining, so this almost automatically implies that confidence in predictions is less, and such a model would have a confidence level classification of Class 1. The Guidelines never suggest that this is not acceptable, or that these models would automatically default to Class 1. They simply explain that confidence will be less.

The findings of the HydroGeoLogic determined that the groundwater model is a Class 2 confidence level and is fit for purpose.

The findings of the review conducted by Dr Townley (2020) determined that the groundwater model is a Class 2 confidence level and has some elements of Class 3.

Dr Townley (2020), in his assessment of the model, places emphasis on two key indicators related to (i) the length of time for which predictions are made relative to the time period of calibration, and (ii) the magnitude of future stresses relative to historical stresses during the calibration period. Given the use of available transient data from historical mining at the Berrima Colliery, Dr Townley (2020) advised that the modelling undertaken for the Hume Coal Project should be judged to be Class 2. These two key indicators often lead to models of greenfields mining projects being considered Class 1, but this conclusion is not reasonable for the Hume Coal Project.

Dr Townley (2020) continues in his review stating:

- that modelling approach is appropriate and consistent with the Australian Groundwater Modelling Guidelines;
- the calibration methodology is consistent with the Australian Modelling Guidelines. The calibration is impressive because this is one of the first times that four separate types of data have been used for calibration in a model for a proposed mining project. This is a challenging but robust way to calibrate and has been done in an attempt to balance the different sources of information;
- the calibration methodology is supported by the Australian Groundwater Modelling Guidelines, which explain in Recommendation 5.4 that over-emphasis on fitting a model to observations of piezometric heads using an arbitrary value of SRMS is not appropriate. Therefore, the attempt to fit the model to four separate data sets is aligned to the recommendations of the Australian Groundwater Modelling Guidelines; and
- regional scale groundwater models can never predict watertable elevation or piezometric heads with an accuracy of less than 1 m. No reference to this requirement was provided, and it is unreasonable to suggest that this level of accuracy is ever possible.

The Guiding Principle in Section 7.4 of the Australian Groundwater Modelling Guidelines indicates that groundwater models are far more effective at producing differential effects (mining induced drawdown) rather than absolute. The Australian Modelling Guidelines also state that:

'It is not unusual for modellers to find that the calibration does not allow all aspects of historical measurements to be reproduced. Sometimes absolute values of heads are too high or too low, suggesting that hydraulic conductivities and recharge are not in balance, but trends are reasonable, suggesting that the relationship between hydraulic conductivity and storage coefficient is reasonable, or that the relationship between perturbations in recharge and specific yield are reasonable. In such cases calibration may be considered reasonable if differences in heads seem to be reasonable. There may be no theoretical reason to support this conclusion, but sometimes there appears to be no alternative.'

Dr Townley (2020) also provided expert advice regarding how mining has been simulated in the groundwater model:

In their response to IPC's Question 6 about the approach taken to decide on drain conductance values used in the modelling, DoI Water claimed to have "recommended that wells are alternatively used also instead of drains to effect dewatering".

In the opinion of the author of this review, the manner in which mining has been represented is appropriate and completely consistent with the way mining has been represented in models for many years. The sequence of mining can be represented using prescribed head (Dirichlet or 1st Type) boundary conditions or mixed (Cauchy or 3rd Type boundary conditions). In each of these, the elevation of mining is specified as part of the boundary condition, as a function of time, and the flow of water towards the boundary nodes is computed at the end of every time step. Since the flow to each node is unknown a priori, it is impossible and completely inappropriate to suggest that mining can be represented using flux (2nd Type) boundary conditions, ie wells.

ii Interburden (geology between base of the Hawkesbury Sandstone and the top of the coal seam)

The geological units between the base of the Hawkesbury Sandstone and the top of the Wongawilli Coal seam have been extensively investigated throughout the assessment of the Hume Coal Project. Commonly termed the 'interburden', these units are conceptualised as a single hydrostratigraphic unit in the groundwater model, and this layer includes the following geological units and formations, where present within the model domain (in order of youngest to oldest):

- Narrabeen Group sediments – observed to be present in the north-east of the model domain, but absent in the Hume Coal Project area;
- Upper Eckersley Formation – identified in some drillholes in the Hume Coal Project area but it is difficult to differentiate this fine- to medium-grained sandstone where the Burratorang Claystone is absent;
- Burratorang Claystone member of the Eckersley Formation – observed to be an important stratigraphic marker in the Hume Coal Project area (Jones 2020) and is a very fine grained massive to weakly laminated tuffaceous deposit. Professor Brian Jones of the University of Wollongong (2020) states that the presence of this unit clearly illustrates that the Hawkesbury Sandstone has not eroded down to the Wongawilli Coal over most of the Project area;
- Lower Eckersley Formation, including the Unnamed Member 3 which consists predominantly of carbonaceous mudstone or shale ranging from structureless to weakly or well laminated;
- Wongawilli R Ply (above the mined seam – it is a ply (coal layer) within the interburden); and
- Farmborough Claystone – regional extensive and present in most of the Project area, except where the Hawkesbury Sandstone has eroded down to the top of the Wongawilli Coal ash and coal lithological units.

The interburden hydrostratigraphic unit is represented in the groundwater model by Layer 8. While Layer 9 and 10 represent the unmined sections of the Wongawilli Coal seam. As presented in previous submissions, the hydrogeological properties (hydraulic conductivity, storage parameters (storativity / specific yield)) are not explicitly simulated. The hydraulic conductivity of the modelled aquifer properties of layer 8, 9 and 10 are identical for the basal subdivision of the Hawkesbury Sandstone (model layer 7). Therefore, these layers do not provide a barrier to simulated drawdown in the Hawkesbury Sandstone as a result of mining.

Table 5.2 below provides a summary of the groundwater model layers and their representation.

Table 5.2 **Groundwater model layers**

Layer number	Layer representation	Median Hydraulic Conductivity (Kh) assigned in RTS model (m/day)
1	Wianamatta Group shale *	1
2	Hawkesbury Sandstone	5×10^{-1}
3	Hawkesbury Sandstone	1×10^{-1}
4	Hawkesbury Sandstone	2×10^{-2}
5	Hawkesbury Sandstone	8×10^{-3}
6	Hawkesbury Sandstone	7×10^{-3}
7	Hawkesbury Sandstone	6×10^{-3}
8	Interburden * <ul style="list-style-type: none"> • Narrabeen Group (where present) • Upper Eckersley Formation • Burragorang Claystone • Lower Eckersley Formation, including Unnamed Member 3 • Wongawilli R Ply • Farmborough Claystone 	3×10^{-3}
9	Wongawilli Coal – unmined section	3×10^{-3}
10	Wongawilli Coal – unmined section	3×10^{-3}
11	Wongawilli Coal – mined section	2×10^{-3}
12	Kembla Sandstone and other basal units of the Illawarra Coal Measures	1×10^{-3}
13	Shoalhaven Group sediments	1×10^{-4}

Note: * To be conservative hydrogeological properties (K and Ss/Sy) of the Wianamatta Group and Interburden units are not explicitly simulated in the groundwater model

Item 140 queries the assertion by community groups that the Hawkesbury Sandstone is in direct contact with the coal seam to be mined and that the hydraulic conductivity is highest in this area. As presented in previous submissions, listed above and as described by Professor Jones (2020), there are geological units that make up the hydrostratigraphic unit of the interburden present between the base of the Hawkesbury Sandstone and the Wongawilli Coal mining seam across most of the Project area.

As stated in EMM (2018b), there are no compelling data sets to confirm there is any uniform regional layering or an increase in hydraulic conductivity of the sandstone strata at the base of the Hawkesbury Sandstone. The braided stream depositional environment of the Hawkesbury Sandstone explains why there are no consistent regional layers, and why the hydraulic conductivity within the unit varies spatially and with depth (but not in a uniform manner). The Hawkesbury Sandstone is a dual porosity system, and regional studies completed for the Kangaloon Borefield project to the east of the Hume Coal Project area confirm that the hydraulic conductivity and yield from bores drilled through the whole Hawkesbury Sandstone sequence are not directly related to the depth of the bores, but to the degree and depth of fracturing and fracture interconnection (URS Australia 2007, URS Australia 2008).

Yields from water bores that intercept deeper fractures can be very high yielding across localised areas of the Southern Highlands (URS Australia 2007 and Parsons Brinckerhoff 2009b). With the added advantage of significant available head, deep bores can pump high volumes (up to 50 L/s) at selected locations. The Hawkesbury Sandstone can have high hydraulic conductivity at depth however, this trend is more related to (localised) secondary hydraulic conductivity features such as fractures, and the fact that bores designed for large yields are generally constructed as fully penetrating large diameter bores, rather than high (regional)

primary permeability. Groundwater bore yields are presented and discussed in the detailed geology report, included as Annexure B.2 of Appendix B to this report.

iii Geological structures

Faults and igneous intrusions can operate as both barriers and conduits to flow on a local scale; however, at a regional scale faults and fractures rarely influence groundwater flow in a significant way. This is consistent with what has been observed for this Project. The equivalent porous medium approach has been adopted for this Project. That is, at a regional scale, such as a Project impact assessment scale, the influence of structures such as faults and intrusions is minor and groundwater flow is consistent with porous media. As outlined in the Annexure C and Annexure B (Townley 2020) of Appendix B to this report, regional scale groundwater flow systems are sensitive to and depend on average values of hydrogeological properties, with properties averaged over relatively large distances.

In terms of the influence of major geological structures such as faults and dykes on mining, the mine layout as shown in the EIS in its entirety, has been developed around currently known or inferred features, as well as the Hume Motorway which cuts across the proposed mining area. It has never been intended or even suggested that web pillars will be formed up in close proximity to major geological structures and the layout fully confirms this intent.

iv Model conservatism related to reject emplacement and injection of surplus water

There have been submissions from the NSW Government that the groundwater model is not conservative in its simulation of mining and reject emplacement. Figure 5.1 presents a conceptual schematic of the mine progression, reject emplacement and water reinjection for the Hume Coal Project.

The review by HydroGeoLogic for the NSW Government advised that the approach to simulating mining in the groundwater model is conservative for assessing the potential impacts of the proposed mining operation on the groundwater system. The inclusion of more water underground will mean that less groundwater has to drain from the overlying, adjacent or underlying strata to fill the void space. If this was simulated, there would be less drawdown.

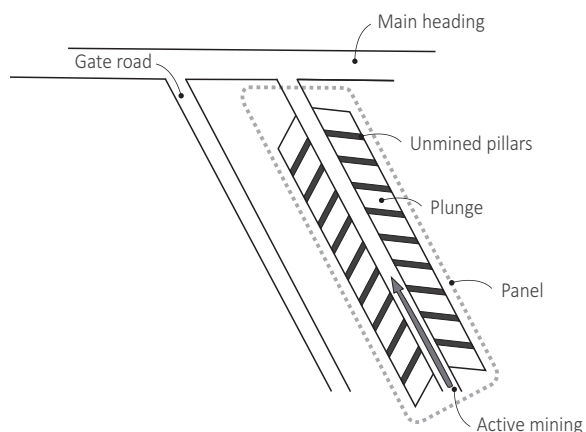
The review by Dr Townley (2020) also confirms that the approach is conservative. Dr Townley (2020) states:

The Modified EIS Model already includes some representation of the construction of bulkheads and of refilling of the mined voids behind these bulkheads. By deactivating drain cells and changing hydraulic conductivities and storage parameters after the end of mining in each pine feather panel, some account is taken of the dynamics of refilling. This means that each model simulation during uncertainty analysis already partially includes the effect of backfilling and emplacement of water.

In the opinion of the author of this review, the approach taken is conservative, in the sense that if backfilling were simulated in more detail, including injection of water into voids behind bulkheads, the model would predict faster recovery after the end of mining that panel and smaller values of maximum drawdown. This would be apparent in every individual simulation undertaken during uncertainty analysis, and therefore in the statistics of the ensemble.

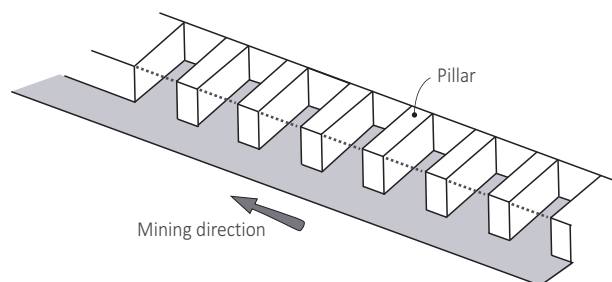
PLAN VIEW

ACTIVE MINING



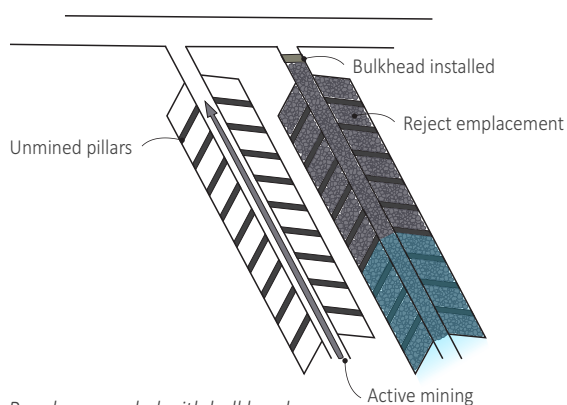
Note: Mining of panels commences with establishing the gate road, then mining in the plunges back to the main heading

SECTION VIEW

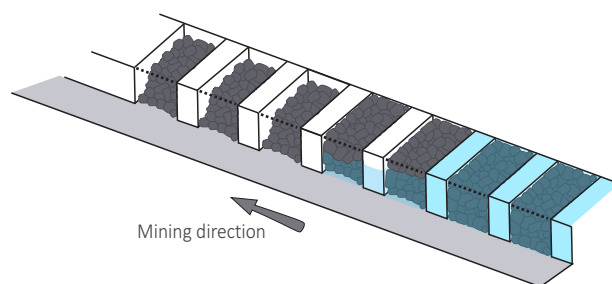


Note: Active dewatering occurring

REJECT EMPLACEMENT

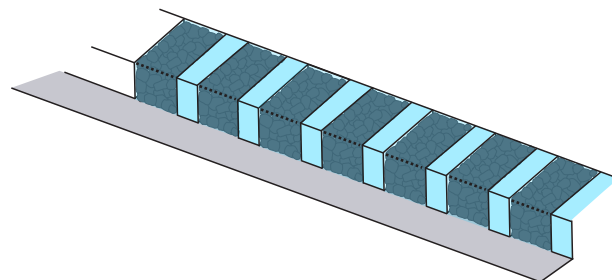
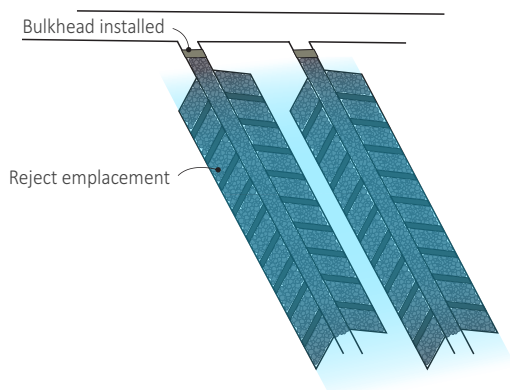


Note: Panels are sealed with bulkhead immediately after rejects are emplaced in mined plunges



Note: Co-disposal reject emplacement occurs in previously mined plunges. Excess mine water is pumped into sealed panel and receives natural groundwater inflow

END OF MINING



Note: Void space in panel becomes full and groundwater system becomes fully saturated. In times of water deficit, water in sealed panels may be accessed to meet mine water requirements

NOT TO SCALE

(This is a schematic representation only and does not accurately represent the size or plan for all panels)

Hume Coal mine progression, reject emplacement and water injection

ii Item 145 and 146

The make good arrangements for bore owners needs to be tailored for each bore owner. Hume Coal will work with individuals to arrive at tailored solutions that work at the local scale.

There are many options at each site to provide access to water, drilling deeper bores into deeper formations is only one option, and although it may not provide the full solution for irrigation, it may very well provide a percentage of the water requirements and therefore remains a part of the solution. Based on the current available information, access to deeper formations will provide good solutions for low yield stock and domestic users (ie users that do not require large instantaneous volumes of water). Other options for irrigation bores may include several of the following:

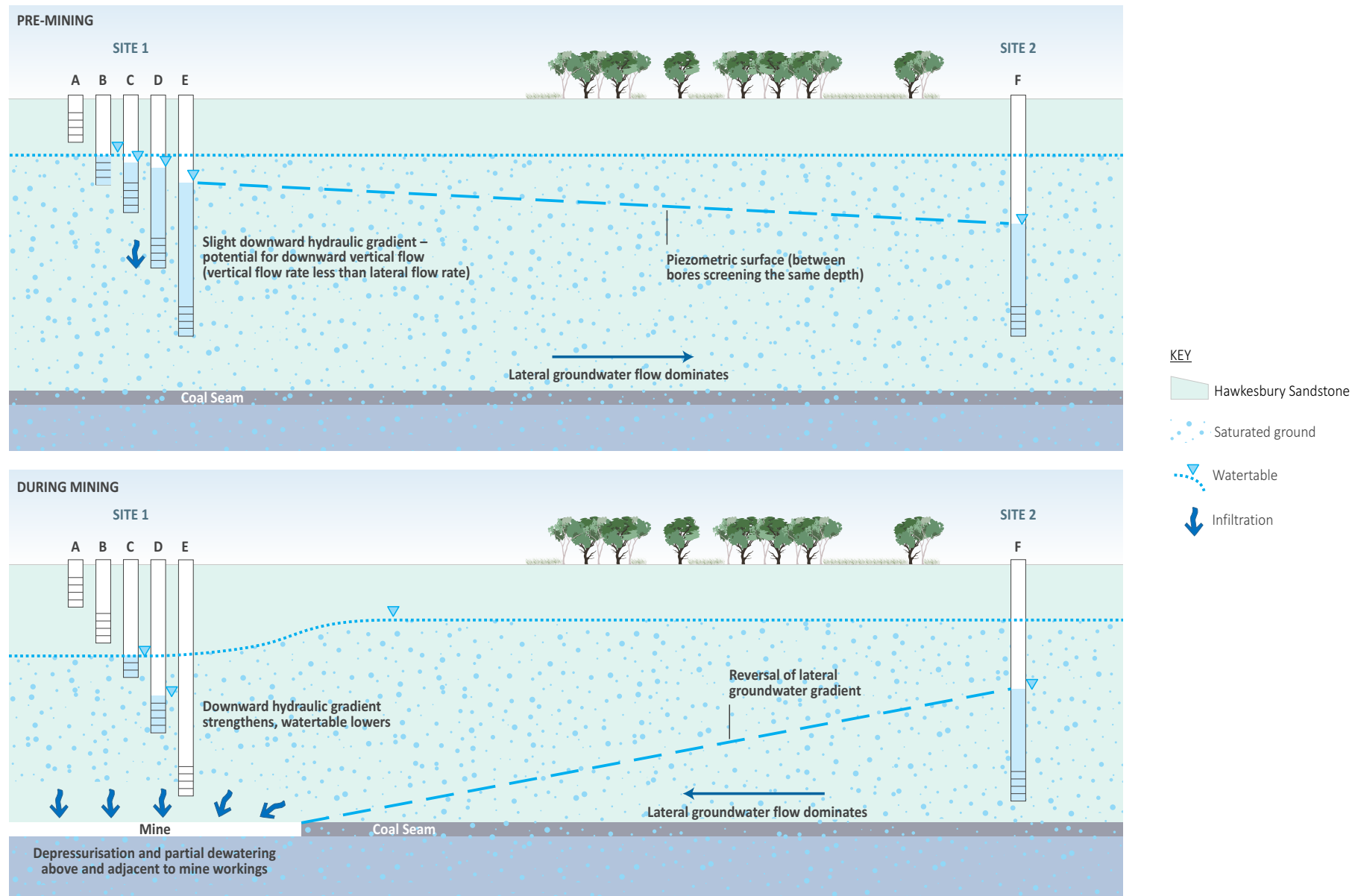
- additional bores to replace one (to maintain bore yields);
- drilling shallower bores into the mid-section of the Hawkesbury Sandstone, which remains saturated throughout mining and recovery (see Figure 5.2);
- relocating bores further away from the mine area (for large properties this is often an option);
- construction of additional storage (dams and tanks); and
- financial compensation for part or all of the duration of impact, e.g. to compensate for additional pumping costs.

iii Item 147

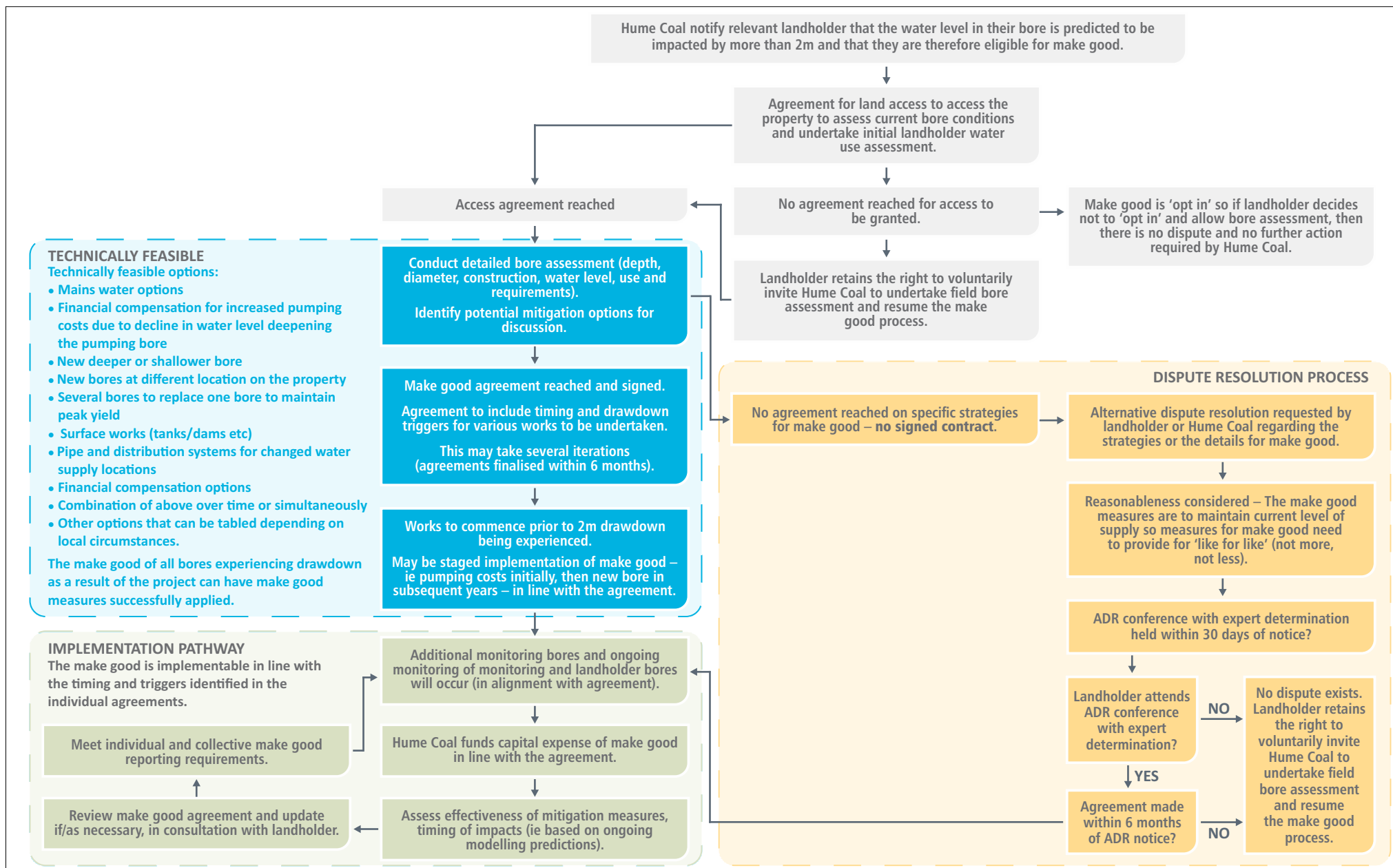
Hume Coal has continuously considered the needs of the community throughout the preparation of the EIS for the Project. The mine design is an example of the innovation and consideration invested to minimise the impacts of the Project. The adoption of very detailed make good considerations and a conservative approach to inclusion of all bores within the 67th percentile predicted 2 m drawdown extent should also be noted.

The loosely defined pathway for proponents to manage conflict resolution of 'make good' in NSW means that projects such as Hume Coal have the potential for uncertainty and disruption. However, Hume Coal have been aware of this throughout the planning of the process and have designed a detailed strategy for resolving conflict at every stage.

Hume Coal have mapped out the potential areas of conflict in this process and have a solid approach to dispute resolution (see Figure 5.3).



Hydraulic head in bores schematic – pre-mining and during mining



Make good flow chart

5.5 Analysis and response to recommendations R4, R5 and R6

The summary of the IPC recommendations relating to groundwater, and Hume Coal's responses are presented in Table 5.3 below. Detailed responses to recommendations R4, R5 and R6 are provided in Section 5.5.1, Section 5.5.2 and Section 5.5.3 respectively.

Table 5.3 Response to IPC recommendations – Groundwater

Reference number	IPC's recommendation	Hume Coal response
R4	That the Department review the advice of Department of Industry - Water dated 24 April 2019 and the Applicant's correspondence of the 17 May 2019 and gives consideration to requesting the completion of the revised groundwater flow model, taking into consideration the advice provided.	This is addressed in Section 5.5.1 and discussed further in Appendix B and Annexure A of Appendix B.
R5	<p>Because the Applicant and Department of Industry - Water remain a considerable distance apart regarding their positions on the groundwater modelling, the Commission suggests that the Department or the Applicant, or both of them jointly (and in any case in consultation with Department of Industry - Water), engage a new independent expert (or alternatively a small technical group with Chair) with experience in groundwater modelling with a view to resolving ongoing differences of opinion. The independent expert/Chair should consider:</p> <ul style="list-style-type: none"> • what practical steps, if any, can be taken to make the model a class 2 model or seek agreement on the class of the model; • what additional work is required to establish the extent to which the emplacement of water in mined-out voids will reduce the level of drawdown in the later years of the project; • the range used for the input parameters in the modelling sensitivity/uncertainty analysis and recommend if a wider range is required so that there is no unreasonable truncation of results; and • if additional geological information is required. 	<p>Hume Coal engaged Dr Lloyd Townley of GW-SW Pty Ltd to conduct an independent review of the groundwater modelling. Dr Townley's report is provided as Annexure C of Appendix B.</p> <p>A summary of Dr Townley's review and response to questions raised in R5 is provided in Section 5.5.2.</p>
R6	That the Department give close attention to the practical adequacy of make good provisions during the final assessment process, with an independent review if necessary. This should include the practical aspects such as dispute resolution and economics as well as the technical.	This is addressed in Section 5.5.3 and discussed further in Appendix B.

5.5.1 Detailed response to R4

EMM and HydroSimulations (now SLR Consulting), on behalf of Hume Coal, provided a response to the then Dol Water response to IPC questions (Dol Water 2019). Hume Coal submits that the Dol Water response to questions from the IPC contain errors and unsupported claims, and as such, should be given little weight.

The NSW Government's independent groundwater peer reviewer, Hugh Middlemis of HydroGeoLogic, is an extremely experienced, accomplished and reputable hydrogeologist and groundwater modeller. Hugh Middlemis' review (HydroGeoLogic 2017) found the Hume Coal groundwater model to be suitable for mining impact assessment purposes (Class 2 confidence level) and confirmed that the model is 'fit for purpose'. This finding appears to have been overlooked by Dol Water in its response to the IPC's questions.

Consultation between Hume Coal and DoI Water on the groundwater model has occurred over the past ten years. Many of the concerns raised in the DoI Water April 2019 letter have been raised previously by DoI Water and addressed in Hume Coal's previous responses. As part of the independent expert review, HydroGeoLogic considered that most of Hume Coal's responses (within the RTS) adequately addressed the issues raised, and that the Hume Coal groundwater model is fundamentally consistent with best practice in design and execution.

The uncertainty analysis undertaken of the Hume Coal groundwater model is extremely detailed and of a world class standard, having been undertaken by Dr Noel Merrick, a world class groundwater modeller. The mathematics and concepts in uncertainty analysis are fundamental to the results and their interpretation. This is a critical reason why the IPC and the NSW Government can rely on the findings of the experience and expertise of the independent peer reviewer appointed by DPE (now DPIE).

Following the correspondence referred to in R4, a meeting was held on 30 July 2019 between DPIE Water hydrogeologists, DPIE Planning and Assessment personnel, Hume Coal personnel, EMM and HydroSimulations/ SLR Consulting hydrogeologists. Seven actions were discussed and agreed out of that meeting. The minutes were recorded by Hume Coal and distributed to all parties on 15 August 2019. The seven actions were:

1. Cross sections – Hume Coal to provide additional north–south and east-west sections to assist DPIE with making their assessment on impacts.
2. Hydraulic data with depth and spatially – Hume Coal is to re-evaluate original data from EIS and RTS graphs showing hydraulic conductivity with depth (Coffey's EIS graphs and refined HydroSimulations graphs in the RTS). The data is to be reproduced and charted spatially on a map or series of maps.
3. Berrima Colliery comparison – Hume Coal to provide an enhanced discussion of the similarities and differences between the existing Berrima Colliery and the proposed Hume Coal Project.
4. Calibration statistics – Hume Coal to provide more information on model calibration statistics. DPIE Water requested if the model predicts 70% of the monitoring bores hydrograph history match is in excess of 2 m, then what are the impacts of the 2 m drawdown on landowner bores. Hume Coal will provide information and discussion on this.
5. Uncertainty analysis – Hume Coal to describe the range of parameters explored and map them.
6. Packer tests – Hume Coal to provide raw data from the packer tests conducted for the Project.
7. DPIE Water report – Hume Coal to reference the original submission from DoI Water to the EIS (and subsequent submissions) and consider the data and information requests from the original submission. This is to include data and information requested in the Appendix from the response to the IPC.

Annexure A of Appendix B to this report provides a detailed response to the seven actions.

Following submission of the RTS, SLR Consulting conducted additional model verification work by extending the model history match period to July 2018 and comparing to Project monitoring data. The results of the verification are consistent with the RTS groundwater modelling. Future improvements to the Hume Coal groundwater model will be undertaken as and when new data become available. As mining progresses, a need for further model updates will be assessed regularly based on evaluation of groundwater monitoring data and findings of impact verification. It is expected the confidence level of model predictions will increase over time as the model is updated to reflect the observed effects on groundwater obtained from the monitoring program. This is consistent with International Organisation for Standardisation (ISO) continuous improvement guidelines. The process for continuous improvement related to groundwater modelling is illustrated in Figure 5.4.

5.4.2 Detailed response to make good items

i Overview

The revised water assessment completed as part of the RTS recognises that 400 landholder bores are registered within a 9 km radius of the proposed mine (WaterNSW 2018). The dominant licensed purpose of these bores is for domestic and stock use, but irrigation bores are also present.

The results of the RTS groundwater model have been used to assess the scale and duration of drawdown in each registered landholder bore that have current Works and Use Approvals, both during and post mining. Drawdown is defined as the change in water level (pressure head) in a bore over a period of time. Drawdown can occur due to a combination of stresses on the groundwater system. Existing stresses on the groundwater system prior to the start of the Project can include climatic changes, existing landholder pumping and/or the long history of groundwater take by Berrima Colliery. These stresses are considered part of the baseline conditions.

The AIP requires that the Project considers its own effects on bores and whether the Project will exceed the minimal impact criteria on landholder bores, which is 2 m as measured in the landholder bore. It is critical to note that:

- minimal impact considerations relate to a 'water dependent asset' and not the groundwater system itself (ie a project can create drawdown in excess of 2 m, but when that occurs at a landholder bore it triggers further investigation);
- a 2 m drawdown in a landholder bore is not necessarily considered an 'impact' to that bore. The bore may be fully functioning and largely unaffected with this level of drawdown (and at levels of significantly more drawdown). Whether there is an 'impact' to the use of the bore involves many variables such as bore depth, pump depth, level of drawdown actually experienced, climatic conditions;
- the AIP policy states that:
"Where the predicted impacts are greater than the Level 1 minimal impact considerations by more than the accuracy of an otherwise robust model, then the assessment will involve additional studies to fully assess these predicted impacts. If this assessment shows that the predicted impacts do not prevent the long-term viability of the relevant water-dependent asset, as defined in Table 1, **then the impacts will be considered to be acceptable.**"

In NSW, a project can have impacts on other users that are deemed 'greater than minimal impact', but these impacts must be managed and mitigated via 'make good provisions'. Hume Coal acknowledge that there will be changes to groundwater levels in excess of the 'minimal impact criteria' proposed by the AIP at some landholder bores. Therefore, Hume Coal commits to negotiate make good arrangements with these users, in accordance with any relevant conditions of consent. The presence of the mine will not threaten the ability of other groundwater users to access groundwater for their operations and will therefore not influence the property market. Hume Coal is committed to the principle of maintaining existing users' access to groundwater and making good any impacts deemed to be greater than minimal impact.

Partial depressurisation of the Hawkesbury Sandstone aquifer overlying the mine will occur as mining progresses, with some dewatering near the watertable. Shallow bores in the sandstone that are not fully penetrating will be the most impacted as drawdown occurs (they may not experience the greatest drawdown but because of their shallow depth they may go dry). Greater water level drawdowns will occur in the deeper sandstone, but groundwater will still occur in these rocks (ie they will remain saturated). The majority of the Hawkesbury Sandstone will remain saturated throughout mining. The Hawkesbury Sandstone aquifer will not be 'drained', 'cracked through' or 'destroyed'. It will be depressurised, and as a result the watertable will experience some drawdown, but not total dewatering. The integrity of the Hawkesbury Sandstone is not compromised and will not be 'damaged', as the mine is designed to result in minimal levels of overburden deformation. There will be no irreversible damage to the Hawkesbury Sandstone, and groundwater levels will fully recover in time.

The make good analysis considers both the depressurisation and drawdown impacts of the Project on individual landholder bores (ie reduced yields and lower water levels) and has used the detailed uncertainty analysis from the groundwater modelling to provide greater confidence in the predictions for each individual landholder bore.

The conclusion of the NSW DPI in respect to impacts on landholder bores is that the proposed strategies are "reasonable considering the circumstances".

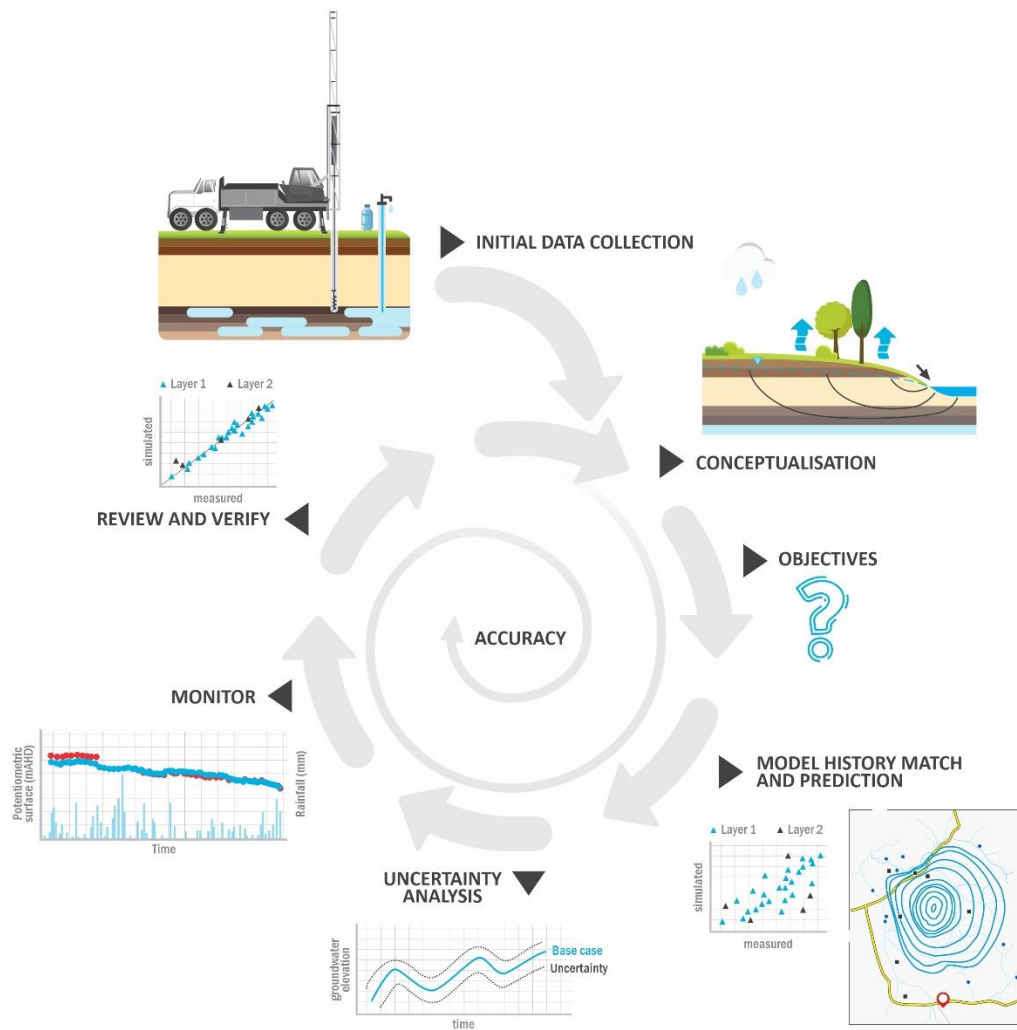


Figure 5.4 Groundwater modelling continuous improvement

In addition to the verification work, SLR Consulting and Hume Coal have continued to review the groundwater model assessing varying scenarios (which is being referred to as the 'post- RTS' groundwater model). This groundwater modelling work is continual and aligns to best practice in groundwater modelling. The post-RTS modelling includes assessing the watertable response to potential injection of surplus water, refinements to topography, influence of the interburden hydrostratigraphic unit on groundwater flow and watertable response to mining. This post-RTS modelling has not been undertaken for the purpose of responding to the IPC recommendations or DPIE Water requests, but has incorporated learnings over time from other projects, and incorporated additional data as it continues to become available. The post-RTS modelling is not a requirement of the NSW Government, because the RTS groundwater model has been determined fit for purpose and appropriate for assessing the potential impacts of the Project on groundwater users (HydroGeoLogic (2017) and (2018); Townley (2020)).

The post-RTS modelling work can be made available to the NSW government either via a presentation or via a report at a later date as required.

5.5.2 Detailed response to R5

i Independent review

Hume Coal engaged Dr Lloyd Townley of GW-SW Pty Ltd, an expert with over 40 years of experience in groundwater modelling, to independently review the RTS groundwater model. The experience and qualifications of the reviewer are summarised in Attachment 1 of his review. The full review is contained in Annexure C of Appendix B to this report (Townley 2020).

DPIE advised Hume Coal, following the release of the IPC report, that they would not be willing to jointly engage an independent expert.

With a view to resolving ongoing differences of opinion between DPIE and Hume Coal on the groundwater modelling, Townley (2020) conducted an independent and systematic review focusing on three issues raised by the IPC:

1. whether the model is Class 2 and if not, what would be needed to increase the class category to Class 2;
2. whether additional work is required to understand the effect of emplacement of water in mined out voids on drawdown; and
3. whether the range used for input parameters in the modelling sensitivity analysis and uncertainty analysis is appropriate.

A fourth issue, whether additional geological information was required, has been assessed separately to Townley (2020).

ii Model adequacy and class

Townley (2020) concluded that modelling undertaken for the Hume Coal Project is fit for purpose, for the purpose of predicting groundwater inflows to the proposed mine and drawdown of the watertable within and near the Project area. This conclusion is consistent with the previous expert reviews by HydroAlgorithmics Pty Ltd (2016), Kalf and Associates Pty Ltd (2016) and HydroGeoLogic (2017, 2018) on behalf of DPE that concluded the original EIS model and subsequently the Modified EIS Model (RTS model) were fit for purpose.

Townley (2020) notes that Hume Coal has modified the design of its mine during the process of environmental impact assessment, in order to ensure that potential environmental impacts are significantly lower than they would be with mining methods used in many other projects.

With respect to the discussion of the confidence level classification for the model, following extensive review of the Australian Groundwater Modelling Guidelines (Barnett et al 2012) and their intent, Townley (2020) concludes that the model is a Class 2 model, and has some elements of a Class 3 model. Earlier reviews by HydroGeoLogic (2017) and HydroSimulations (2018) considered all aspects of the model and argued that the model is Class 2.

Townley (2020) agrees that the model is Class 2 with Class 3 elements and also places special emphasis on two key indicators related to:

- the length of time for which predictions are made relative to the time period of calibration, and
- the magnitude of future stresses relative to historical stresses during the calibration period.

These two key indicators often lead to models of greenfields mining projects being considered Class 1, but this conclusion is not reasonable for the Hume Coal Project. Because transient data are available during historical mining at the Berrima Colliery, the modelling undertaken for the Hume Coal Project should be judged to be Class 2.

iii Emplacement

With respect to the issue of whether additional work should be done to better predict the effect of emplacement of water in voids on drawdown in the later years of the project, Townley (2020) concludes that, although additional work could be done, it is unnecessary. Townley (2020) states that the modelling approach is conservative, in the sense that if backfilling were simulated in more detail, including injection of water into voids behind bulkheads, the model would predict faster recovery after the end of mining and smaller values of maximum drawdown. This would be apparent in every individual simulation undertaken during uncertainty analysis, and therefore in the statistics of the ensemble.

iv Uncertainty analysis

Regarding the appropriateness of the range of input parameters used, Townley (2020) notes that uncertainty analysis has been undertaken with a large number of spatial distributions of hydraulic conductivities and concludes that the range of parameters is sufficient and should not be larger. Townley (2020) further notes that the value or validity of sensitivity analysis is not based on if the range of input parameters is large but, rather, it is based on how realistic the input parameters are. Variability within generated spatial fields of hydraulic conductivities and storage coefficients should be consistent with variability observed in the real world. Townley (2020) states that the range of the distributions of horizontal hydraulic conductivity (Kh) generated by HydroSimulations (2018) is probably large enough and may be too large; and the range of Kh/Kv may be too small, as it is not uncommon for Kh/Kv to be 1,000 or 10,000 in some materials in the Sydney Basin. However, if Kh/Kv were larger the predicted impacts on the watertable would tend to be smaller. Therefore, as previously stated, the groundwater model predictions are conservative.

v Geological and hydrogeological data

Regarding the need for additional geological information, Townley (2020) outlines that the Australian Groundwater Modelling Guidelines provide no specific advice about the amount of geological or hydrogeological information required to undertake modelling for a project like the Hume Coal Project. Nor are there industry standards. In addition, there is no requirement for proponents to make geological information available in the public domain.

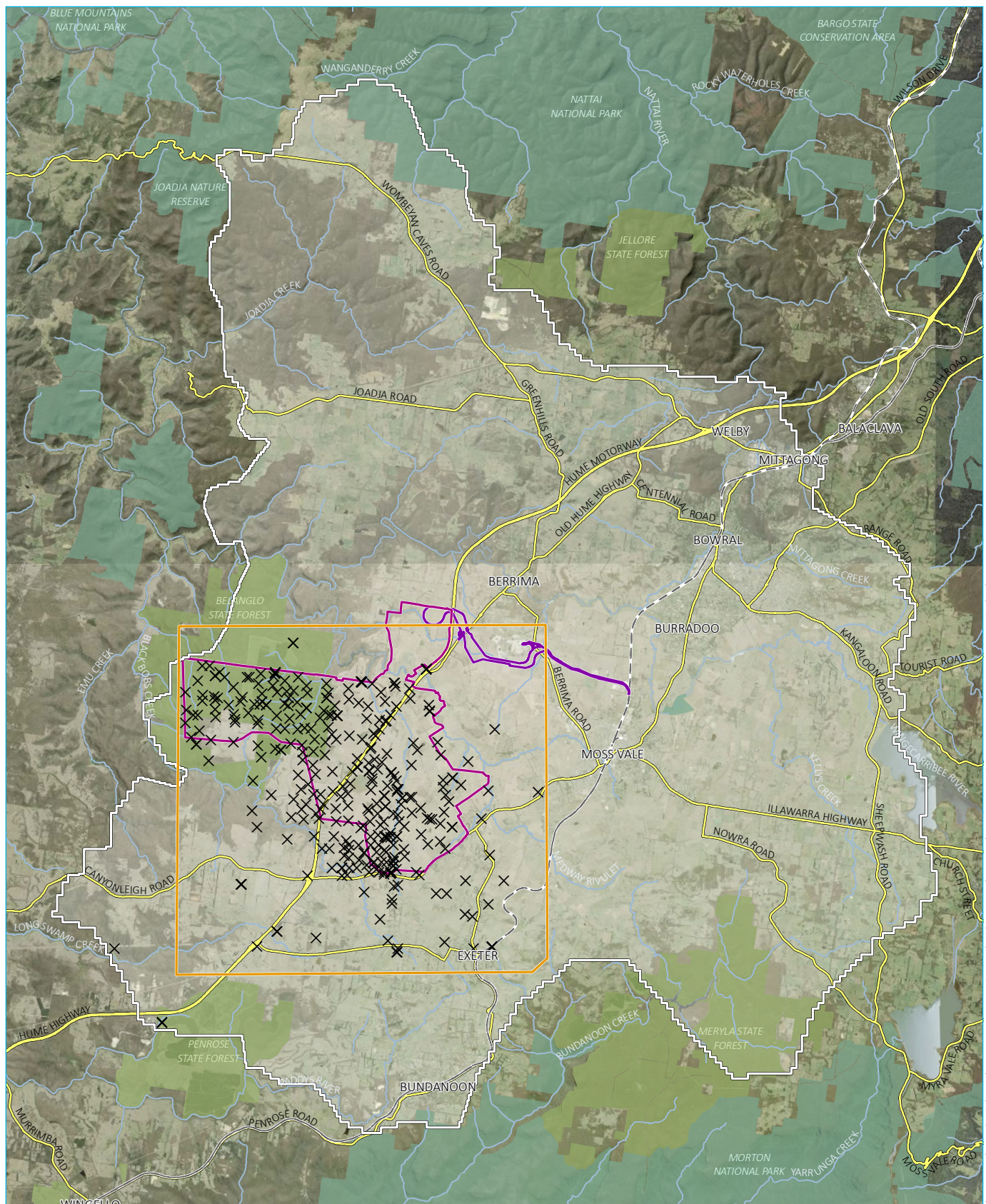
As part of the independent expert review conducted by HydroGeoLogic on behalf of the then DPE, Hume Coal provided the raw data files and all information used to develop the conceptual and numerical models.

As part of his review, Dr Bruce Hebblewhite (2019) commented that the amount of data provided was quite considerable and is consistent with similar mining projects at this stage of evaluation and development.

At the meeting with Dol Water on 30 July 2019, and following a presentation on the geology of the Hume Coal Project, Mr Druzynski of Dol Water stated he “wasn’t aware Hume Coal had so much geological data”.

The geological and hydrogeological data for the Project is extensive, with 345 individual holes drilled within the A349 (179 of which are within the proposed mining area, see Figure 5.5). All Hume Coal drill holes have been geophysically logged, core photographed and used to develop a robust geological model. In addition to the drilling of boreholes, extensive aerial magnetic and radiometric surveys have been conducted over the Project area. Surface magnetic surveys were also undertaken targeting specific geological structures that were located by the aerial surveys. Surface seismic surveys were undertaken in the Belanglo State Forest and property owned by the applicant. In total, approximately 36 linear km of data was obtained. Geological mapping was undertaken on accessible properties and where drilling was undertaken.

Figure 5.5 shows the extent of the Hume Coal geological model, mineral drill hole data locations and the extent of the groundwater model. Cross sections have been cut within the geological model and groundwater model for comparison purposes, as requested by DPIE Water at a meeting held in July 2019. These cross sections are discussed further in Annexure A of Appendix B.



Source: EMM (2020); Hume Coal (2016); DFSI (2017)

KEY

- | | |
|---|--|
| Hume Coal Project area | Existing environment |
| Berrima Rail Project area | Rail line |
| Groundwater model extent | Major road |
| Geological model extent | Named watercourse |
| X Hume drill holes | Named waterbody |
| | NPWS reserve |
| | State forest |

Comparison of groundwater model and Hume Coal geological model extents

Hume Coal and Berrima Rail Project
IPC response report
Figure 5.5

5.5.3 Detailed response to R6

i Predicted impacts

The RTS groundwater model predicts that there will be 94 landholder bores on 72 properties that will experience drawdown in excess of the AIP Level 2 impact criteria of 2 m as a direct result of the Project.

Hume Coal realise that there remains ongoing concern from the community and the NSW Government about the total number of bores that are predicted to experience drawdown as a result of the Project. It is important to note that the number of bores is not directly related to the significance of the Project impact.

Bores in this area are common due to high quality water at shallow depths, however, most bores provide a secondary (back-up) water supply, and many are also used to top up constructed surface water features used for water storage or garden aesthetics. Some bores are used for stock and domestic purposes and a small percentage are used for irrigation and some bores not used at all. It is important to note that most other coal mines have purchased all the overlying land (ie so effectively removed the overlying users) resulting in a much smaller number of active overlying and adjacent bores.

The key message of the Project is that although the number of bores experiencing drawdown in excess of 2 m is higher in comparison to other approved mining projects, the actual impacts are not. The Project impacts have been statistically compared to other approved coal mining projects in the NSW that have similar data in the public domain and the following has been summarised from the data:

- the predicted peak annual inflow to Hume Coal mine is equivalent to the average inflow from a group of 29 mines;
- the predicted maximum extent of the 2 m drawdown contour at Hume (2 km) is less than half the average 2 m drawdown extent (4.7 km) from a group of 10 mines; and
- the predicted time for groundwater recovery back to 2 m at the Hume Coal Project is less than a fourth of the average from a group of 15 mines.

Figure 5.6 to Figure 5.8 present a comparison between the Hume Coal and other NSW coal mines related to predicted impacts related to mine inflows, predicted area of 2 m drawdown extent and predicted time to recovery.

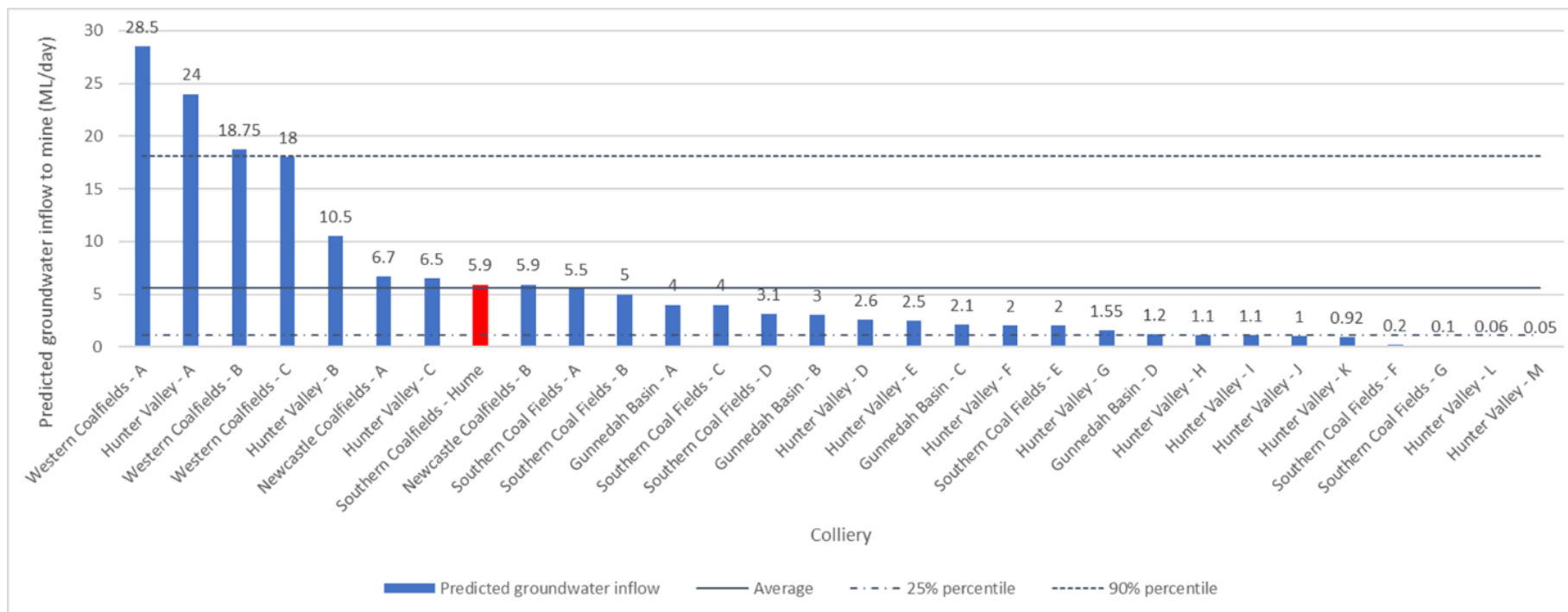


Figure 5.6 Groundwater inflow to open cut or underground workings –comparison between Hume Coal and other projects

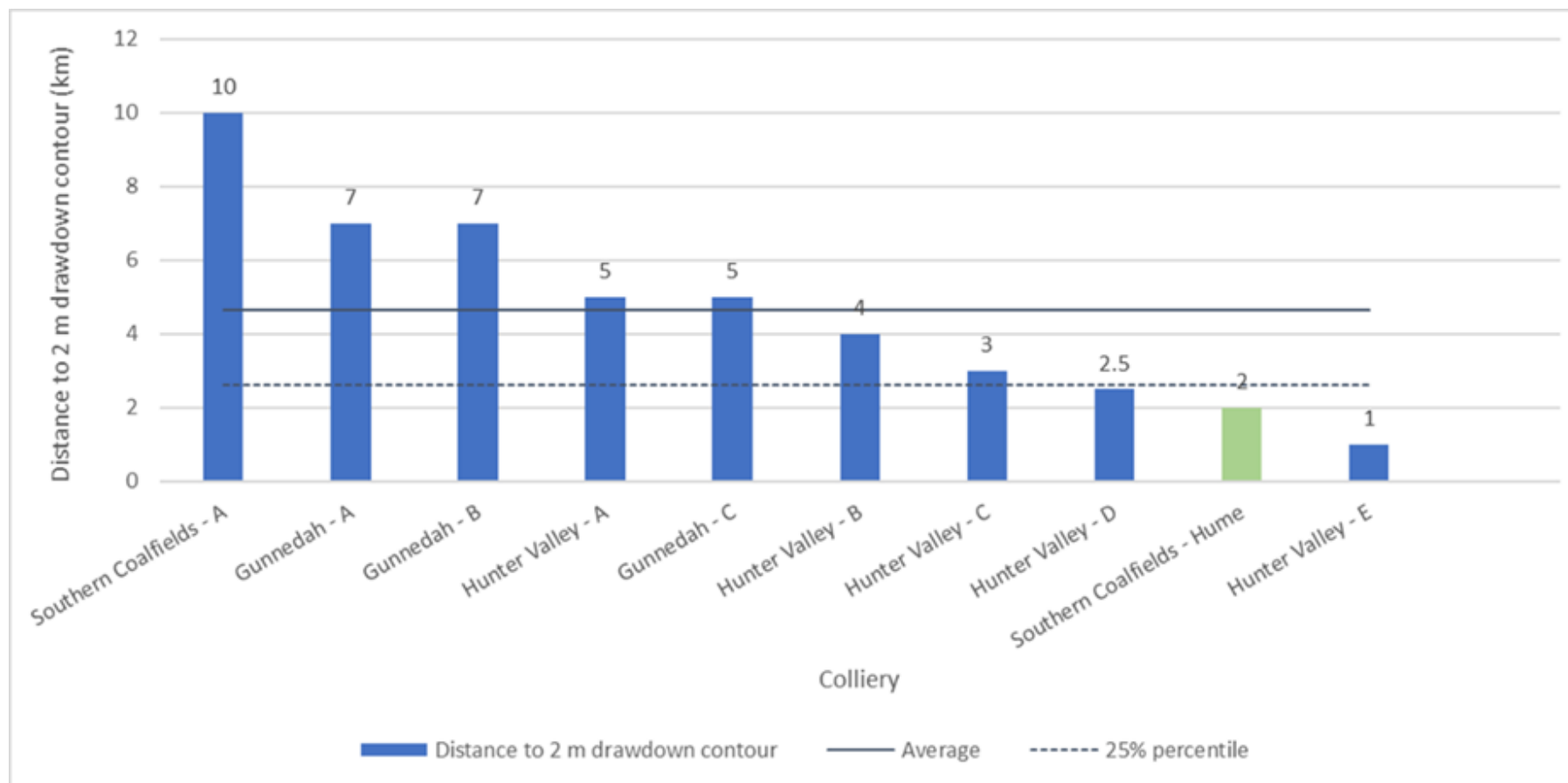


Figure 5.7 Distance to 2 m drawdown contour—comparison between Hume Coal and other projects

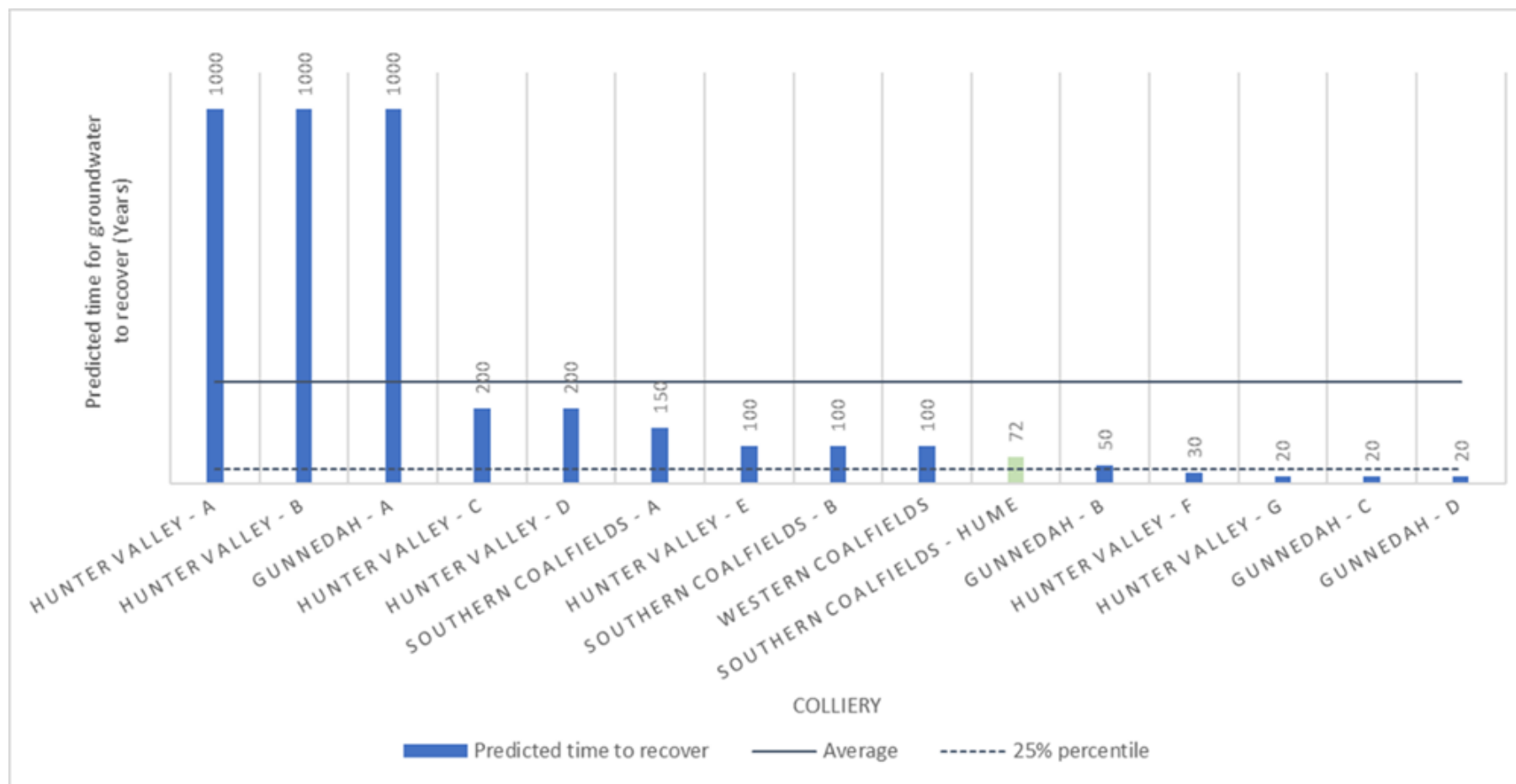


Figure 5.8 Predicted time for groundwater recovery – comparison between Hume Coal and other projects

ii Make good strategy

Landholder bore assessments and make good provisions were proposed as part of the EIS, and then revised again and proposed a second time in the RTS.

The make good report included as part of the revised water assessment (EMM 2018b) in the RTS refines 'make good' strategies for individual bores using the drawdown outputs from the RTS groundwater model. By applying the concept of make good for landholder bores, the drawdown effects are mitigated, and a landholder's access to water for farming and other purposes are not compromised.

The perceived concerns about make good are considered throughout the RTS and the IPC process and these concerns generally fall into three categories, being:

1. Technical feasibility;
2. Ability to implement; and
3. Identification of conflict resolution pathways.

A flowchart has been prepared (Figure 5.2) which outlines the make good process and allocates the key actions and decisions into the three categories for ease of conceptualisation.

Hume Coal has developed an industry leading approach to make good which considers and maps out three components being:

- practical, technically feasible options as endorsed by the independent peer reviewer and DPIE, being a combination of:
 - financial compensation for increased pumping costs;
 - deepening of pumps;
 - redrilling bores (or several bores, if needed);
 - associated earth works and water storages;
 - water management infrastructure; and
 - other options as negotiated with individual landholders.
- the process for implementation of the make good measures:
 - landholder engagement via meetings, letters, etc;
 - negotiation pathway for tailored solutions of maintaining water supplies for landholders;
 - measurement, monitoring and verification of impacts over time;
 - installation of new monitoring bores at strategic locations to provide for monitoring of baseline and changing conditions over time during and post mining - these locations will be targeted between the mine and key landholders (ie irrigators); and
 - process for conflict resolution.
- dispute resolution for make good measures between landholders and Hume Coal:
 - mapping out areas and reasons that conflict may occur; and
 - providing a structured process for resolution of disputes.

6 Surface water (R7 and R8)

6.1 Introduction and background

6.1.1 EIS

A surface water assessment was conducted as part of the EIS for the Hume Coal Project and Berrima Rail Project and reported in an overarching water assessment (EMM 2017c). The surface water related technical studies included development of a water balance model for the Project, and assessments of surface water quality, surface water flow and geomorphology and flooding. The assessments were completed in accordance with the appropriate guidelines, policies and industry requirements, the SEARs and in consultation with relevant government agencies.

The potential impact of the Project on surface water resources was assessed to be minimal, including surface water quality and flooding related impacts.

6.1.2 RTS

The most commonly raised technical issue in submissions related to water resources, in particular the potential impacts to groundwater, however some submissions raised concerns about impacts to surface water resources. The revised aspects of the surface water assessment demonstrate that the Project will meet the Neutral or Beneficial Effect (NorBE) criteria for surface water quality across all aspects of the Project.

6.1.3 IPC response

An additional scenario has been assessed using the RTS Goldsim water balance model in order to respond to part of R8 the IPC report. This is outlined in Section 6.3 below.

6.2 IPC recommendations

The IPC made two recommendations in relation to surface water, these are:

- **R7** - *The Applicant is to confirm whether the provisional Water Treatment Plant does form part of the Project – and if so, provide suitable information to permit an appropriate assessment of its impacts.*
- **R8** - *Should underground emplacement and water impounded have to cease for any reason, the Applicant is to confirm how long under normal mining operations it would take for the reject emplacement stockpile and Primary Water Dam to reach capacity.*

6.3 Approach for responding to IPC assessment, findings and recommendations

As outlined in the RTS report (EMM 2018b), excess water will be managed by storing it in the Primary Water Dam (PWD) and pumping to the void/underground behind the sealed bulkheads. A Water Treatment Plant (WTP) was included in the RTS assessment as a provisional item only. However, as the water balance work has assessed that PWD has adequate capacity to store excess water under all 107 climate scenarios, the WTP will not be required. Therefore, this item (R7) has not been assessed further.

The RTS Goldsim water balance has been used to respond in part to R8, assessing how long under normal mining operations it would take for the PWD to reach capacity. A summary response is provided in Section 6.5.1 and detailed further in Appendix B to this report.

6.4 Analysis and response to Commission's findings

The summary of the IPC findings relating to surface water, and Hume Coal's responses are presented in Table 6.1 below. Detailed response to item 185 is provided in Section 6.4.1.

Table 6.1 Response to IPC findings – Surface water

Reference number	IPC's finding	Hume Coal response
183	The Commission has carefully considered the additional information in the Applicant's Submission and its responses to the Commission's questions regarding surface water. The Commission has also noted the response of the Resources Regulator which has indicated that successful storage of water occurs at a number of NSW mines. This information suggests that the concerns expressed by the Department's PAR and those raised at the public hearing on the possible impact of the Project on surface water could be resolved satisfactorily if the mine design, safety of proposed operations and underground emplacement are demonstrated to be able to be implemented as proposed in the Project.	Section 4 provides information regarding mine method and safety.
184	The Commission finds that that the Department may not have adequately assessed the potential impacts of the Project on surface water because, whilst the Commission agrees that mine water should not be disposed to surface watercourses, it does not agree with the Department's suggestion that safety risks may necessarily result in the transfer of mine water to the surface with subsequent discharge into watercourses.	Noted. Excess water will not be discharged to watercourses. The work completed as part of the RTS shows that the PWD has sufficient capacity to store excess water under all 107 assessed climate scenarios.
185	At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding surface water impacts because of disagreement over the acceptability of the mine design and the consequent ability to store water underground.	Section 4 provides information regarding mine method and safety. Discussion regarding ability to store water underground is provided in Section 6.4.1 below.

6.4.1 Response to item 185

As outlined in previous submissions to the NSW government, the proposed mine design is based on long established mine principles. Many mines also store water underground. Notably, water will be stored downdip of the sealed bulkheads in the majority of the mine workings, with the exception of one panel towards the end of mine life where the seam dip flattens out. There is therefore no information to support claims that the mine design, combined with the storage of water underground, will result in serious safety risks, therefore the claims are rejected.

The risk of inrush and inundation in relation to the Project, has been addressed in Section 8.2 of Russell Howarth & Associates (2020).

6.5 Analysis and response to Commission's recommendations

The summary of the IPC recommendations relating to surface water, and Hume Coal's responses are presented in Table 6.2 below. Detailed responses to recommendation R8 are provided in Section 6.5.1.

Table 6.2 Response to IPC recommendations – Surface water

Reference number	IPC's recommendation	Hume Coal response
R7	The Applicant is to confirm whether the provisional Water Treatment Plant does form part of the Project – and if so, provide suitable information to permit an appropriate assessment of its impacts.	The WTP no longer forms part of the Project. As outlined in the RTS report (EMM 2018b), excess water will be managed by storing it in the PWD and pumping to the void / underground behind the sealed bulkheads. A WTP was included in the RTS assessment as a provisional item only. However, as the water balance work has assessed that PWD has adequate capacity to store excess water under all 107 climate scenarios, the WTP will not be required. Therefore, this item (R7) has not been assessed further.
R8	Should underground emplacement and water impounded have to cease for any reason, the Applicant is to confirm how long under normal mining operations it would take for the reject emplacement stockpile and Primary Water Dam to reach capacity.	The surface water (PWD) aspects of this recommendation are addressed in Section 6.5.1 and discussed further in Appendix B.

6.5.1 Detailed response to R8 (PWD)

Site water management for the proposed Hume Coal Project relies on four sediment basins (SBs), four mine water dams (MWDs), one PWD, and an underground mine sump (sump).

The PWD, which has an operational capacity of 724 ML, is essentially a balancing storage, which receives and stores surface water runoff and groundwater abstracted from underground mine workings, in excess of operational requirements, and supplies water to satisfy mining and other Project related water requirements, except for potable water, which will be sourced and stored separately.

The operational objective of the PWD is to buffer periods of water deficit and excess, particularly stormwater runoff generated within the Project site, to avoid uncontrolled release of water. Therefore, whenever possible, the operational storage is maintained at low volumes to provide the required buffering storage for periods of excess, while still supplying the required water demands.

The void spaces behind the bulkheads will be utilised to emplace the coal rejects in the form of co-disposed reject, as well as excess water from the underground sump. If required, water stored within the void spaces can be pumped to the PWD to meet water demands.

If reinjection from the sump to the sealed mined-out panels is prevented during mining operations, the PWD is the only storage that can be utilised to store excess water from the underground mine sump. Therefore, more details about the potential risk of the PWD reaching its maximum capacity during the life of mining operations has been requested by the IPC.

The RTS Goldsim water balance model was used to estimate the length of time it would take for the PWD to reach capacity (720 ML), if the option of reinjection of surplus water to underground voids is prevented or unavailable at any time during the 19-year mine life. This water balance assessment of the time to reach the PWD storage capacity was run for each of the 107 climate (rainfall/evaporation) sequences, with different initiation dates for ceasing reinjection.

The water balance assessment applied 107 climate scenarios to each scenario where reinjection is unavailable from first day of each year of mining of the 19-year mine life. For example, the first scenario looked at how long it would take for the PWD to reach capacity if reinjection was unavailable from the first day of Year 1, under 107 climate scenarios. The next scenario looked at how long it would take for the PWD to reach capacity if reinjection ceases on day one for Year 2, under 107 climate scenarios. This is repeated for the 19-years of mine operation. Further details of the water balance assessment are provided in Appendix B.

The statistical summary of the modelling results indicate the following:

- The average duration (over the 107 data sequences) for the PWD to reach capacity (without reinjection) decreases throughout the life of the mining operation. For example, if reinjection were to cease in the first year (Year 1) of mining operations and water collected in the underground mine sump is diverted to the PWD, the average time to fill the PWD is

estimated to be 14 years. This average duration to fill the PWD reduces to approximately 8 years if reinjection ceases in the seventh year of mining, and declines further to approximately 0.8 years if reinjection is ceased in the final year of the 19-year period of operations.

- The longest duration for the PWD to reach capacity is estimated to be 16.5 years, if reinjection were to cease in the first mining year. However, it is important to note that this only occurs for one of the 107 climatic data sequences. As detailed above, the average duration to reach the PWD capacity if the reinjection ceases at the start of the first year (based on the 107 climatic sequences) is 14 years.
- The shortest duration for the PWD to reach capacity is estimated to be 0.5 years, if reinjection ceases at the start of the last year (Year 19) of mining. Once again, it is important to note that this minimum duration only occurs for one of the 107 climatic data sequences. As detailed above, the average duration for the PWD to reach capacity if reinjection ceases at the start of the 19th year of mining (based on the 107 climatic sequences) is 0.8 years.
- The decreasing trend of the duration for the PWD to reach capacity reflects the relative influence of the changes in the water supply-demand balance over the life of mine. Net water deficits exist during the earlier years of mining which transitions to a net water surplus dominant situation over the later years of mine operation.

As expected, the average duration for the PWD to reach capacity is largely dependent on the year in which surplus water reinjection ceases. In the early stages of mine operations, the average duration for the PWD to reach capacity is longer than in the later stages of mining. This is a function of several factors, but generally reflects a net water deficit in the early stages of mining and a water surplus in the later stages.

Additional mine planning has resulted in improvements to the mine schedule and therefore review of the requirements of the temporary coal reject stockpiles. Refinement of the requirements of temporary coal reject stockpiles included updates to the designed angles of repose and a slight (4 m) increase in height to the main (eastern reject stockpile) requiring a total height of 19 m. The footprint of the main (eastern reject) remains unchanged as presented in the EIS and RTS. The secondary (western reject) temporary stockpile will be removed from the proposed project. The design of the main temporary coal reject stockpile takes into account the capacity of the now removed western stockpile. The rejects stockpile will be placed back underground at the end of the operational phase of the mine's life.

7 Surface level reject emplacement (R9)

7.1 Introduction and background

The surface level reject emplacement methodology was described in the EIS, RTS and expanded on in a late submission letter from Hume Coal to the Commission dated 12 April 2019. In the EIS and RTS, two temporary coal reject stockpiles were proposed, with one of these included for emergency use. At the completion of mining, no reject material will remain permanently above ground, and the surface emplacement areas will then be rehabilitated to integrate with the natural landform.

7.2 Independent Planning Commission recommendation

The IPC made one recommendation in relation to reject emplacement requiring further information and assessment, this was:

- **R9** - *The Applicant is to provide greater detail on its surface level reject emplacement process, including the use of the temporary coal reject stockpile (as discussed in paragraph 188) once underground emplacement has been commenced.*

7.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

In order to provide a greater level of detail, Hume Coal has reviewed the process of surface level emplacement on the temporary coal reject stockpile and potential use of the temporary coal reject stockpile, once underground emplacement commences.

7.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to surface level reject emplacement, and Hume Coal's responses are presented in Table 7.1 below.

Table 7.1 Response to Independent Planning Commission findings – Surface level reject emplacement

Reference number	IPC's finding	Hume Coal response
188	The Hume Coal EIS stated that over <i>"the life of the project approximately 11 Mt of coarse and fine reject material... will be produced. During the initial 12-18 months... the coal reject will be stored in a temporary coal reject stockpile adjacent to the CPP [coal processing plant]... until sufficient void space is available underground, and the plant is commissioned to commence underground emplacement."</i> However, in relation to the temporary coal reject stockpile, the Hume Coal EIS stated that <i>"At the end of the operational phase of the project the reject on the temporary coal reject stockpile will be put back through the reject plant and pumped underground prior to sealing the surface entries to the underground mine"</i> .	When the first paragraph in Section 2.8ii of the EIS Main Report is read in isolation, it can appear contradictory. Clarification was provided in Section 10.3.3 of the RTS stating the temporary coal reject surface stockpile accrued during the first 12 to 18 months of the project, will be treated with 2% limestone and progressively reshaped, capped and re-vegetated. References to progressive disposal of reject throughout the EIS, referred to the coal reject generated after the first 12 to 18 months. However, further review of the reject emplacement schedule and temporary reject stockpile design has been completed in response to recommendation R9 and this is addressed in Section 7.5.1.

7.5 Analysis and response to recommendation R9

The summary of the IPC recommendations relating to surface level reject emplacement, and Hume Coal's responses are presented in Table 7.2 below. A detailed response to recommendation R9 is provided in Section 7.5.1 below.

Table 7.2 Response to Independent Planning Commission recommendations – surface level reject emplacement

Reference number	IPC's recommendation	Hume Coal response
R9	The Applicant is to provide greater detail on its surface level reject emplacement process, including the use of the temporary coal reject stockpile (as discussed in paragraph 188) once underground emplacement has been commenced.	This is addressed in Section 7.5.1.

7.5.1 Detailed response to R9

The Commission have sought more detail on the surface level reject emplacement process and the use of the temporary coal reject stockpile, once underground emplacement activities have commenced.

The commencement of the underground emplacement activities will coincide with the completion of mining in down-dip panel W002. Void space will be available for reject emplacement in the 19th month of operations. This is similar to the range of 12-18 months predicted in the EIS and RTS.

Hume Coal wishes to provide more detail as to the physical size of the temporary reject stockpile, the process of emplacement on the temporary reject stockpile and its availability for use post commencement of underground emplacement. Mine planning is a constantly evolving process that improves with knowledge as the working is undertaken and "real time" information becomes available and plans are updated. Additional mine planning has resulted in improvements to the mine schedule and therefore review of the requirements of the temporary coal reject stockpiles.

In the EIS and RTS, two temporary coal reject stockpiles were proposed, with one of these included for emergency use.

Refinement of the requirements of temporary coal reject stockpiles included updates to the designed angles of repose and a slight (4 m) increase in height to the main (eastern reject stockpile) requiring a total height of 19 m. The footprint of the main (eastern reject) remains unchanged as presented in the EIS and RTS. The secondary (western reject) temporary stockpile would be removed from the proposed project. The design of the main temporary coal reject stockpile would be placed back underground at the end of the operational phase of the mine's life. After the initial emplacement for 18 months is completed the stockpile would be available for future use, for a period of another 10 months, should it become necessary. The ultimate capacity of the main temporary reject stockpile would be 810,000 tonnes.

In respect to other elements of the surface level reject emplacement process, it is intended to form the main temporary reject stockpile utilising an automated stacker during the daytime and night-time, combined with a D9 bulldozer pushing out to the extents of the main temporary reject stockpile footprint during daylight hours only.

8 Noise impacts (R10, R11)

8.1 Introduction and background

8.1.1 Environmental impact statements

A Noise and Vibration Assessment Report (NVAR) was prepared and submitted to DPIE as part of the EIS for the Hume Coal Project. The operational noise assessment identified that during adverse weather conditions and with all feasible and reasonable mitigation applied:

- eight assessment locations (nine dwellings) were predicted to experience residual noise levels of between 3 dB and 5 dB above project-specific noise levels (PSNL) and are therefore entitled to voluntary mitigation upon request; and
- two assessment locations were predicted to experience residual noise levels greater than 5 dB above PSNLs and are therefore entitled to voluntary acquisition upon request; and
- the predicted internal noise levels at relevant locations will be well below those likely to cause sleep disturbance.

During construction, the NVIA found that some noise will be above relevant noise criteria (ie management levels (NMLs)). This will be confined to properties to the north-west of the project area and will mostly be from 1 dB to 3 dB above NMLs.

Noise from operation of the Berrima Rail Project (including both existing users and Hume Coal trains) was assessed in accordance with the *Rail Infrastructure Noise Guideline* (EPA 2013). One dwelling (assessment location 28) was predicted to be impacted by noise from the project on the Berrima Branch Line (non-network rail line) above the trigger level for voluntary mitigation rights in accordance with the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) (NSW Government 2014).

8.1.2 Response to submissions

A number of submissions from the community, EPA, special interest groups and businesses raised issues relating to noise. Issues included concerns relating to the potential for low frequency noise and sleep disturbance from the operation of the mine, rail curve noise, sleep disturbance and vibration from the operation of the rail line, and concerns relating to construction noise from both the rail line and the Hume Coal Project.

The RTS report, which incorporated responses to all of the submissions relating to noise, was submitted to DPIE in June 2018. No additional noise modelling was required to be undertaken, and specific concerns were responded to with more detailed or clarified information.

8.1.3 Independent Planning Commission response

The noise impact assessment has been updated in accordance with current NSW noise policy and guidelines, which have evolved since the EIS was submitted in 2017.

Additional mine planning has resulted in improvements to the mine schedule and therefore review of the requirements of the temporary coal reject stockpiles. Refinement of the requirements of temporary coal reject stockpiles included updates to the designed angles of repose and a slight (4 m) increase in height to the main (eastern reject stockpile) requiring a total height of 19 m. The main (eastern) temporary coal reject stockpile was modelled to a height of 15 m previously and so the noise modelling was updated to ensure compliance with relevant legislation. This maximum reject stockpile height does not exceed the height of the product stockpiles.

This increase in height has required updated noise modelling to ensure compliance with relevant legislation.

8.2 Independent Planning Commission recommendations

The IPC made two recommendations in relation to noise:

- **R10** - *The Department is to consider and advise if Assessment Location No 7 should be afforded mitigation rights under the application of the Noise Policy for Industry.*
- **R11** - *The Applicant and Department should explore opportunities to further mitigate noise impacts. Such opportunities may include more extensive noise monitoring, closer attention to atmospheric conditions, incorporation of any recently developed rail and rolling stock modifications, construction of noise bunds and physical barriers and stop-work when exceedances are observed.*

8.3 Approach for responding to IPC assessment, findings and recommendations

8.3.1 R10 – Assessment Location 7

The approach to responding to R10 required the assessment of the Project in accordance with current NSW noise policy and relevant guidelines. Two key NSW noise guidance documents have been updated since the preparation of the NVAR for the EIS, as follows:

- the Industrial Noise Policy (INP) (EPA, 2000) has been replaced by the Noise Policy for Industry (NPfI) (EPA, 2018); and
- the Voluntary Land Acquisition and Mitigation Policy (VLAMP) originally released by the NSW Government in 2014 was updated in 2018.

The noise impacts of the Project have therefore been reassessed in accordance with these policies. However, it is noted that the changes in assessment requirements between the INP (superseded) and the NPfI have no material impact on the assessment of road traffic noise, construction vibration and blasting completed for the Project and therefore these matters have not been considered further.

8.3.2 R11 – mitigation measures

The need for further mitigation measures was considered in light of the results of the revised noise assessment.

8.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to noise, and Hume Coal's responses are presented in Table 8.1 below.

Table 8.1 Response to Independent Planning Commission findings – Noise impacts

Reference number	IPC's findings	Hume Coal response
222	The Commission, whilst recognising that a number of properties are likely to be noise affected such that they fall within the purview of VLAMP provisions, finds that containment of noise and vibration impact from the Project can be successfully regulated in concert with an appropriate agreed Noise Management Plan.	Noted. Hume Coal has committed to the preparation of a noise management plan post determination, in consultation with the EPA.
223	The Commission notes that the EPA retained minor residual concerns after its review of the Hume Coal RTS regarding rail noise mitigation measures. However, the Commission notes that the assessment of noise in the Department's PAR was limited and that a more detailed assessment would be required in its Final Assessment Report.	Noted.

8.5 Analysis and response to Independent Planning Commission's recommendations

A summary of the IPC recommendations relating to noise, and Hume Coal's responses, are presented in Table 8.2 below. Detailed responses to recommendations R10 and R11 are provided in Section 8.5.1 and Section 8.5.2 respectively.

Table 8.2 Response to Independent Planning Commission recommendations – Noise impacts

Reference number	IPC's recommendation	Hume Coal response
R10	The Department is to consider and advise if Assessment Location No 7 should be afforded mitigation rights under the application of the Noise Policy for Industry	The updated noise assessment (Appendix C) has resulted in a change in the significance of the predicted residual impact from negligible to marginal at assessment location 7, and hence this means that location is entitled to voluntary mitigation in the form of mechanical ventilation/comfort condition systems.
R11	The Applicant and Department should explore opportunities to further mitigate noise impacts. Such opportunities may include more extensive noise monitoring, closer attention to atmospheric conditions, incorporation of any recently developed rail and rolling stock modifications, construction of noise bunds and physical barriers and stop-work when exceedances are observed.	The updated noise assessment (Appendix C) confirmed that no further mitigation measures are recommended. Notwithstanding, Hume Coal commits to investigating further noise mitigation post-approval in consultation with landholders.

8.5.1 Detailed response to R10

i Background noise and assessment criteria

The following section describes the implications of applying the NPfl (EPA, 2017) (instead of the INP (EPA, 2000)) and the updated VLAMP to the NVAR.

There are minor differences in the methods described in the NPfl compared to the superseded INP. These differences in method result in no change to the ambient noise levels presented in the EIS which relate to residential properties potentially exposed to noise from proposed operation of the Project.

One of the main differences between the NPfl and the INP is the minimum rating background level (RBL) applied for the daytime period. The minimum RBL for daytime as per the NPfl is 35 dB which is 5 dB greater than that provided in the INP. This would result in an increase to the "Final background noise level, RBL" at some locations during the daytime. Therefore, where the final RBL is 35 dB or less for the day period, the NPfl minimum background noise level of 35 dB has been adopted. This would increase the relevant construction and operational daytime noise criteria at some locations. Noise criteria for evening and night-time remain unchanged. The assessment of the likelihood of sleep disturbance has also been revised with the NPfl, with additional screening criteria and levels at all locations.

The update to the VLAMP has resulted in minor changes to the categorisation of residual noise impacts including consideration of both intrusive and amenity noise levels.

The updates in noise policy have no implications for the assessment of noise associated with road or rail traffic, and hence is limited to the defined industrial activities proposed.

ii Impact assessment

Noise modelling methodologies for the NPfl assessment were consistent with those adopted in the NVAR. This included modelled meteorological conditions, equipment quantities, sound power levels, operational scenarios (including maximum noise level events) and adopted noise mitigation and/or management measures. Operational activities associated with the proposed change to the size of the reject stockpile were also modelled.

As a result of the increased height of the proposed rejects stockpile, predicted increases in noise predictions from the Hume Coal Project operations are by up to 3 dB at assessment locations 11 and 14, and by up to 2 dB at assessment location 7. The 2 dB increase at assessment location 7 has resulted in a change in the significance of residual impact from negligible to marginal, and hence this means that assessment location 7 is entitled to voluntary mitigation in the form of mechanical ventilation/comfort condition systems. The characterisation of noise impacts is predicted to be unchanged at all other assessment locations as a result of this change in rejects stockpile design.

During worst-case prevailing noise-enhancing weather conditions for all assessment periods, for the mining life, with all feasible and reasonable mitigation measures applied, the NPfI assessment found that:

- nine assessment locations (10 dwellings) within the area modelled are predicted to experience marginal residual noise levels and therefore entitled to voluntary mitigation in the form of mechanical ventilation/comfort condition systems according to the VLAMP; and
- two assessment locations within the area modelled are predicted to experience moderate residual noise levels as per the NPfI. However, according to the VLAMP these two assessment locations (11 and 12) are predicted to experience significant residual noise levels and therefore entitled to voluntary acquisition. This differences in outcomes between the NPfI and the VLAMP, for these two locations arise in the way the amenity noise trigger level is adopted in each noise policy.

Alternatively, Hume Coal may enter into amenity agreements with the landholders who are entitled to voluntary mitigation or acquisition.

8.5.2 Detailed response to R11

In response to R11, the NVAR prepared for the EIS was re-assessed in accordance with the NPfI (EPA, 2017) and the revised 2018 VLAMP. This process allowed a contemporary assessment of noise impacts and ensured that all mitigation measures required by the current version of the VLAMP were identified. One additional property (location 7) is entitled to voluntary mitigation measures following this review, as is discussed below.

As a result of the 4 m increase in height of the main (eastern) temporary coal rejects stockpile, the Hume Coal Project operations are predicted to increase noise by up to 3 dB at assessment locations 11 and 14, and by up to 2 dB at assessment location 7.

The updated noise assessment to the NPfI (EPA, 2017) and assessment against VLAMP 2018 found that:

- nine assessment locations (10 dwellings at locations 4, 5, 6, 7, 8, 10, 14A, 14B, 15 and 16) within the area modelled are predicted to experience 'marginal' residual noise levels and are therefore entitled to voluntary mitigation in the form of mechanical ventilation/comfort condition systems according to the VLAMP. For example, this could include mechanical ventilation/comfort condition systems to enable bedroom windows to be closed without compromising internal air quality/amenity; and
- two assessment locations (locations 11 and 12) within the area modelled are predicted to experience 'significant' residual noise levels, and are therefore entitled to voluntary acquisition. Alternatively, the landholder may enter into an amenity agreement for improvement to ventilation and façade elements to reduce noise levels. Hume Coal would comply with any conditions of consent in this regard.

Hume Coal is committed to liaising with affected landholders during construction and operation, and based on the results of further noise monitoring Hume will enter into agreements where parties identify further mitigation is required, in accordance with the VLAMP 2018.

Noise and vibration will be managed during construction and operation in accordance with the relevant measures in the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) respectively. The CEMP and the OEMP will include noise and vibration mitigation and management measures from the EIS and RTS and will also include further noise mitigation, to be determined post-approval in consultation with affected landholders.

9 Air quality (R12)

9.1 Introduction

9.1.1 Environmental impact statements

Air quality impact assessments (AQIA) were undertaken by Ramboll Environ Australia in 2017 as part of the EISs for the Hume Coal Project and Berrima Rail Project. The AQIAs included modelling to predict the impacts of air emissions on the environment and were prepared in accordance with the SEARs and relevant statutory assessment requirements, guidelines and policies.

The results of the air quality modelling showed that for both construction and operational phases of both projects, the predicted particulate matter, gaseous pollutant concentrations and dust deposition levels associated with Project emissions were well below the relevant criteria at neighbouring sensitive receptors.

9.1.2 Response to submissions

Statutory and community submissions raised concerns regarding the adequacy of the assessment, the background air quality and meteorological data, impacts of coal transport by rail, the construction phase assessment and cumulative impacts.

The RTS responded to general concerns and reiterated the statement from the NSW Environment Protection Authority (EPA) that the air quality modelling was conducted in accordance with the approved methods and had no requirement to alter the scope or the methodology.

No additional air quality modelling was undertaken. Specific concerns were responded to with more detailed or clarified information.

9.1.3 Independent Planning Commission response

Additional data analysis has been undertaken for the response to the IPC report. The findings of this additional analysis are summarised in Section 9.5.1.

9.2 Independent Planning Commission recommendations

The IPC made one recommendation in relation to air quality, this was:

- **R12** - *The Department's Final Assessment Report should confirm the suitability of the assumptions in the Applicant's modelling in relation to the prevailing wind data utilised as this was questioned by members of the public in submissions.*

9.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

Meteorological monitoring data from four weather stations (Bureau of Meteorology (BoM) Moss Vale Automatic Weather Station (AWS), Boral Berrima, Hume 1 and Hume 2) was analysed to demonstrate the suitability of the monitoring data adopted in the AQIAs for the Hume Coal Project and Berrima Rail Project EISs. To further demonstrate the suitability of the monitoring data adopted in the AQIAs, data recorded at all four stations for the five-year period between 2013 and 2018 was collated and analysed, following the guidance of the Approved Methods for Modelling¹. The use of these four weather stations was undertaken to account for all likely meteorological conditions that could be experienced in the vicinity of the Project.

¹ Section 4.1 of the Approved Methods for Modelling states that site-representative data should be correlated against a longer-duration site-representative meteorological database of at least five years (preferably five consecutive years) to be deemed acceptable.

9.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to air quality, and Hume Coal's responses are presented in Table 9.1 below.

Table 9.1 Response to Independent Planning Commission findings – Air quality

Reference number	IPC's finding	Hume Coal response
240	The Commission, whilst recognising that some sensitive receivers will be subject of reduced air quality over that currently experienced, finds that predicted concentrations of particulate matter, gaseous emissions and dust deposition levels would be negligible at the 76 sensitive receptors included in the studies. All these locations are predicted to be well below applicable air quality impact criteria and impacts are minor relative to existing ambient conditions. The results of the Hume Coal dispersion modelling show that air quality is expected to remain well below applicable air quality impact assessment criteria.	Noted.
241	The Commission finds that that the Applicant and Department have appropriately considered and assessed the impact of air quality within the locality, and at this stage of its assessment the Commission finds that it is generally satisfied with the technical information provided up to this point regarding air quality impacts because the Applicant has provided a thorough expert analysis of the predicted impacts which has been peer reviewed by the EPA against the requirements of relevant Government policy framework. The EPA did not have any residual concerns relating to air quality impacts. However, the Commission notes that the Department's assessment of air quality in its PAR was limited and that a more detailed assessment would be required in its Final Assessment Report.	Noted.

9.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to air quality, and Hume Coal's responses are presented in Table 9.2 below. A detailed response to recommendation R12 is provided in Section 9.5.1.

Table 9.2 Response to Independent Planning Commission recommendations – Air quality

Reference number	IPC's recommendation	Hume Coal response
R12	The Department's Final Assessment Report should confirm the suitability of the assumptions in the Applicant's modelling in relation to the prevailing wind data utilised as this was questioned by members of the public in submissions.	Issues related to the suitability of prevailing wind data is addressed in Section 9.5.1 of this report.

9.5.1 Detailed response to R12

Analysis of annual wind roses for the four monitoring stations showed the consistency and similarity in recorded wind speed and direction profiles over a four-year basis. The analysed data supported the use of the 2013 meteorological monitoring datasets used for the AQIA undertaken for the EIS. The use of the different meteorological datasets addresses any potential uncertainty relating to the suitability of wind speed or directions applied in the dispersion modelling.

Section 4 of the EIS AQIA presents the analysis of meteorological and climate data collated for the assessment. As detailed in Section 4.1 of the AQIA, meteorological data was collated from the following sources:

- a Hume-owned weather station located approximately 8 km south of the proposed surface infrastructure area of the Project, referred to as Hume 1;
- a Hume-owned weather station located directly south of Mereworth homestead, referred to as Hume 2;

- the Bureau of Meteorology (BoM) automatic weather station (AWS) at Moss Vale, approximately 11.5 km east south east of the proposed surface infrastructure area; and
- a meteorological station at the Berrima Cement Works owned by Boral Cement Limited, approximately 4.5 km east south east of the proposed surface infrastructure area.

Extensive discussion is presented in Section 4 of the AQIA in relation to the recorded wind speed and direction patterns recorded at each of these monitoring stations. Key findings of the analysis of wind speed and direction data from the AQIA include:

- the dominant wind direction profile is similar across all four monitoring stations, featuring westerly, north-easterly and south-easterly air flow;
- the BoM Moss Vale AWS records higher wind speeds than the three other stations, which is representative of the more exposed location of that monitoring station;
- the Hume 1 and Hume 2 stations record similar wind speed and direction on an hour by hour basis, with wind speeds slightly higher at the Hume 1 station; and
- the Boral Berrima Cement station records the lowest wind speeds of the four stations.

To account for all likely meteorological conditions that could be experienced in the vicinity of the Project, 12-months of monitoring data from each of the Hume 1 and BoM Moss Vale AWS monitoring stations were adopted. By utilising two separate 12-month meteorological monitoring datasets to undertake atmospheric dispersion modelling of emissions from the Project, the AQIA goes beyond the requirements of the Approved Methods for Modelling (NSW EPA 2016). The modelling results presented in the AQIA therefore account for wind conditions recorded at two separate monitoring sites in the local area.

To further demonstrate the suitability of the monitoring data adopted in the AQIA, data recorded at all four stations has been collated and analysed between 2013 and 2018. Interannual wind roses are presented for Hume 1 (Figure 9.1), Hume 2 (Figure 9.2), BoM Moss Vale (Figure 9.3) and Boral Berrima (Figure 9.4). Further, frequency distribution plots for wind direction and wind speed are presented for each station between Figure 9.5 and Figure 9.8.

The following points are noted from the processing of the data:

- for the Boral Berrima Cement station, a period of missing data exists between July 2016 and December 2017 at the time of reporting. While the reason for missing data could not be ascertained, it is the opinion of EMM that the notable increase in recorded wind speeds for 2018 at this location relative to earlier years is indicative of a wind sensor replacement;
- the data from the Hume 1 station recorded after December 2017 (until November 2019) is erratic and is likely due to instrumentation issue. Consequently, this period of data has been disregarded; and
- the Hume 2 weather station was installed in October 2015. Data is presented for 2016 onwards.

The following points are made in relation to the annual wind roses and frequency distribution plots presented between Figure 9.1 and Figure 9.8:

- across all stations, the wind roses presented illustrate similarity in the recorded wind speed and direction profiles on an inter-annual basis;
- all stations and years exhibit similar dominant wind direction profiles to the data analysed for the AQIA, namely a dominance of westerly, south-easterly and north-easterly air flow;
- the average wind speed and frequency of calm winds presented for each site and year are consistent with the 2013 dataset that was adopted for the dispersion modelling in the AQIA;
- the recorded wind speeds at the BoM Moss Vale AWS are consistently higher than the other presented monitoring stations, consistent with the analysis from the AQIA; and

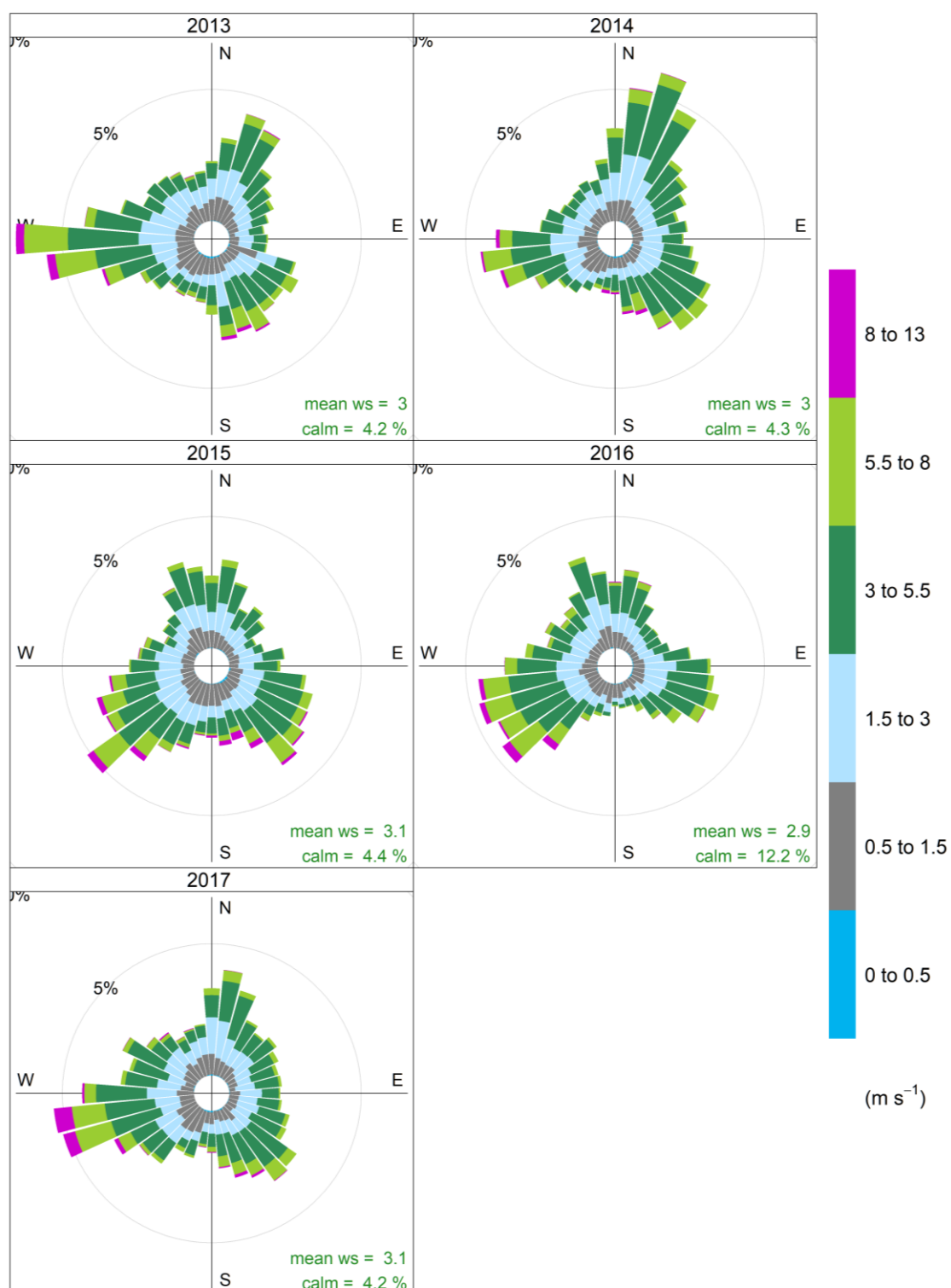
- the Hume 2 wind roses recorded from 2016 onwards illustrate a similar profile to the wind roses presented for Hume 1 between 2013 and 2018, supporting the use of the Hume 1 station data in the AQIA dispersion modelling.

Despite issues with completeness of monitoring data from the accessed monitoring resources, it is considered that the data analysed above supports the use of the 2013 meteorological monitoring datasets from the BoM Moss Vale AWS and Hume 1 monitoring stations in the AQIA. It is reiterated that the dispersion modelling conducted utilised two complete 12-month meteorological datasets, which is beyond the recommendations of the Approved Methods for Modelling, therefore confirms the suitability of the assumptions used. The similarity in wind direction profiles observed across multiple monitoring data resources and years, is considered consistent and therefore the use of the two meteorological datasets addresses any potential uncertainty relating to the suitability of wind speed or directions applied in the dispersion modelling is justified.

It is repeated that the wind speeds recorded at the BoM Moss Vale dataset in the modelling are the highest of the four reviewed monitoring resources. The use of elevated wind speeds (average and gust conditions) from BoM Moss Vale AWS in the emission calculations returns the highest potential for dust emission generation. Consequently, the use of the BoM Moss Vale AWS providing an upper bound estimate of emissions from the Project is considered appropriate.

The IPC report makes specific reference to potential impacts from the Project to residential communities such as the village of Berrima, located approximately 2 km north east of the surface infrastructure area. The AQIA includes the closest individual sensitive receptors and the closest neighbouring town centres (including Berrima) as assessment locations in the dispersion modelling completed. As demonstrated in the AQIA and within this chapter, the dispersion modelling is based on two meteorological datasets that are representative of the range of dispersion conditions likely to be experienced in the local area. Therefore, it is considered that the likely impacts from the Project at surrounding residences and community centres have been robustly quantified.

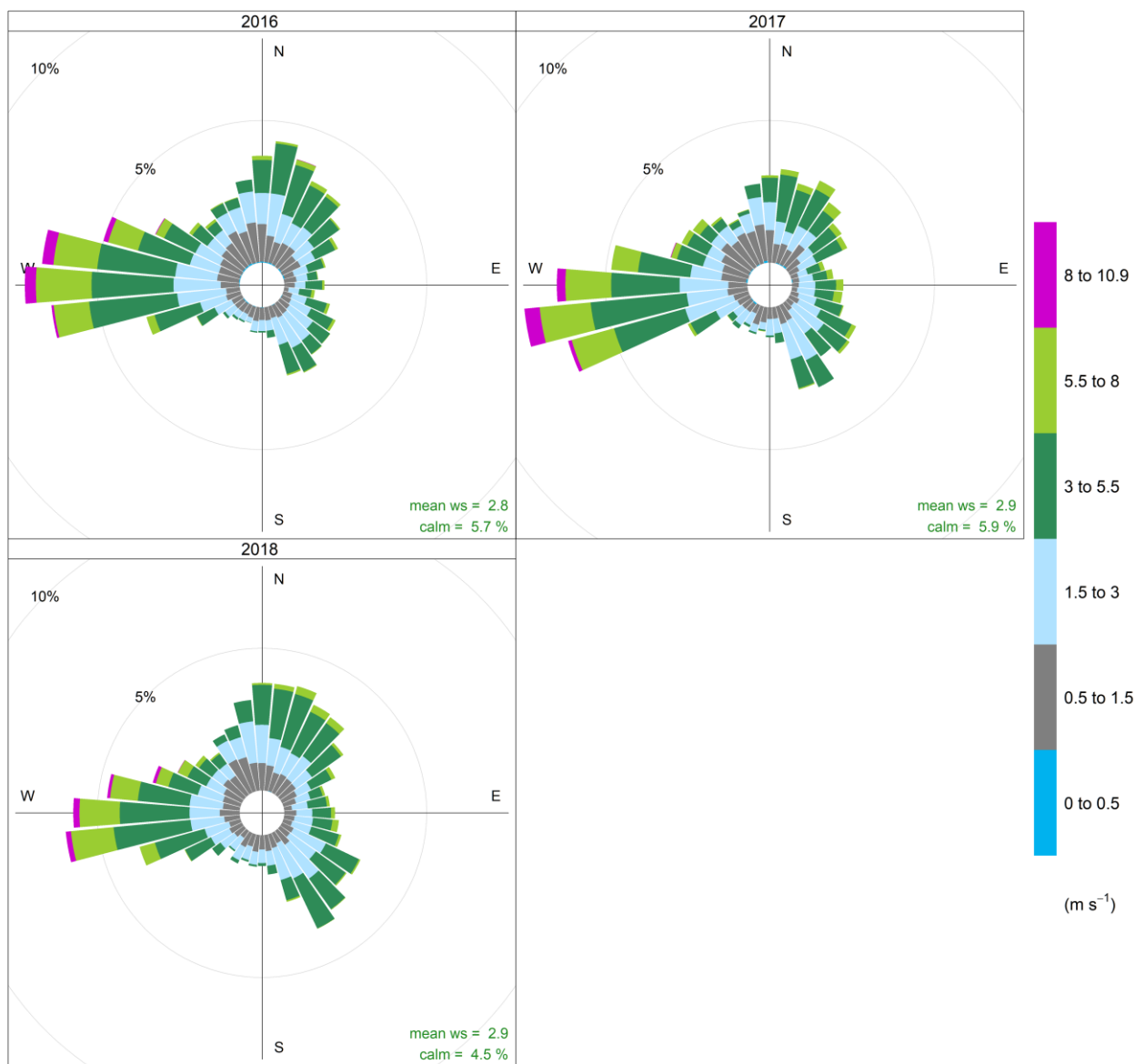
Finally, it is noted that in the submission from the EPA to DPIE, dated 30 June 2017, the EPA review comments relating to the AQIA *“did not identify any issues that have the potential to alter the overall conclusions and outcomes of this assessment”*; thus supporting the findings of the Hume Coal Assessments.



Frequency of counts by wind direction (%)

Figure 9.1 Annual wind roses – Hume 1 meteorological station – 2013 to 2018

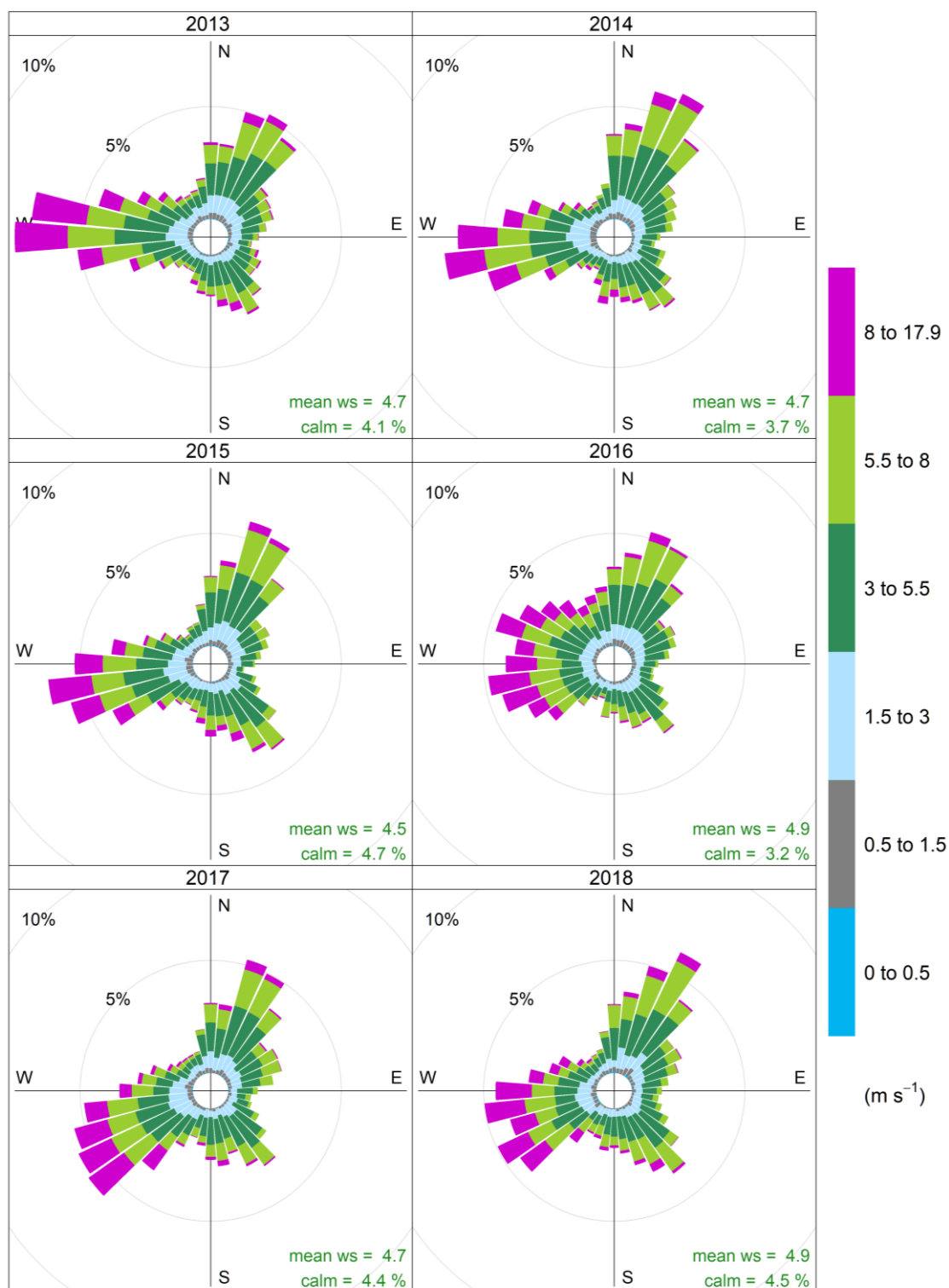
Note: data for 2018 onwards appears erratic and was excluded.



Frequency of counts by wind direction (%)

Figure 9.2 Annual wind roses – Hume 2 meteorological station – 2013 to 2018

Note: station was installed in October 2015. Only wind roses for 2016 to 2018 are presented.



Frequency of counts by wind direction (%)

Figure 9.3 Annual wind roses – BoM Moss Vale meteorological station – 2013 to 2018

Note: data for 2018 onwards appears erratic and was excluded.

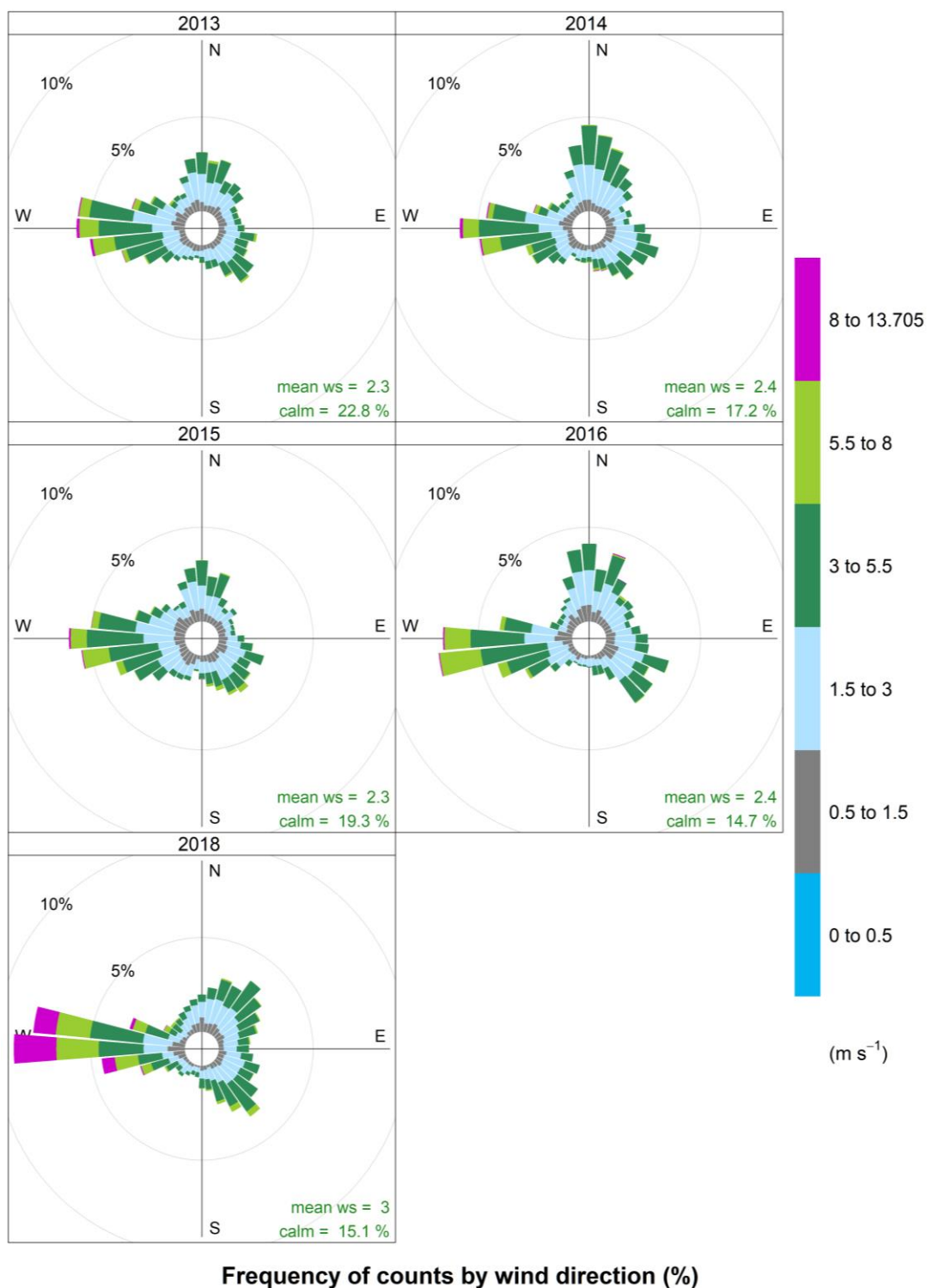


Figure 9.4 Annual wind roses – Boral Berrima Cement meteorological station – 2013 to 2018

Note: data from [redacted] data is incomplete between July 2016 and December 2017 and was excluded.

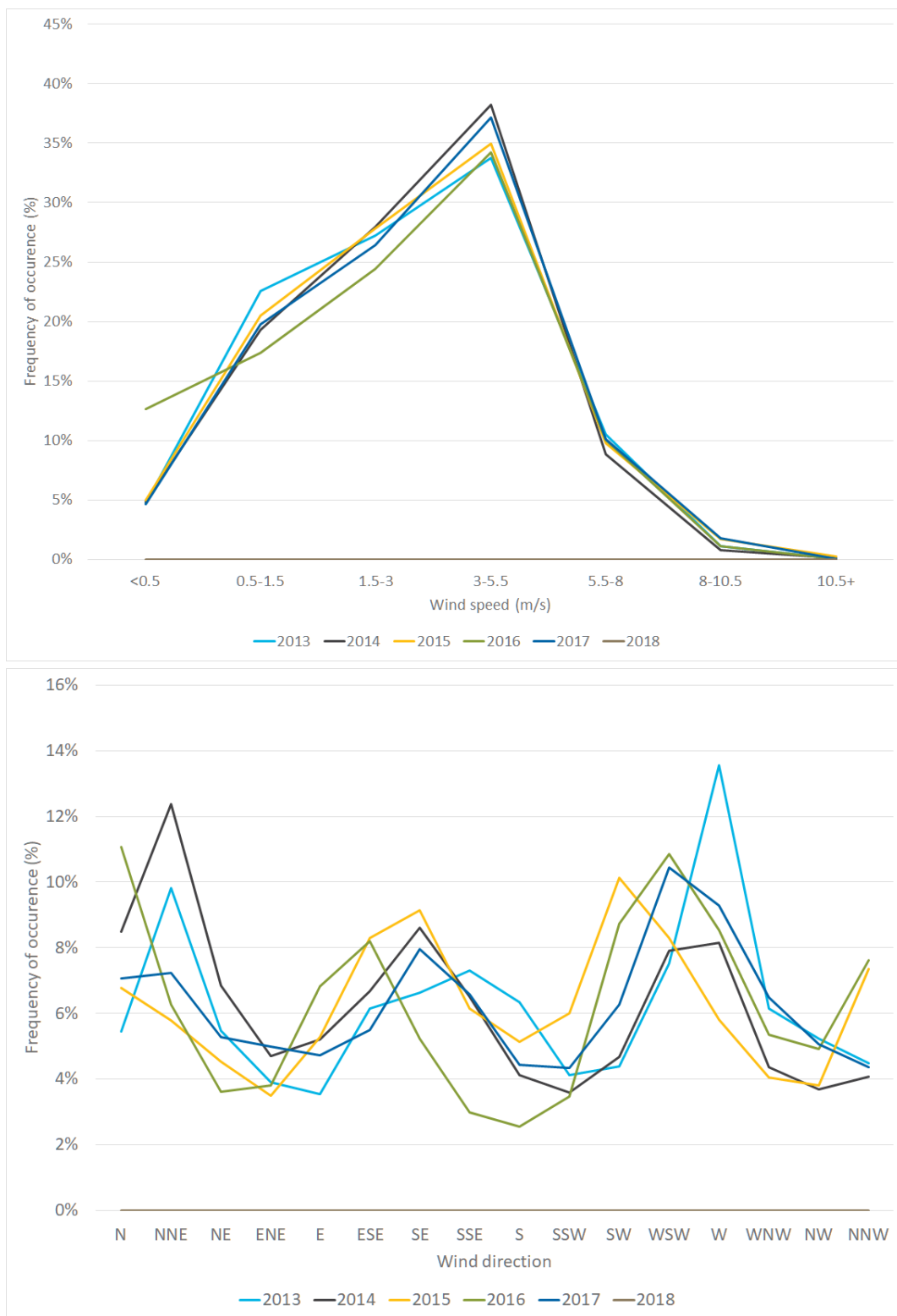


Figure 9.5 Distribution of wind speed and direction – Hume 1 meteorological station – 2013 to 2018

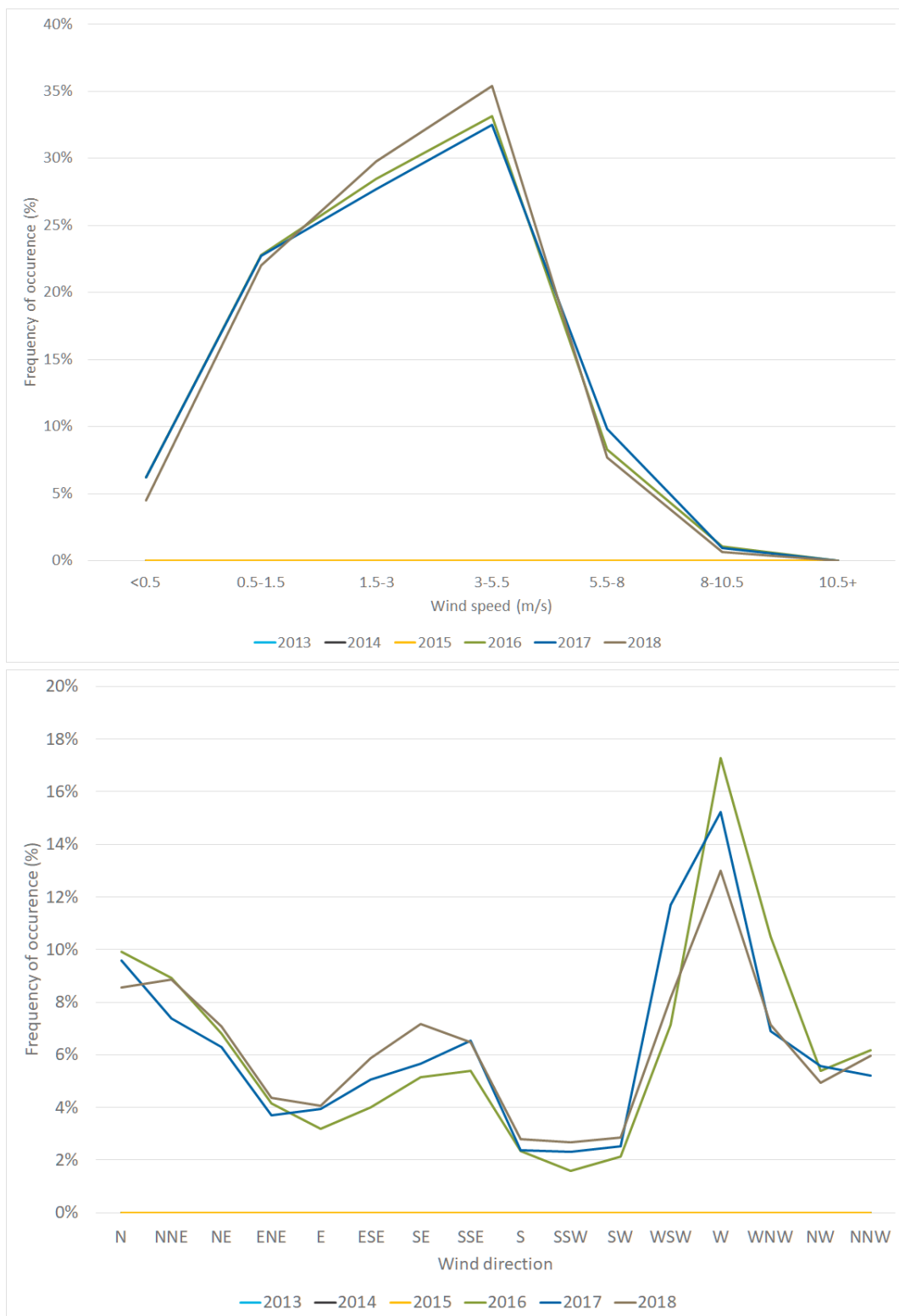


Figure 9.6 Distribution of wind speed and direction – Hume 2 meteorological station – 2013 to 2018

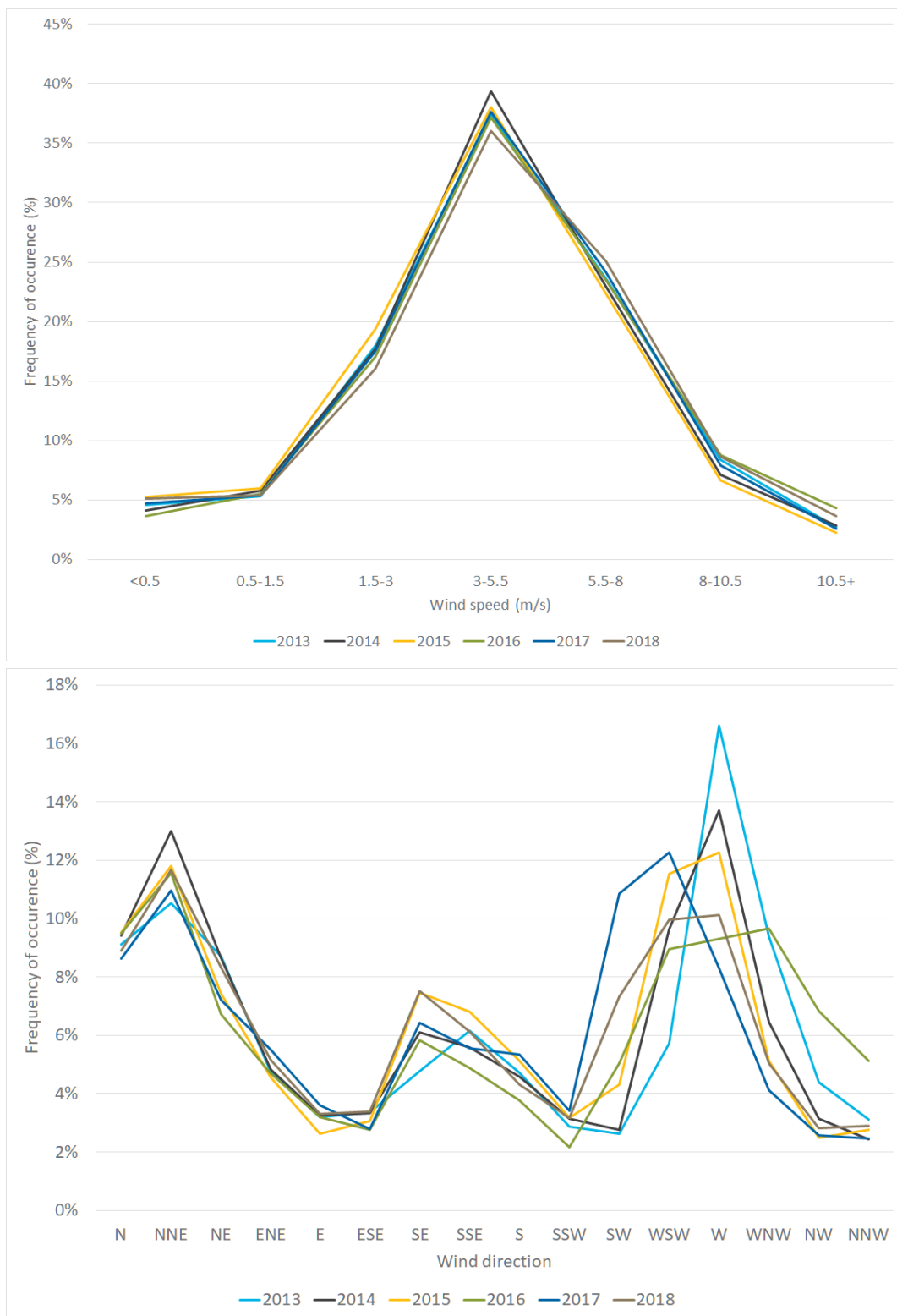


Figure 9.7 Distribution of wind speed and direction – BoM Moss Vale meteorological station – 2013 to 2018

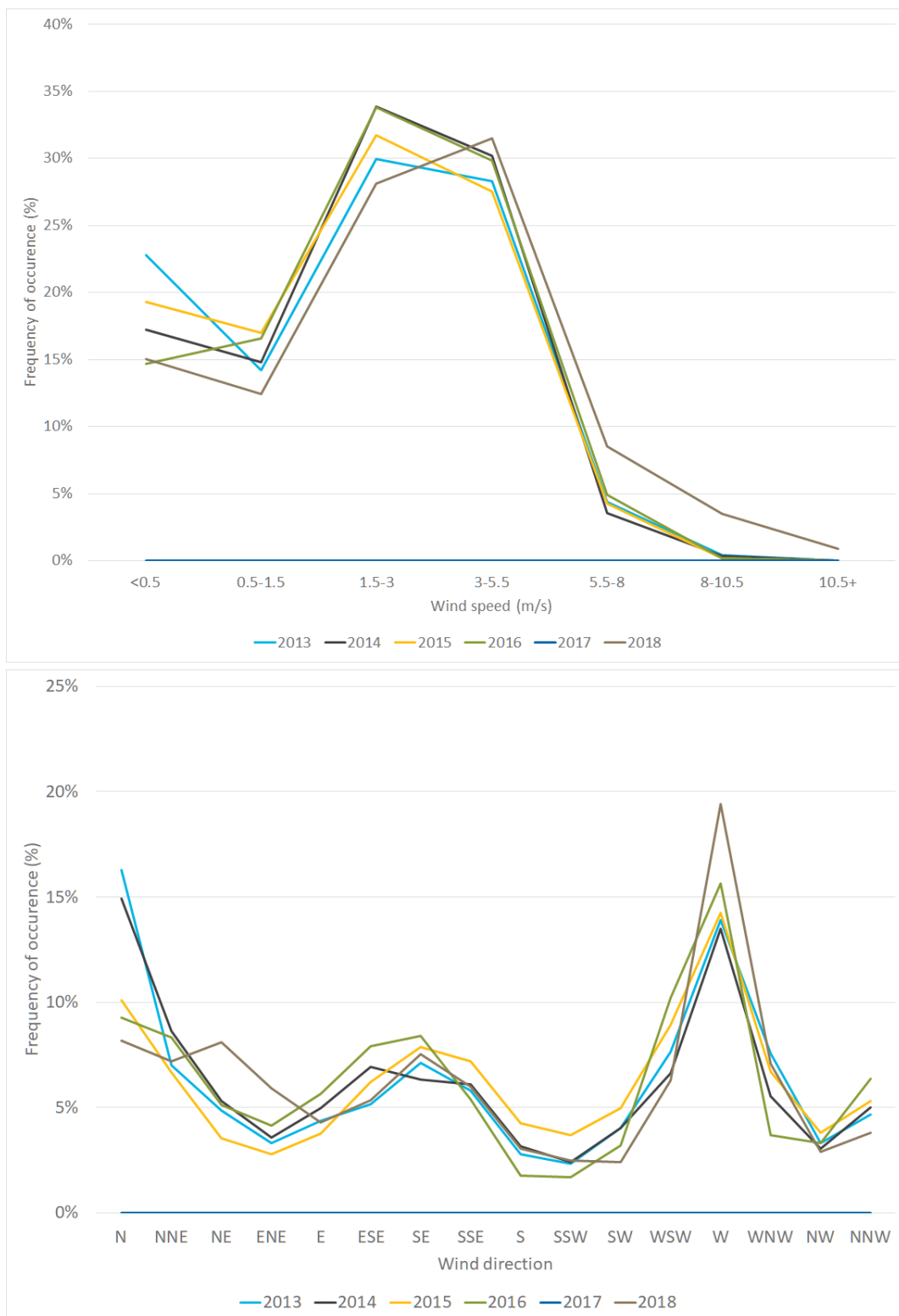


Figure 9.8 Distribution of wind speed and direction – Boral Berrima meteorological station – 2013 to 2018

10 Greenhouse gas emissions (R13, R14)

10.1 Introduction

10.1.1 Environmental impact statements

An Air Quality Impact and Greenhouse Gas Assessment was undertaken by Ramboll Environ Australia in 2017 as part of the EISs for the Project: Appendix K of the Hume Coal Project EIS and Appendix F of the Berrima Rail Project. The assessment included greenhouse gas (GHG) emissions quantification, using DAWE's National Greenhouse Accounts (NGA) Factors. The NGA Factors are designed for use by companies and individuals to estimate GHG emission from an operation. Scope 1, 2 and 3 GHG emissions from all significant emission sources were quantified and reported.

10.1.2 Response to submissions

Submissions raised concerns regarding the contribution of the Project to climate change, Scope 3 emissions and the inconsistency of the Project with energy policy objectives. A revision to the original GHG calculations was undertaken (also by Ramboll Environ Australia) to address the submissions.

The RTS responded to concerns and reiterated the statement from the NSW EPA that there were no issues with the GHG assessment that had the potential to alter the overall conclusions and outcomes of the assessment.

10.1.3 Independent Planning Commission response

An updated GHG assessment (Appendix D) has been prepared for this IPC response report. The updated GHG assessment has been prepared to address specific issues related to the request for a more rigorous and detailed GHG assessment, and more clearly defined mitigation measures.

The findings of the updated GHG assessment are summarised in this chapter, and full details can be found in Appendix D.

10.2 Independent Planning Commission recommendations

The IPC made two recommendations in relation to GHG emissions, these are:

- **R13** - *The Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.*
- **R14** - *The Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.*

10.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

A rigorous quantification of GHG emissions from the Project has already been undertaken for both the EISs and RTS. It is, however, acknowledged that greater detail relating to the management of GHG emissions can be provided. In order to increase the robustness of the GHG assessment for the Project, the following additional steps were undertaken:

- Hume Coal commissioned Coalbed Energy to undertake a stand-alone GHG assessment for the Project, focusing specifically on fugitive gas emissions from the underground mine (included as Annexure A to Appendix D); and
- further discussion on GHG mitigation measures, energy consumption reductions and offset strategies (further detail provided in Appendix D).

10.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to GHG emissions, and Hume Coal's responses are presented in Table 10.1 below.

Table 10.1 Response to Independent Planning Commission findings – Greenhouse gas emissions

Reference number	IPC's finding	Hume Coal response
250	During its meeting with the Commission on 11 February 2019, the Applicant indicated that such coal should not be confused with soft coking coal produced from mines in other parts of Australia. The Commission understands that 55% of the coal produced by the Hume Mine is semi-hard coking coal which is a premium product in producing metallurgical coke for the production of steel, which has different implications for the calculation of GHGE than the consumption of thermal coal.	Noted. Further discussion is included in Appendix D.
251	During the public hearing the Applicant was asked by Counsel Assisting the Commission "would coal be sold to countries that are signatories to the Paris Climate Accord?" The Applicant took the question on notice and the Commission notes that a response to this question has not been received to date.	With regard to the offshore end-use of product coal, Hume Coal confirms a commitment to only sell its coal products to countries that are signatories to the Paris Agreement.
252	Since the release of the Department's PAR, the decision of the Land and Environment Court on the Rocky Hill project has emphasised that a consent authority may be required to consider the impacts of a proposed mine on climate change (including by reason of downstream emissions) for a number of reasons including section 4.15(1)(a) of the EP&A Act – applicable environmental planning instruments such as the provisions of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP), section 4.5(1)(b) - the likely impacts of a development and section 4.15(1)(e) the public interest, which includes the principles of ESD. The decision confirmed that indirect, downstream GHG emissions are a relevant consideration to take into account in determining applications for activities involving fossil fuel extraction. It concluded that the consideration of impacts on the environment and the public interest justify considering not only Scope 1 and Scope 2 emissions, but also Scope 3 emissions, and also noted that cl 14(2) of the Mining SEPP requires consideration of an assessment of the greenhouse gas emissions (including downstream emissions) of development for the purposes of mining.	Noted. Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation in the context of the Rocky Hill decision is presented in Appendix D.
253	The Commission finds that the Applicant and Department have not appropriately considered or assessed the full impact of emissions as required by section 4.15 (1) of the EPA Act, including the provisions of the Mining SEPP. At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding GHG emission related impact, particularly Scope 3 emissions and confirmation of any proposed mitigation measures it has proposed to the Commission.	Noted. Discussion of Scope 1, 2 and 3 emissions and the regulatory framework for their calculation is presented in Appendix D.

10.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to greenhouse gas emissions, and Hume Coal's responses are presented in Table 10.2 below. Detailed responses to recommendations R13 and R14 are provided in Section 10.5.1 and Section 10.5.2 respectively.

Table 10.2 Response to Independent Planning Commission recommendations – Greenhouse gas emissions

Reference number	IPC's recommendation	Hume Coal response
R13	The Applicant should undertake a more rigorous and detailed assessment of Project Greenhouse Gas Emissions, including Scope 3 end use of product coal, and this should be assessed prior to the Department's Final Assessment.	Issues related to the further assessment of GHG emissions are addressed in Section 10.5.1 of this report and Appendix D.
R14	The Applicant is to clearly define how it intends to mitigate/offset its greenhouse gas emissions through measures such as ensuring that all Project coal is only used within countries that are parties to the Paris Agreement.	Issues related to the mitigation of GHG emissions are addressed in Section 10.5.2 of this report and Appendix D.

10.5.1 Detailed response to R13

The Coalbed Energy assessment (Annexure A of Appendix D) used in-situ gas values from Hume Coal's exploration boreholes to determine a more appropriate site-specific emission factor than was used for the EIS. The Coalbed Energy assessment identified the site as being a 'low gas' situation and therefore the Scope 1 results were considered more realistic and were significantly reduced from those presented in the EIS and RTS. Emission calculations were revised based on the latest national GHG emission factors and a more conservative 45/55 thermal/coking coal split for Scope 3 emissions. The Project is very low in Scope 1 GHG emissions intensity relative to the Australian coal mining industry facility average and these are lower than the NGER Act threshold level, therefore would not be classed as a large GHG emitting facility.

Scope 3 emissions have been included in all GHG assessments to date, including the EIS and RTS, as well as for this IPC response report. The associated Scope 3 emissions from the Project are less than 1% of the Paris Agreement emissions targets for each potential end user country of product coal from this Project.

10.5.2 Detailed response to R14

A brief summary of mitigation measures for the reduction of Scope 1, 2 and 3 GHG emissions include the following measures to be implemented by Hume Coal, where practicable:

- Scope 1 measures:
 - use of battery-electric powered vehicles for surface activities and underground personnel transport;
 - use of fuel-efficient locomotive engines and systems;
 - reduction of engine idling times; and
 - routine servicing and maintenance.
- Scope 2 measures:
 - procure power supply from renewable energy sources, where practicable; and
 - establish solar power cells and storage batteries to power administration buildings on site;
- Scope 3 measures:
 - only sell coal products to countries (states or organisations) that are signatories of the Paris Agreement.

The Project will also offset some of its GHG emissions by undertaking tree planting on Hume Coal owned land. Hume Coal has already planted about 4.57 ha of trees. The exact rate of planting per year would be determined based on the results of ongoing monitoring of fugitive mine gas from the operational ventilation outlet. However, it is anticipated that a planting rate of between 1 to 2 ha per year would be required to completely offset Project Scope 1 fugitive GHG emissions.

Following approval of the Project, Hume Coal commit to undertaking a detailed tree planting assessment to identify the most appropriate areas of their land to undertake planting, the amount of planting required and the species of trees to plant. Species will be selected on their appropriateness for the proposed planting location and will seek to complement native plant communities present within the area. The offset areas will also be used to provide protection barriers around existing streams and water courses, and will be fenced off from livestock which will also allow natural regeneration of native regrowth. Hume Coal may also consider participation in future government carbon-in-soil or other initiatives.

11 Visual impact (R15)

11.1 Introduction

11.1.1 Environmental impact statements

A visual impact assessment (VIA) was undertaken by EMM in 2017 as part of the EISs for the Project. The VIA was prepared in accordance with the SEARs and relevant statutory assessment requirements, guidelines and policies.

The VIA concluded that the Project would not have significant adverse visual impacts on the area due to vegetation and topography shielding the majority of the Project infrastructure from view. Two viewpoints were assessed as having the potential to experience moderate to high unmitigated visual impact, however the use of distance, topography and vegetation as mitigation measures reduced the residual visual impact. Some mitigation measures, particularly vegetation screening, were determined to take some time to become established and fully effective but were found to be suitable for mitigating visual impacts of the Project on both residents and motorists in the Project area.

11.1.2 Response to submissions

Government and community submissions questioned the findings of the VIA and raised concerns about the perceived impact of the Project on the visual amenity of the area, viewpoint selection, night lighting and the visually prominent nature of some of the mine infrastructure. Many submissions disagreed with the claimed effectiveness of proposed mitigation measures. Submissions also raised concerns that the location of a coal mine would negatively impact on the perceived aesthetic and heritage values of the landscape in the area, in particular the views from Mereworth House and Garden.

At this time, no additional visual impact assessment was undertaken, but the RTS responded to the concerns and provided greater detail regarding the selection of viewpoints, the effectiveness of tree planting and the visibility of key infrastructure.

With regards to the views from Mereworth House and Garden, the RTS provided additional photomontages as requested by the Heritage Council of NSW, and reiterated the commitments to manage impacts with a Historical Heritage Management Plan and Conservation Management Plan for Mereworth House and Garden.

11.1.3 Independent Planning Commission response

An Updated Visual Impact Assessment (UVIA) (Appendix E) has been prepared to provide clarity and context to the findings presented in the EIS and RTS related to visual amenity, and to address specific issues raised in the IPC assessment report. This is a targeted response that not only addresses perceived visual impacts, but also discusses the Project impacts on the linked matters of visual amenity, cultural landscape, historical heritage and the house and garden at Mereworth.

The findings of the UVIA are summarised in this chapter, and full details, including photomontages and figures, can be found in Appendix E.

11.2 Independent Planning Commission recommendations

The IPC made one recommendation in relation to visual impact, this is:

- **R15** - Further visual impact assessment should be completed for assessment and should include at a minimum:
 - dimensioned plans of the project area and the railway extension. The plans should include a survey with contours and the location and size of all works as well as the relative heights above ground level of significant structures, including the coal stockpiles, the coal loader and primary water dam walls;
 - views of the project area and railway extension from sensitive properties within and in the vicinity of the Project area (including heritage items), from the Hume Highway and Medway Road or any likely affected property. The distance and heights of the viewing points should be provided;

- views should be without mitigation measures (screen planting) and with mitigation measures in place after 5 years and 15 years;
- any findings in relation to groundwater impacts on gardens, plantings and landscape settings; and
- further assessment of the impacts of night-time lighting.

Any photomontages of the view impacts should be certified in accordance with the Land and Environment Court's Direction on use of photomontages http://www.lec.justice.nsw.gov.au/Pages/practice_procedure/directions.aspx.

11.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

The purpose of the UVIA is to undertake a further visual assessment of the Project, as requested by the IPC. Specifically, it addresses parts of the IPC considerations, findings and recommendations for visual assessment that necessitated the completion of a revised historical archaeological assessment and statement of heritage impact.

The UVIA includes additional viewshed analysis; 26 viewpoint assessments (compared with 11 in the EIS) of which 11 have been subjected to photomontage analysis (compared with six in the EIS). This additional assessment and analysis provides a greater robustness to the assessments of both visual and heritage impacts.

11.4 Analysis and response to Independent Planning Commission's findings

11.4.1 Summary

The summary of the IPC findings relating to visual impacts, and Hume Coal's responses are presented in Table 11.1 below. Detailed responses to item 268 is provided in Section 11.4.2.

Table 11.1 Response to Independent Planning Commission findings– visual impacts

Reference number	IPC's finding	Hume Coal response
267	The Commission notes that a number of visual impact videos had been prepared by the Applicant and have been available on the Commission's website since 20 March 2019. The Applicant has confirmed that the videos were prepared independent of the Hume Coal EIS and before the Hume Coal RTS in support of the public exhibition process.	An excerpt still image has been used to prepare an oblique image (Figure 4.2 of Appendix E) of the infrastructure area of the mine.
268	The Commission finds that that the Applicant and Department have not adequately assessed or considered the visual impacts of the Project. At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding visual impacts because the Commission considers that six viewpoints are not sufficient and that more information is needed to assess the visual impacts of the Project from private properties, particularly heritage items, and public roads.	Addressed in Sections 5.3.1, 5.4, 5.4.1 and 7.2 of the UVIA included as Appendix E. The UVIA included 26 viewpoint assessments (compared with 11 in the EIS). Of these 26 viewpoints, 11 have been subjected to photomontage analysis (compared with six in the EIS).
269	The VIA, based on expert studies, also assumes that the level of groundwater drawdown will not impact on the cultural landscape and scenic quality of the area. However, there are residual questions in relation to the level of water table draw down which may be relevant to the visual assessment.	The groundwater dependence assessment for cultural heritage landscape and gardens has been prepared to address concerns relating to the impacts of water table decline on exotic trees and gardens which may be relevant to the visual assessment. The findings of this report are summarised in Section 13.5.1 of this report and Appendix G. A qualitative review of the effects of groundwater drawdown has also been included in the UVIA in Appendix E.

11.4.2 Response to item 268

The visual impact assessment (VIA) undertaken for the EIS contained seven viewpoints in and around the Project area which were identified for further analysis, including desktop analysis and a line of sight analysis to surface infrastructure to confirm potentially affected viewpoints. The seven locations were chosen on the basis of having the greatest potential to experience a visual impact due to exposure to surface infrastructure. These locations were also representative of likely visual impact to surrounding private residential landowners or motorists travelling in the vicinity of the Project. Five of these viewpoints were subjected to further photomontage analysis.

The UVIA assessed an additional 15 viewpoints, taking the total number of viewpoints assessed to 26. Six of the additional viewpoints were selected for photomontage analysis, taking the total number of photomontages to 11. These viewpoints were selected as being views from key locations within the Significant Potential View (SPV) zone, and representing views from public roads and private properties. The photomontage subset of viewpoints was selected to show the potential changes to the landscape arising as a result of the Project.

An additional 16 viewpoints and 8 photomontage analyses relating to Mereworth House and Garden were also assessed.

Full details of the site selection criteria and viewpoint photographs are presented in Section 5.4 of Appendix E.

11.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to visual impacts, and Hume Coal's responses is presented in Table 11.2 below. A detailed response to R15 is provided in Section 11.5.1.

Table 11.2 Response to Independent Planning Commission recommendations – Visual impacts

Reference number	IPC's recommendation	Hume Coal response
R15	Further visual impact assessment should be completed for assessment and should include at a minimum:	Dimensions and details of the project elements are addressed in Section 4 – <i>Visual elements of the project</i> , Figure 4.1 and Figure 4.1 of Appendix E.
	<ul style="list-style-type: none"> dimensioned plans of the project area and the railway extension. The plans should include a survey with contours and the location and size of all works as well as the relative heights above ground level of significant structures, including the coal stockpiles, the coal loader and primary water dam walls; 	
	<ul style="list-style-type: none"> views of the project area and railway extension from sensitive properties within and in the vicinity of the Project area (including heritage items), from the Hume Highway and Medway Road or any likely affected property. The distance and heights of the viewing points should be provided; 	View shed and photomontage analysis from key locations in the public domain have been prepared and are presented in Section 5.4; visual sensitivity is provided in Section 5.3 of Appendix E.
	<ul style="list-style-type: none"> views should be without mitigation measures (screen planting) and with mitigation measures in place after 5 years and 15 years; 	Photomontages encompassing undisturbed, post construction, 5 year, 15 year with mitigation measures in place and end of mine timeframes are provided in Section 5.4.1 and Section 6.2 of Appendix E.
	<ul style="list-style-type: none"> any findings in relation to groundwater impacts on gardens, plantings and landscape settings; and 	The groundwater dependence assessment for cultural heritage landscape and gardens has been prepared to address concerns relating to the impacts of water table decline on exotic trees and gardens which may be relevant to the visual assessment. The findings of this report are summarised in Section 13.5.1 of this report and Appendix G.
	<ul style="list-style-type: none"> further assessment of the impacts of night-time lighting. 	Night-time lighting is discussed in Sections 7.2.2 and 7.3(vi) of Appendix E.

Table 11.2 Response to Independent Planning Commission recommendations – Visual impacts

Reference number	IPC's recommendation	Hume Coal response
	Any photomontages of the view impacts should be certified in accordance with the Land and Environment Court's Direction on use of photomontages http://www.lec.justice.nsw.gov.au/Pages/practice_procedure/directions.aspx .	The Land and Environment Court Direction is provided in Annexure B of Appendix E. Photomontages are provided in Section 5.4.1 and Section 6.2 with certification of images provided in Annexure C of Appendix E.

11.5.1 Response to recommendation R15

i Detailed plans

Surface infrastructure required to service the mine will be constructed in the northern portion of the Project area, on land owned by Hume Coal and its subsidiaries. It will have a disturbance footprint of approximately 117 ha and will include the coal preparation plant (CPP), main mine office buildings and workshop area, water management structures, conveyor network, stockpiles and main ventilation shaft site.

The heights of key surface mine and rail infrastructure elements are presented in Table 11.3, along with heights of existing industrial elements nearby. Full details of built dimensions and natural ground level of infrastructure elements are presented in Section 4.2 of Appendix E.

Table 11.3 Heights of key surface mine and rail infrastructure and existing industrial elements

Element/feature	Height above ground level (m)
<i>Mine infrastructure</i>	
Stacker/reclaimers (Product coal)	30
Product coal stockpiles	20
Coal Handling and Preparation Plant (CHPP)	24
Primary water dam wall (at highest point)	19
Ventilation shaft pad structures	8
Conveyor drift / portal	6.5
ROM Coal Stockpile	21
ROM Conveyor tower	31
<i>Rail infrastructure</i>	
Train load out (TLO) at rail loop	37
Rail loop at TLO	4.7
Rail Bridge (Old Hume Highway)	8
Rail rolling stock maintenance facility	7
Acoustic barrier – Medway road	4
Rail loop at Medway Road	1
<i>Existing industrial infrastructure nearby</i>	
Berrima cement works – no. 6 kiln	87
Berrima cement works – clinker store and conveyor	35
Berrima cement works – clinker silos	47

Table 11.3 Heights of key surface mine and rail infrastructure and existing industrial elements

Element/feature	Height above ground level (m)
Berrima feed mill –mill building	50

ii **View of the Project area from sensitive properties**

As discussed in Section 11.4.2, the UVIA assessed an additional 15 viewpoints, of which six were selected for photomontage analysis; these were in addition to the viewpoints analysed for the EIS. The viewpoints used for the UVIA were collated from photographs taken for the EIS, RTS and from submitter documentation. They were selected as being views from key locations within the significant potential viewing (SPV) zone, and representing views from public roads, heritage items and private properties. The viewpoints and their characteristics are described in Table 11.4. A detailed assessment of each viewpoint and photographic exposure details are presented in Annexure D of Appendix E.

Table 11.4 SPV Zone viewshed photographic summary

Viewshed	Source	Landscape character type	Reason for assessment
Viewpoint 1	EIS Appendix N, Visual Amenity Assessment Report	Undulating pastoral	This is representative of views to the project for motorists travelling north along the Hume Motorway. It is the closest position on the Motorway, south of the MIA, that a motorist travelling north could safely stop to view the MIA in a forward-facing manner. These views would be static views if stopped, however most motorists would experience this transient view at speed.
Viewpoint 2	EIS Appendix N, Visual Amenity Assessment Report	Undulating pastoral	The view from this location is typical of the view for motorists travelling along Belanglo Road to access the recreational and tourist opportunities within Belanglo State Forest and for residents accessing private dwellings to the north and south of the road.
Viewpoint 4 (Photomontage 2)	EIS Appendix N, Visual Amenity Assessment Report	Urban areas/Undulating pastoral	The view from this receptor is typical of the view for motorists travelling along Medway Road to access the village of Medway and the rural residential properties located on the northern and southern side of Medway Road. This viewpoint overlooks the northern boundary of the MIA, the train load out and rail loop.
Viewpoint 5 (Photomontage 3)	EIS Appendix N, Visual Amenity Assessment Report	Undulating pastoral	This viewpoint is an elevated position looking towards the surface infrastructure. The view is typical of the view from the western side of the Hume Motorway travelling north (being the main transport corridor which runs through the project area) in closest proximity to the MIA and the proposed rail loop and noise barrier. Most of the industrial elements are visible from this viewpoint. Generally it is not safe to stop at this location and transient views would be experienced by passengers to the left (west) and behind the moving vehicle.
Viewpoint 6 (Photomontage 4)	EIS Appendix N, Visual Amenity Assessment Report	Urban areas	This view is experienced from the edge of Medway Road immediately to the west of the MIA. The viewshed overlooks the vicinity of the MIA containing the Product Coal Stockpile. It is intended to be typical of the static views of private rural residential properties in the locality, particularly to the south of the road.
Viewpoint 7 (Photomontage 5)	EIS Appendix N, Visual Amenity Assessment Report	Undulating/flat pastoral	This view is typical of the view of Mereworth house and gardens from the edge of Old Hume Highway. The viewpoint represents a point where motorists could safely stop to view the MIA. Such views would be static; however most motorists would experience transient view from moving vehicles when travelling either north or southwards. Vegetation planting undertaken in 2015/2016 on Hume land, between Old Hume Highway and the Hume Motorway will eventually screen views.

Table 11.4 **SPV Zone viewshed photographic summary**

Viewshed	Source	Landscape character type	Reason for assessment
Photograph 5.2	EIS Appendix N, Visual Amenity Assessment Report	Undulating pastoral	This viewpoint overlooks the MIA from the edge of the Hume Highway. Views from the motorway at this location are not possible on account of screen planting on the western side of the motorway and the motorway being within a cutting at this point.
Photograph 5.3	EIS Appendix N, Visual Amenity Assessment Report	Undulating pastoral	This viewpoint overlooks the MIA from the edge of the Hume Highway in the vicinity of the crossing of Oldbury Creek. This view overlooks parts of the MIA. It is not safe to stop at this location and therefore represents transient views when travelling north.
CL VP1	Morris and Hay (2017)	Undulating pastoral	View from Oldbury Road over the western parts of Mount Gingenbullen and southwest towards the Wells Creek floodplain and shows the indicative character of the landscape at this location.
CL VP2	Morris and Hay (2017)	Undulating pastoral /plantation pine	Panoramic image and image of view looking to the north-west from Oldbury Road overlooking Oldbury Farm. Static views with a wide vista are afforded at this location and overlooks the Hume Motorway, Medway Rivulet and the southern parts of the MIA.
CL VP11	Morris and Hay (2017)	Flat pastoral	Looking north from the approach to 11972 Hume Motorway toward Medway Rivulet and Mereworth. The location of this photograph is from a service road providing access to a private property adjoining the Motorway. It looks northwards to the southern parts of the MIA (portals and conveyors) in the foreground and the industrial elements of the MIA in the background of the image.
CL VP13	Morris and Hay (2017)	Urban areas/Undulating pastoral	Looking south-west from Medway Road between the Old Hume Highway and the Hume Motorway towards the Berrima Rail project (midground behind tree) and industrial elements of the MIA. Note new boundary screen planting to undertaken by Hume Coal in 2015/2016.
CL VP14	Morris and Hay (2017)	Undulating pastoral	Panoramic image and image of view from elevated viewpoint on the Hume Motorway looking towards the Berrima rail project provisioning/maintenance shed and the rail bridge over the Old Hume Highway. The Berrima Cement Works is located to the left of the panoramic image and is screened by vegetation. The view is typical of the view from the western side of the Hume Motorway travelling south (being the main transport corridor which runs through the project area). Generally it is not safe to stop at this location and transient views would be experienced by passengers to the left (east) the moving vehicle.
CL VP14a	Morris and Hay (2017)	Urban areas	View from elevated viewpoint on the Hume Motorway (Medway Road overpass) looking south east towards the Berrima rail project provisioning/maintenance area. View overlooks Medway Road. Generally it is not safe to stop at this location and transient views would be experienced by passengers to the left (east) the moving vehicle.
CL VP16	Morris and Hay (2017)	Undulating pastoral	This view is typical of the view of Mereworth house and gardens from the edge of Old Hume Highway. It is a similar location to Viewpoint 7. This viewpoint is in the vicinity of the former Mereworth property access road (prior to construction of the motorway). The viewpoint represents a point where motorists could safely stop to view the MIA. Such views would be static; however, most motorists would experience transient view from moving vehicles when travelling either north or southwards. Vegetation planting undertaken in 2015/2016 on Hume land, between Old Hume Highway and the Hume Motorway will eventually screen views, however from this location view of the primary water storage dam will still be possible.
CLVP17	Morris and Hay (2017)	Flat pastoral	Medway Rivulet valley from Old Hume Highway looking south east toward Golden Vale Road. Oldbury is in this view catchment and is backgrounded by Mount Gingenbullen. Photo shows the indicative character of the landscape at this location.

Table 11.4 SPV Zone viewshed photographic summary

Viewshed	Source	Landscape character type	Reason for assessment
CL VP18	Morris and Hay (2017)	Undulating/ flat pastoral	Panoramic views from Mereworth Road to the south and west. This represents static viewing opportunities from public land of the southern portions of the MIA. Views of the larger coal handling industrial elements to the north (behind the photographer), are hidden by elevated terrain to the north. The Medway Rivulet is located in the midground, left of photo, just below the tree line. The main photograph shows the character of the southern part of the MIA in the vicinity of the coal and personnel portals, conveyor and ventilation shaft pad.
CL VP18a	Morris and Hay (2017)	Undulating/ flat pastoral	View from the same point at CL VP18 looking south-east to Mount Gingenbullen. The Hume Motorway can be seen in the midground, below the foot-slopes of the mount, where it crosses over Mereworth Road (intersection with the Old Hume Highway).
CL VP21	Viewpoint identified by Morris (2017)	Undulating pastoral	This view is on approach along Old Hume Highway toward Berrima from the south (travelling north). The old highway at this point is flanked by Remembrance Driveway planting which focus views along the road. This is representative of views for motorists travelling north at a point where they could safely stop and view the rail bridge.
CL VP22	Viewpoint identified by Morris (2017)	Urban areas	The view from the ridgeline from the Old Hume Highway to the north of Greenhills Road, Berrima. This ridge contributes to the sense of enclosure that Berrima has. Views of the elements of the VIA are generally not possible from this point. It is representative of the character of the elevated landscape north of Berrima and the south and west of the Motorway (background).
CL VP24/27	Viewpoint identified by Morris (2017)	Undulating pastoral	This is representative of views to the project for motorists travelling north west along Golden Vale Road. These views would be static views if stopped, however most motorists would experience this transient view at moderate speed (80 km/h). It is representative the rolling pastoral landscape of the area.

Viewpoints subjected to further photomontage analysis are emboldened

iii Photomontages with varying degrees of screening plant growth

Photomontages in the UVIA have been updated to show the growth over time of screening vegetation, with photomontages showing growth at year 5 and year 15.

iv Groundwater impacts on gardens, plantings and landscape settings

This is discussed in detail within Section 13.5.1 and Appendix G of this report.

v Further assessment of night-time lighting

Existing night-time lighting sources include rural residential properties, farm machinery and vehicles on roads. Vehicles travelling north-south along the Hume Motorway provide a moderate source of lighting during times of darkness. Existing sources of night lighting in the immediate vicinity of the mines surface elements (west of the Hume Motorway) are less due to its rural setting and state forest to the west. Any new lighting, if unmitigated, would constitute an intensification of night-time lighting at the edge a night lighting environment (from the Berrima industrial enterprise area). Surface lighting effects could be experienced at locations identified by surface visibility analysis however visual impacts as a result of Project-related night time lighting are likely to be low to moderate.

12 Historical Heritage (R16, R17, R18)

12.1 Introduction

12.1.1 Environmental Impact Statement

The Statement of Heritage Impact (SoHI), included as Appendix T to the Hume Coal Project EIS and Statement of Heritage Impact (SoHI), included as Appendix I to the Berrima Rail Project EIS, were prepared in accordance with the SEARs and relevant statutory assessment requirements, guidelines and policies.

The SoHIs (which included the findings of the Historic Heritage Assessment (HHA)) identified heritage items in the Project area and surrounds. Eight properties that are listed on the *Wingecarribee Local Environmental Plan 2010* (LEP) were found to be either wholly or partially within the project area. Only one of these locally listed heritage items is within the surface infrastructure area associated with the project, being *Mereworth* house and garden. The mine plan was located and refined to avoid items listed on the State Heritage Register (SHR).

The SoHI concluded that the Project would have moderate impacts on the visual setting surrounding the house and garden at *Mereworth*. Mitigation measures included those recommended by the VIA, as well as commitments to prepare management plans for the conservation of heritage items and unexpected finds for the Project.

12.1.2 Response to submissions

Government agency and community submissions claimed that the area's true character was misrepresented in the EIS, giving more weight to the mining and industrial history of the area rather than the rural, cultural and historical heritage aspects of the region. The RTS acknowledged that some heritage items in the broader region were not considered in the original EIS due to an oversight; however concluded that the outcomes of the SoHI were not affected by their omission as none of the sites were in, or close to, the Project area.

The Heritage Council of NSW claimed that the assessment of impacts of the Project on the Berrima, Sutton Forest and Exeter Cultural Landscape was insufficient. A discussion and analysis of the cultural landscape, including potential impacts was presented in the RTS.

The SoHI prepared by Colleen Morris and other submissions claimed that the significance of *Mereworth* house and garden were not sufficiently assessed. Additional photographs and photomontages of *Mereworth* house and garden, as well as an analysis of Sorensen's design and views from *Mereworth* were included in the RTS to respond to these submissions.

No additional mitigation measures were proposed, but it was noted that the historical heritage management plan would be prepared in accordance with the conditions of consent, in consultation with relevant stakeholders and to the satisfaction of DPIE.

12.1.3 Response to the Independent Planning Commission

An updated SoHI for the Project (Appendix F) has been prepared for this IPC response report, which has been revised in consideration of the following additional assessments:

- groundwater impact assessment for cultural heritage landscapes and gardens (Annexure A);
- cultural landscape assessment (Annexure B);
- Sorensen garden analysis and the garden at *Mereworth* (Annexure C);
- supplementary historical archaeological assessment (Annexure D); and
- summary table of archaeological sites (Annexure E).

These reports have been prepared to address specific issues raised in the IPC report. These are targeted responses that specifically address perceived heritage impacts.

The findings of these reports are summarised in this chapter, and full details, including photos and figures, can be found in Annexures A to E of Appendix F.

12.2 Independent Planning Commission recommendations

The IPC made three recommendations in relation to heritage, which are:

- **R16** - *Further information should be provided to allow the assessment of the potential impact of water table drawdown on heritage items (including gardens, plantings and landscape settings) within or in the vicinity of the Project area. The information should include confirmation of the existing level of the water table and the anticipated drawdown at both the 67th percentile and the 90th percentile.*
- **R17** - *The Applicant should address the recommendations of the Heritage Council of NSW's correspondence to the Department dated 17 August 2018 as referenced in paragraph 283.*
- **R18** - *The Statement of Heritage Impact Assessment should be updated in response to recommendations R16 and R17, and the visual impact of the project on the significance of the above items and the cultural landscape in accordance with an updated visual impact assessment (see R15 in Visual Impact recommendations).*

12.3 Approach for responding to the Independent Planning Commission's assessment, findings and recommendations

The purpose of the updated SoHI and accompanying reports is to respond directly to relevant portions of the IPC assessment, findings and recommendations. Specifically, they address parts of the IPC considerations, findings and recommendations for historical heritage that necessitated the completion of revised heritage assessments.

Notably, the assessment of heritage values of the original SoHI undertaken for the Hume Coal Project EIS EMM (2017a) have not changed in the updated SoHI. Where necessary, the updated SoHI also addresses items presented in the IPC assessment report that the applicant feels are erroneous, unsubstantiated or are otherwise worthy of response.

Further details on the assessment methods used to undertake the updated SoHI and its constituent reports are presented in Appendix F and Annexures A to E respectively.

12.4 Analysis and response to Independent Planning Commission's findings

A summary of the IPC findings relating to historical heritage, and Hume Coal's response, is presented in Table 12.1 below. A detailed response to item 285 is provided in Section 12.4.1.

Table 12.1 Response to Independent Planning Commission findings – Historical heritage

Reference number	IPC's finding	Hume Coal response
284	The Commission notes that the Statement of heritage impact assessment (SHIA), based on expert studies, assumes that the level of groundwater drawdown will not impact on the cultural landscape. However, there are residual questions in relation to the level of water table draw down. The additional information provided in the Hume Coal RTS illustrated the impact on the three SHR items outside the Project area but not on the items that are within or partly within the Project area where the level of water table drawdown is greater. Furthermore, the impacts were based on the 67th percentile and not the 90th percentile and the level of water table decline is not confirmed.	Issues related to the impacts of groundwater drawdown on cultural heritage landscapes and gardens are addressed in Section 13.5.1 of this report and the Groundwater dependence assessment for cultural heritage landscapes and gardens, included as Annexure A of Appendix F. The groundwater dependence assessment for cultural heritage landscapes and gardens details the current water table, and anticipated drawdowns at the 50 th , 67 th and 90 th percentile.
285	The Commission notes that the historic heritage impacts of the Project within the locality have been peer reviewed by the Heritage Council of NSW against the requirements of relevant Government policy framework. The Commission notes that the Heritage Council of NSW retained concerns which included: <ul style="list-style-type: none"> the adequacy of the assessment on the impacts on Mereworth House; and the need for a detailed assessment of the impacts of the Project on the Berrima, Sutton Forest and Exeter cultural landscape. 	The report on the cultural landscape and of <i>Mereworth</i> house and garden and predicted impacts concluded that while both elements have significant values, impacts overall will be minor and can be addressed through screening and a garden succession plan. This is addressed in Section 11.4.1 of this report, the updated SoHI (Appendix E) and its constituent reports on cultural landscape assessment (Annexure B of Appendix F); and the Sorensen garden analysis and the garden at Mereworth (Annexure C of Appendix F).
286	At this stage of its assessment the Commission finds that it is not satisfied with the information provided up to this point regarding historic heritage impacts. The Commission considers that the magnitude of water table drawdown is not confirmed and thus there is a potential change to the aesthetic significance of the heritage items' settings (gardens, tree plantings) and cultural landscape. The SHIA relies on the VIA and further information provided with the Hume Coal RTS to assess the visual impacts of the surface infrastructure on Mereworth House, other heritage items and the cultural landscape. However, the visual impact assessment has shortcomings (that are addressed separately) and the impacts on heritage significance would need to be reassessed in accordance with an updated visual impact study.	Issues related to the impacts of groundwater drawdown on cultural heritage landscapes and gardens are addressed in Section 13 of this report and Annexure A of Appendix F. Issues related to visual impact are addressed in Section 11.5.1 of this report and Appendix F.

12.4.1 Response to item 285

i The adequacy of the assessment on the impacts on Mereworth House

Additional assessment of the impacts of the Project on *Mereworth* house and garden, including assessment against the requirements of the relevant government policy frameworks is included in the following reports:

- Sorensen garden analysis and the garden at Mereworth (CBLA, 2020b) (Annexure C); and
- supplementary historical archaeological assessment (EMM 2020a) (Annexure D).

The *Sorensen Gardens Analysis and the Garden at Mereworth* (SGA) report (Annexure C of Appendix F) was prepared by Catherine Brouwer Landscape Architects to respond to part of IPC recommendation R17. Catherine is a landscape planner and registered landscape architect with specialist knowledge of cultural gardens, plantings and landscape conservation areas. Catherine is a widely respected expert in landscape heritage, including preparation of conservation management plans and impact assessments, and in landscape character, intangible heritage and scenic assessments for strategic planning and management plans. The SGA report included research, desktop assessment and visits to some Sorensen gardens.

The outcomes of the comparative analysis of the Sorensen garden at *Mereworth* are:

- the garden around *Mereworth*, and the avenue of trees possesses a good level of integrity;
- the important consideration in the comparative analysis of the house and garden at *Mereworth* as a whole heritage places is the loss of much of the driveway when the Hume Motorway was built, which was a major component that contributed substantially to the calibre of Sorensen's overall design;
- the scope of the garden design, including the plantings, are not representative of Sorensen's finest gardens;
- external review by garden experts has not given widespread or high acclaim to the garden at *Mereworth*;
- the garden design at *Mereworth* lies in the mid to upper range of Sorensen's body of garden design; and
- the garden at *Mereworth* is a relatively small and simple design, expressing fewer design responses to the house and the potential garden surround such as Sorensen's garden rooms, having less local responsiveness and richness in the trees and other planting design, and having just one focused view relationship from the gardens around the house to the rural landscape setting, in comparison to Sorensen's other homestead gardens.

The supplementary historical archaeological assessment (SHAA) report (Annexure E of Appendix F) was prepared by Pamela Kottaras of EMM Consulting to respond to parts of IPC recommendations R16, R17 and R18. Pamela has expertise in built heritage assessment, as well as experience in archaeological landscapes and their management. Pamela is an archaeologist with over 20 years of experience working on numerous heritage assessments.

The outcomes of the supplementary research and field inspections for the historical archaeological assessment are:

- *Mereworth 1* has been re-defined as the Cowley homestead, built around 1912 and inhabited by the Cowley family;
- relics associated with the Cowley homestead were possibly identified in an active stockyard away from proposed mining activities; and
- the potential for relics to exist across the landscape exists, however, primary sources to verify this claim were not located and access to private property was not permitted.

Management measures have been developed to remove, reduce and monitor potential impacts. Additional investigations support the findings of the EIS (EMM 2017a).

Full details of the assessment methods used are presented in the respective reports.

ii A detailed assessment of the impacts of the Project on the Berrima, Sutton Forest and Exeter cultural landscape

A detailed assessment of the impacts of the Project on the Berrima, Sutton Forest and Exeter (B,SF&E) cultural landscape against the requirements of the relevant government policy frameworks and the Heritage Council of NSW is included in the cultural landscape assessment (CLA) (Annexure B of Appendix F). The CLA was prepared by Catherine Brouwer, and assesses the impacts of the Project on the B,SF&E cultural landscape as proposed in the 'Cultural Landscape Assessment of the Berrima, Sutton Forest and Exeter Area', a report prepared by Colleen Morris, May 2017 for the Berrima Residents Association, with support of WSC.

The analysis of the cultural landscape against the values of the proposed B,SF&E cultural landscape found that the Morris assessment failed to consider the role that industry has played in the development of the cultural landscape as it appears today and did not provide justification for the proposed boundary of the cultural landscape.

The CLA found that Project surface infrastructure and the Berrima rail loop lie over part of the *Mereworth* property and will be visible from some viewpoints and therefore impacts will be visual over a section of the cultural landscape.

Where visible from the public realm, the heritage places in the B,SF&E contribute to the aesthetic value of the cultural landscape and impacts would be to the historical value, aesthetic, research and representative values of the place.

The Project will have some degree of impact to the cultural landscape and therefore its interpretability. The Berrima rail loop is unlikely to be seen from heritage places in the northern cultural landscape, and the Sorensen Remembrance Driveway plantings, which are closest to the proposed rail line will experience visual impact.

However, impacts to the proposed B,SF&E cultural landscape in the central and northern locality is assessed to be low. With consideration of the context of the overall *Central Southern Highlands Cultural Landscape*, impact on some of the heritage places on the whole cultural landscape experience and identity (extending east past Werai and Bundanoon, south beyond the Sally's Corner Road viewshed, west to the Belanglo Forest and north to the Wingecarribee River), would be much lower.

Full details of the assessment methods used are presented in the CLA.

12.5 Analysis and response to Independent Planning Commission's recommendations

A summary of the IPC recommendations relating to historical heritage, and Hume Coal's responses are presented in Table 12.2 below. A detailed response to recommendation R17 is provided in Section 12.5.1.

Table 12.2 Response to Independent Planning Commission recommendations – Historical heritage

Reference number	IPC's recommendation	Hume Coal response
R16	Further information should be provided to allow the assessment of the potential impact of water table drawdown on heritage items (including gardens, plantings and landscape settings) within or in the vicinity of the Project area. The information should include confirmation of the existing level of the water table and the anticipated drawdown at both the 67th percentile and the 90th percentile.	Issues related to the impacts of groundwater drawdown on cultural heritage landscapes and gardens are addressed in Section 13.5.1 of this report and the Groundwater dependence assessment for cultural heritage landscapes and gardens, included as Annexure A of Appendix F. The groundwater dependence assessment for cultural heritage landscapes and gardens details the current water table, and anticipated drawdowns at the 50 th , 67 th and 90 th percentile.
R17	The Applicant should address the recommendations of the Heritage Council of NSW's correspondence to the Department dated 17 August 2018 as referenced in paragraph 283.	Issues related to the recommendations of the Heritage Council of NSW's correspondence is addressed in the following places: Photomontages taken from <i>Mereworth</i> house and garden are presented in the UVIA included as Appendix E. This is addressed in Section 12.5.1 of this report, the updated SoHI (Appendix F) and its constituent reports on cultural landscape assessment (Annexure B of Appendix F); and the Sorensen garden analysis and the garden at <i>Mereworth</i> (Annexure C of Appendix F).
R18	The Statement of Heritage Impact Assessment should be updated in response to recommendations R16 and R17, and the visual impact of the project on the significance of the above items and the cultural landscape in accordance with an updated visual impact assessment (see R15 in Visual Impact recommendations).	The SoHI has been updated in response to the responses to recommendations R15, R16 and R17. This is included as Appendix F to this report.

12.5.1 Detailed response to R16

All listed heritage gardens accessing shallow groundwater and part of the vegetation in the landscape conservation areas are situated above the Wianamatta Group shale. As this is a perched groundwater system with limited hydraulic connection to the underlying Hawkesbury Sandstone (where groundwater drawdown is predicted to occur), no impacts are predicted in these areas. Should private gardens, non-native vegetation or exotic grasslands occur in areas where the Wianamatta Group Shale outcrops at surface, there will also be no impacts due to the perched groundwater system.

The regional scale RTS groundwater model was used to predict watertable drawdown in vegetated areas identified to contain plants that may access shallow groundwater and may be susceptible to water stress during periods of prolonged drought. During average and wet climate periods, vegetation in these areas will not be affected by groundwater level drawdown. During especially dry periods when the soil moisture is low and not replenished by rainfall or surface water runoff, vegetation in these areas may exhibit increased stress or die back due to reduced access to groundwater as a result of groundwater level drawdown. These areas are limited to low lying topographical areas where the watertable is shallow and near watercourses where groundwater discharges as baseflow. However, under prolonged drought conditions, without mining, the watertable would decline naturally in these areas. As such, vegetation either currently naturally adapts or is subject to water stress during these times, with replenishment when the drought breaks.

During drought conditions, approximately 0.1 ha of planted pine windbreaks at the Mereworth property (outside the heritage curtilage of Mereworth House and Garden) has a high risk of impact during drought conditions. Part of the southern windbreak is in an area proposed for surface mine infrastructure, in particular entry/exit to the personnel and materials drift and an access road to the explosives magazine. Parts of the windbreak that can be avoided by mine infrastructure will be monitored for signs of water stress during prolonged drought, with remedial action taken as required.

Within the landscape conservation study area, the 50th percentile results (about as likely as not) where Hawkesbury Sandstone outcrops at the surface predicts:

- no risk of impact during drought conditions to 5.2 ha of non-native vegetation and 0.2 ha of grasslands;
- low risk of impact during drought conditions to 0.8 ha of non-native vegetation;
- moderate risk of impact during drought conditions to 3.5 ha of non-native vegetation; and
- high risk of impact during drought conditions to 6.8 ha of non-native vegetation and 3 ha of grasslands.

Accordingly, 9.8 ha of non-native vegetation (including exotic grasslands) has a high risk of impact during drought conditions under the 50th percentile results. This only represents 0.08% of the cultural landscape study area and 0.06% of the common boundary of the cultural landscapes.

Within the landscape conservation study area, the 67th percentile results (unlikely) where Hawkesbury Sandstone outcrops at the surface predicts:

- no risk of impact during drought conditions to 3.8 ha of non-native vegetation and 0.1 ha of grasslands;
- low risk of impact during drought conditions to 0.7 ha of non-native vegetation;
- moderate risk of impact during drought conditions to 4.5 ha of non-native vegetation; and
- high risk of impact during drought conditions to 7.2 ha of non-native vegetation and 3.1 ha of grasslands.

Accordingly, 10.3 ha of non-native vegetation (including exotic grasslands) has a high risk of impact during drought conditions under the 67th percentile results. This only represents 0.09% of the cultural landscape study area and 0.07% of the common boundary of the cultural landscapes.

Within the landscape conservation study area, the 90th percentile results (very unlikely) where Hawkesbury Sandstone outcrops at the surface predicts:

- no risk of impact during drought conditions to 1.8 ha of non-native vegetation and 0.1 ha of grasslands;
- low risk of impact during drought conditions to 0.6 ha of non-native vegetation;
- moderate risk of impact during drought conditions to 5.2 ha of non-native vegetation; and
- high risk of impact during drought conditions to 8.7 ha of non-native vegetation and 3.1 ha of grasslands.

Accordingly, 11.8 ha of non-native vegetation (including exotic grasslands) has a high risk of impact during drought conditions under the 90th percentile results. This only represents 0.11% of the cultural landscape study area and 0.08% of the common boundary of the cultural landscapes.

Private properties with gardens containing the species located within the predicted area of groundwater drawdown and overlying the Hawkesbury Sandstone may be subject to increased water stress during prolonged drought as a result of the project.

Following project approval, Hume Coal will conduct additional 'post-approval' groundwater modelling and field investigations, where possible, to confirm the depth to groundwater in the areas identified as being at high risk of water stress during periods of prolonged drought.

Planted pine windbreaks on Mereworth, that cannot be avoided by surface mine infrastructure, will be monitored for signs of water stress during prolonged drought, and supplemented with water if required.

There will be no impacts to gardens and plantings within local or state listed heritage items.

The remaining non-native, exotic grassland and private gardens located within the landscape conservation study areas that are predicted to experience watertable drawdown and have been identified as being at risk of water stress during periods of prolonged drought cover a small area, are not classified as high priority GDEs and are not covered under any statutory requirement to manage or mitigate the potential and unlikely effects.

Ongoing 'post-approvals' groundwater modelling will be undertaken as and when new data become available, and at regular intervals throughout the life of the mine. It is expected the confidence level of model predictions will increase over time as the model is updated to reflect the observed effects on groundwater obtained from the monitoring program. This is consistent with International Organisation for Standardisation (ISO) continuous improvement guidelines and industry standard.

Additional context and background on the assessment methods used in calculating the abovementioned results are provided in the Groundwater dependence assessment for cultural heritage landscapes and gardens, included as Annexure A of Appendix F.

12.5.2 Detailed response to R17

The Commission had one recommendation relating to the recommendations of the Heritage Council of NSW's correspondence:

- **R17** - *The Applicant should address the recommendations of the Heritage Council of NSW's correspondence to the Department dated 17 August 2018 as referenced in paragraph 283.*

The correspondence from the Heritage Council of NSW dated 17 August 2018 is separated in to three subject areas:

- Mereworth house and garden;
- Berrima, Sutton Forest and Exeter Cultural Landscape; and
- Historical Archaeology.

These are addressed separately in Sections 12.5.1, i, ii and iii below. Full details are presented in the SGA, CLA and SHAA included as Annexures B, C and D of Appendix E.

i Mereworth House and Garden

a Independent Planning Commission recommendation

The correspondence from the Heritage Council of NSW dated 17 August 2018 is as follows:

Mereworth House and Garden

Mereworth House and Garden is listed in the Wingecarribee Local Environmental Plan 2010 as a locally significant heritage item. It is understood that the house dates from 1965, but the garden is potentially very significant as an intact, large-scale work of the renowned master landscape architect, Paul Sorensen.

Unfortunately, the location of Mereworth House and Gardens is not shown in any of the Hume Coal plans for the proposal, this omission makes thorough impact assessment and recommendation of mitigation measures difficult. As that Mereworth House and Gardens is in the centre of the Hume Coal area, a complete plan indicating existing buildings and gardens and the proposed Hume Project must be submitted prior to the determination of the application. This plan should also clearly indicate the location of the open vistas from Sorensen garden to the rural landscape.

It is understood that the current surrounding rural setting contributes to the significance of the Mereworth House and Garden and its Sorenson [sic] landscaping, which sought to blend interior views of the garden with longer rural vistas. Despite additional visual impact assessment in the RtS, the visual impacts of mine on views from the driveway of Mereworth, from points where Mereworth's garden, outer yards and surrounds have outward views, and views of the property from the Hume Highway, do not appear to have been adequately addressed in RtS. Therefore, existing photomontages should be amended to show the real outcome of the proposal before any decision is made. Choices of locations for photographs must avoid 'internal' areas of the garden where enclosure (by vegetation or structures blocks outward views. Based on the existing images of the proposal, it is clear that its construction will have a detrimental impact to this significant landscape and setting.

The RtS notes that a [conservation management plan] CMP will be prepared to manage the significance of the site into the future. This is supported and therefore a condition should be included:

A conservation management plan (CMP) for Mereworth estate, including the house, garden, estate drive, former drive and rural landscape, is to be prepared within 12 months of approval, The CMP shall identify appropriate uses for the house, include a schedule of conservation works, as well as a maintenance schedule for house, garden and farm estate.

A comparative analysis of Sorensen's entire landscape design was previously requested. This was not provided in the RtS. Our previous comments on the EIS in relation to this matter are reiterated and should be addressed prior to determination.

b Approach for response

As stated in Section 12.4.1, two reports were prepared to address the recommendations related to *Mereworth* house and garden. The SGA report addressed recommendations related to the significance of Paul Sorensen's garden at *Mereworth*, and the SHAA addressed recommendations related to the heritage significance of *Mereworth* house. The visual impact of the Project on the views from *Mereworth* house and garden is addressed in Section 10 of this report and the UVIA included as Appendix E.

c Analysis of findings and response to recommendations

Comparative analysis

The SGA included an analysis of Paul Sorensen's garden projects in the context of contemporary NSW garden designers and influences, an analysis of the *Mereworth* garden in the context of its rural setting and other Sorensen designs, and an analysis of the heritage significance of the *Mereworth* garden. The SGA found that Sorensen's designs had many similarities and changed little over the period of his work. Sorensen was not widely renowned, and not identified by many experts as an eminent garden designer. The garden at *Mereworth*, while assessed as an attractive garden in good condition, was determined to be typical of his designs, and more modest in scope and scale in comparison to his other rural homestead gardens. The comparative analysis concluded that the *Mereworth* garden (which is not intact due to changes caused by construction of the Hume Motorway) is typical of Sorensen's designs, but is not uncommon in a state context, and not a place of State heritage significance.

The SHAA concluded that while *Mereworth* house and garden is listed as an item of heritage significance on the Wingecarribee LEP (WSC 2010), this is primarily due to the property's strong association with garden designer Paul Sorensen rather than the house itself. Recent investigations revealed relics on the property, related to the previous homestead (Cowley's homestead) demolished in 1965. *Mereworth* house and garden do not meet the criteria for State heritage listing.

Visual impacts of the surface infrastructure on the house and garden at Mereworth

The visual effect on the Sorensen garden at Mereworth has been represented by a number of photomontages prepared for 11 locations within the primary sensitivity zone of the SPV zone and are representative of the visual effects (i.e. what can be seen in the existing landscape setting and the proposed visual character of the of the project elements). These are emboldened in Table 6.1 of Appendix E. The location of the photomontage views are the same as those identified in Table 7.1 of Appendix E. Photographic technical details of each of the photograph, in accordance with the Land and Environment Court's direction on the use of photo-montages is presented in Appendix E (UVIA). Photomontage viewpoints and directions are identified in Appendix E.

Impacts are anticipated from some viewpoints, while others, such as the view to the north from the terrace on the north side of the house (view Mereworth 1) are generally screened by the existing garden. Where new screening measures are recommended, these can be implemented in conjunction with the recommendations in the Cultural Landscape Assessment (CBLA).

Mitigation measures developed for the anticipated visual impacts are consistent with those in the Cultural Landscape Assessment and includes but is not limited to:

- design elements that involve underground installation of power and other services (where practicable), vehicle circulation, building mass and colour;
- visual integration planting through the preparation of a landscape plan that addresses key heritage and cultural landscape viewpoints, does not obscure the Mereworth avenue of trees, creates a more organic and integrated setting for the proposed dam and respects the existing landscape;
- planting themes and rationale that is not to screen but to integrate the project and to provide visual relief by breaking the mine elements up into separate fields of view;
- potential off-site mitigation treatments to be negotiated with landholders;
- the preparation of a visual management plan (VMP) in consultation with stakeholders to determine the most suitable species and designs;
- suitable rehabilitation of the landscape/landform at mine closure; and
- mitigation of night lighting given the region is largely rural or state forest.

ii **Berrima, Sutton Forest and Exeter Cultural Landscape**

a **Independent Planning Commission recommendation**

The correspondence from the Heritage Council of NSW relating to the Berrima, Sutton Forest and Exeter Cultural Landscape is as follows:

Berrima, Sutton Forest and Exeter Cultural Landscape

Comments provided in the RtS regarding the Berrima, Sutton Forest and Exeter Cultural Landscape highlight that there will not be a significant visual impact to these landscapes because visitors to those areas would not see the Hume Coal and rail loop proposal due to its distance from the highway, the trees and the topography. This statement should be supported by a visual analysis with adequate photomontages and subsequent assessment to indicate possible impacts on this intact colonial pastoral landscape prior to determination. Accordingly, previous comments on the EIS are reiterated and should be addressed prior to determination:

- The EIS should be amended to include a detailed assessment of impacts of both Hume Coal Project (SSD 7172) and Berrima Rail Project (SSD 7171) on the Berrima, Sutton Forest and Exeter Cultural Landscape. The applicant should provide this assessment prior to determination of the application, so that it informs the conclusion and conditions of any determination. The assessment should be undertaken by a heritage consultant with demonstrated experience with similar issues and scale of historic landscapes. The assessment should address the values set out in the National Trust of Australia (NSW) 1998 Summary Statement of Significance in detail. It should analyse any impact on these values as well as significant elements or groupings that comprise the landscape, that is the towns and villages, habitable buildings, pastoral and other structures, roads (such as the Old Hume Highway, Hume Highway, Oldbury Road and other local roads), streets, lanes, paths, fences, waterbodies, trees, plants, paddocks, cropping, their fabric as well as significant historical links across the landscape such as explorer and stock routes, the visual connections across the landscape as well as local and precinct- wide settings. The assessment should also consider whether any modifications to the projects' scope would prevent any adverse impacts to this multifaceted cultural landscape including the impact of project wide water usage, any water table draw-down and altered surface and sub-surface flows.

b Approach for response

As stated in Section 12.4.1, the CLA report was prepared to address the recommendations related to the Project's impacts on the B,SF&E cultural landscape. The CLA was undertaken by Catherine Brouwer, a heritage consultant with demonstrated experience with similar issues and scale of historical landscapes. The CLA addressed each of the requirements of the Heritage Council of NSW related to cultural landscapes, including the potential impacts of groundwater drawdown. The visual impact of the Project on the views of the B,SF&E cultural landscape is addressed in Section 10 of this report and the UVIA included as Appendix E.

c Analysis of findings and response to recommendations

The CLA outlined the cultural landscapes and designated heritage landscapes within the Project area, and assessed them against the values set out in the National Trust of Australia (NSW) 1998 Summary Statement of Significance for the Exeter/Sutton Forest Landscape Conservation Area (E/SF LCA) and the NSW heritage assessment criteria. The CLA concluded that neither the B,SF&E cultural landscape nor the E/SF LCA meet eligibility criteria for state listing.

The CLA identified that the potential impacts of the Project on each of the cultural landscapes would be primarily visual, due to the visibility of new infrastructure. However, any visual impacts on the cultural landscapes would need to be understood in the context of the cultural landscapes' historical and aesthetic values which include the presence of mining, industry and rail over a considerable timeframe.

The CLA concluded that the impacts of views of parts of Project related surface infrastructure on the B,SF&E cultural landscape would have a low effect on the values of the cultural landscape as a whole. The impact of views of surface infrastructure would be over a minor part of the wider cultural landscape, and that impact would be of a minor effect.

iii Historical Archaeology

a Independent Planning Commission recommendation

The correspondence from the Heritage Council of NSW relating to the Historical Archaeology is as follows:

Historical Archaeology

The RtS provided a response to submissions at the EIS stage at Hume Coal Project RTS Main Report part 2 of 2 (Vol 1), section iv - Historical Archaeology.

With regard to point i., there has been no appropriate response received with regard to the requirement for further investigation relating to the archaeological potential of the known site, Three Legs of Mann Inn. Whilst the RtS notes that no mining will occur beneath this item, the response does not adequately address the potential impacts of subsidence to this site as a result of the proposed mining activity. Further justification to support this argument is warranted. This requirement remains unsatisfied by the current submission.

In response to point ii, the RtS does not provide an assessment of archaeological potential associated with the Newbury and Eling Forest Winery Group sites, identified in the EIS as highly likely to retain research potential. It is understood from the RtS that the known buildings will not be impacted, however no research has been included to address whether these structures had earlier associated outbuildings or structures which may be present in the impact area and therefore impacted by this proposal. It is currently unclear whether the proposed mining activities in the vicinity of the above item may cause harm to potential subsurface archaeological deposits associated with this occupation evidence. This requirement remains unsatisfied by the current submission.

In response to points iii and iv the following argument is made: a separate archaeological assessment was not prepared as the response indicated that built heritage and relics are not mutually exclusive but part of the same process. While it is noted the SoHI supporting the EIS was prepared by an historical archaeologist, the comments provided by the Heritage Division to the EIS considered this information and made recommendations for the need for additional, supplementary research specific to understanding the study area. This would then inform an assessment of archaeological potential and significance. This was requested in accordance with specific guidelines for historical archaeology endorsed by the Heritage Council of NSW. The Division reiterates its position for the need for a supplementary historical archaeological assessment to more fully understand the archaeological implications from this proposal. This requirement remains unsatisfied by the current submission.

In response to point v, an historical archaeological assessment would outline the key impact areas and an assessment of potential and significance would determine whether archaeological testing in areas of impact would be required. The response provided does not clearly establish the archaeological potential at the Atkinson's homestead complex and areas of impact. An historical archaeological assessment would do this and outline mitigation measures to manage the impacts in areas of existing and anticipated archaeological potential. This requirement remains unsatisfied by the current submission.

The following recommendations for appropriate archaeological assessment, originally provided in our correspondence dated 17 July 2017, remain relevant and are reiterated:

- 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 Assessing Significance for Historical Archaeological Sites and Relics 2009.
- This Assessment 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.
- The Assessment 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.
- The detailed historical archaeological assessment should be provided to the Heritage Council for review prior to any determination of the application. Based on this supplementary assessment to address these elements in sufficient detail, the Heritage Council would be able to provide more specific advice for recommended conditions of approval to manage this resource.
- For clarity, we also reiterate the recommended conditions of consent which were detailed in our correspondence dated 17 July 2017, and have not been addressed in the RtS:
- 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 State Heritage Register items adjacent to the Hume Coal Project, being Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no.442). This 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.

- An inspection and monitoring program should be established for the State Heritage Register items adjacent to the Hume Coal Project, being Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no. 442) to ensure that any structural changes are identified. This 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.
- Any damage to State Heritage Register items adjacent to the Hume Coal Project, being Oldbury Farm (SHR no. 488), Golden Vale (SHR no. 489) and Hillview (SHR no. 442) due to mine construction and operation and for 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 Historic Heritage Management Plan for both the Hume Coal Project (SSD 7172) and the Berrima Rail Project (SSD 7171).
- 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.
- 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.
- 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.

b Approach for response

As stated in Section 12.4.1, a supplementary historical archaeological assessment (SHAA) (Annexure D of Appendix F) was prepared to address the recommendations related to the Project's potential impacts on historical archaeology.

The overarching objectives of the SHAA were:

- to investigate the potential for items of historical heritage value, including relics, to exist in the Project area;
- to assess the significance of historical heritage items in the study area;
- to assess the potential impacts of the Project on items of historical heritage in the study area; and
- to formulate management measures for the protection of historical heritage items in the Project area.

The SHAA also addressed each of the requirements of the Heritage Council of NSW related to historical archaeology, including the potential impacts of subsidence on archaeological sites.

Notably, the findings of the original historical heritage assessment undertaken for the Hume Coal Project EIS (EMM 2017a) have not changed; the SHAA is a supplementary report which provides additional information as requested by the IPC assessment report.

c Analysis of findings and response to recommendations

Additional research identified the homestead on the hill (under the current house at *Mereworth*) was built by the Cowley family in 1912 and stayed in the family until it was purchased by the Oxley family in 1963.

The stockyard at the rear of the large machinery shed on *Mereworth* was resurveyed and three areas where relics survive were recorded. The relics were visible because the prolonged drought removed the usual grass cover. These three features – sandstone flagging, a sandstone drain (potentially) and an artefact concentration are not in the impact zone and the area will remain a working stockyard.

Possible evidence of the former *Three Legs of Man Inn* was recorded during a field survey undertaken in October 2019, in the form of a stone wall which may have related to the original property. If the wall relates to the original property it would be classified as a relic and signify the potential for other relics on the property. No other archaeological evidence was noted. This item is outside the Project area, with the closest Project boundary being the underground mining area approximately 150 m to the west.

Some of the surrounding paddocks are within the underground mining area but the main structures are not. One shed is visible in aerial photography to be in the underground mining area. At *Newbury*, only one building that appears on the 1862 plan was present until September 2019 but has since been demolished and replaced with a modern building, this building is outside the project area.

Eling Forest Winery was not surveyed due to access restriction, but only 1.6 ha of the property is located over the underground mine area.

Comfort Hill was not surveyed due to access restriction, but 18.97 ha of the property is located over the underground mine area.

Mine infrastructure will not cause impacts to relics or research potential at archaeological heritage locations in and around the Project area. Subsidence is predicted to be negligible, due to the limited coal extraction associated with the proposed mining method; therefore, impacts to archaeological sites are not predicted to occur as a result of the Project.

The following overarching strategy to protect the significance of heritage items within the Project area has been followed to date and will continue as needed:

1. A precautionary approach will be followed to all activities that could impact on heritage items or potential heritage items. That is, the items will either be completely excluded from the disturbance footprint or its heritage values will be investigated and recorded prior to the works.
2. Impacts to heritage items including relics will be avoided through the Project design.
3. Following determination and prior to any work commencing, a historical heritage management plan (HHMP) will be prepared to guide the conservation of heritage items and unexpected finds for the duration of the Project. The relevant measures in the HHMP will be incorporated into the Project construction environmental management plan (CEMP) to avoid inadvertent impacts during the construction phase of the Project. The HHMP and CEMP will include actions in the event that unexpected relics and human skeletal material are unearthed.
4. Management measures will be specified in detail in the HHMP.
5. DPIE as well as Heritage NSW will be consulted on the content of the HHMP and the relevant sections of the CEMP.

13 Biodiversity (R19)

13.1 Introduction and background

This section of the IPC response report addresses the recommendation for further technical assessment on the impacts to native vegetation from a declining water table, and hence is focused on groundwater dependent ecosystems (GDE).

13.1.1 Environmental impact statement

A Biodiversity Assessment Report (BAR) (EMM 2017d) was prepared and submitted to DPIE as Appendix H of the EIS for the Hume Coal Project. A Biodiversity Assessment Report (EMM 2017e) for the Berrima Rail Project was also prepared and submitted to DPIE as Appendix J to the Berrima Rail Project EIS. Both the BARs were prepared in accordance with the former *Framework for Biodiversity Assessment: NSW Offsets Policy for Major Projects* (OEH 2014) and included an assessment of groundwater impacts on native vegetation, following the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (NOW 2012).

Planted exotic gardens and trees are not valued within the biodiversity framework and were not required to be assessed within either of the BARs prepared for the EIS. See Section 13.5.1 for further information on this topic.

Terrestrial native vegetation associated with eight creeks and rivers were identified as potential groundwater dependent ecosystems (GDE). The terrestrial vegetation was classified as having a facultative (opportunistic) dependence on groundwater, meaning this vegetation may use groundwater where available, but can exist without the input of groundwater (i.e. is not entirely dependent).

The upper reaches of Belanglo Creek and a patch of terrestrial vegetation south of Wells Creek showed a potential high risk of impact from water table drawdown exceeding 10 mbgl, during periods of prolonged drought (approximately 13 ha and 6 ha respectively). No impacts to these ecosystems were predicted to occur outside of prolonged periods of drought, due to their opportunistic use of groundwater. Mitigation measures proposed included the monitoring of these ecosystems during extended periods of drought; and to take appropriate action if the condition of the vegetation is observed as a result of mine activities.

The upper reaches of Long Swamp Creek, Oldbury Creek, Medway Rivulet, Black Bobs Creek, Longacre Creek, Red Arm Creek and the Wingecarribee River showed low to moderate risk, and were not predicted to be impacted by drawdown given their opportunistic dependence on groundwater and as the water table would remain above 10 mbgl in these areas.

The BAR also concluded that Long Swamp and Stingray Swamp would not be impacted by the Project.

13.1.2 Response to submissions

Various submissions from special interest groups and community raised concerns about water table drawdown and its impacts on overlying native vegetation in forested areas, private properties, gardens, parks and vineyards.

The former Office of Environment and Heritage (OEH) in their submission, concluded that there were no major issues with direct impacts on biodiversity.

The groundwater model for the Project was revised following the EIS exhibition period, and a revised GDE impact assessment was provided in Section 13.3 – Impacts on groundwater dependent ecosystems in the RTS Main Report.

Planted exotic gardens and trees are not valued within the biodiversity framework and were not required to be assessed within revised GDE assessment provided for the RTS. See Section 13.5.1 for further information on this topic.

The 2 m watertable drawdown contours changed as a result of the revised groundwater model. A number of additional swamps outside the project area were also included in the assessment. The 0 -2 m water table drawdown category was removed from the risk assessment to account for natural fluctuations. The ecosystem drawdown risk (ie low and moderate (2–10 mbgl) or high risk (>10 mbgl)) was then assessed by determining the maximum water table decline as a result of the project.

Predictions to terrestrial vegetation associated with the upper reaches of Belanglo Creek and south of Wells Creek and the proposed mitigation measures remained unchanged. The revised assessment also concluded there would be no impacts to Long Swamp and Stingray Swamp, or any of the additional swamps assessed.

In the revised GDE assessment only terrestrial vegetation in parts of Medway Rivulet and Black Bobs Creek showed a low to moderate risk of impact, and these were not predicted to be impacted by drawdown given their opportunistic dependence on groundwater and given the water table would remain above 10 mbgl in these areas. Vegetation predicted to have a risk of impact along Medway Rivulet (east of the Hume Highway) is predominantly cleared and dominated by exotic species, and therefore this does not pose a risk to biodiversity.

13.1.3 Response to Independent Planning Commission

The Department's PAR concluded that *'The Department and the OEH consider that biodiversity impacts would not be significant and could be managed thorough...a Biodiversity Management Plan'*, as noted in clause 337 of the IPC assessment report.

The Commission found in their IPC assessment report, clause 340, *'that the Applicant and Department have considered and assessed the impacts on biodiversity, and at this stage of its assessment the Commission finds that it is generally satisfied with the information provided up to this point regarding biodiversity impacts on native species'*.

Given the Department, former OEH and the IPC are satisfied with the information provided up to this point regarding biodiversity impact on native species, further GDE assessment on native vegetation has not been undertaken for this IPC response report. However, additional information relating to rooting depths of native species, other than Eucalypts, is discussed in Section 13.5.1.

A 'Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens' (included as Appendix G) has been undertaken to address concerns relating to the impacts of water table decline on planted exotic garden and trees within listed heritage items and previously identified cultural landscapes. This assessment has been prepared to respond directly to the IPC findings and recommendations R16 and R19 and is discussed further in Section 13.5.1.

13.2 Independent Planning Commission recommendations

The IPC made one recommendation in relation to biodiversity:

R19 - *The Applicant is to undertake further technical assessment on the impacts on private gardens, exotic trees and native vegetation from a declining water table.*

13.3 Approach for responding to the Independent Planning Commission assessment, findings and recommendations

Given the Department, former OEH and the IPC are satisfied with the information provided up to this point regarding biodiversity impact on native species, further GDE assessment on native vegetation has not been undertaken for this IPC response report. Impacts to native vegetation within the groundwater model domain have been previously assessed within Section 13 of the RTS Main Report.

Additional information provided by an arborist with expertise in plant biology and responses to reduced water availability; on rooting depths of native species, other than Eucalypts, is provided in Section 13.5.1. This is provided in relation to community concerns identified during the EIS submissions and noted by the IPC in clause 340.

Impacts on private gardens and exotic trees, from a declining water table are assessed in response to R16 and R19 within the 'Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens' included as Appendix G.

13.4 Analysis and response to the Independent Planning Commission's findings

The summary of the IPC findings relating to biodiversity, and Hume Coal's responses are presented in Table 13.1 below.

Table 13.1 Response to Independent Planning Commission findings – Biodiversity

Reference number	IPC's finding	Hume Coal response
339	The Commission notes the Applicant's attempts to best reduce surface impacts from infrastructure in the mine design and acknowledges that during its site inspection and locality tour it was apparent that the Project site has already been significantly cleared for farming purposes and that there has been significant historical investment in the establishment of exotic trees and gardens in the area.	Noted.
340	The Commission finds that that the Applicant and Department have considered and assessed the impacts on biodiversity, and at this stage of its assessment the Commission finds that it is generally satisfied with the information provided up to this point regarding biodiversity impacts on native species, however it is not satisfied that appropriate consideration and assessment has been given to the possible impacts of water table decline on exotic trees and gardens. The Hume Coal EIS reporting is based on eucalyptus tree species and their estimated rooting depths. Nothing has been reported on the rooting depths of introduced garden plants and exotic trees.	<p>Given the IPC are satisfied with the information provided up to this point regarding biodiversity impact on native species, further GDE assessment on native vegetation has not been undertaken.</p> <p>Additional information relating to rooting depths of native species, other than Eucalypts, is discussed in Section 13.5.1.</p> <p>A 'Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens' has been undertaken to address concerns relating to the impacts of water table decline on planted exotic garden and trees. The findings of this report are summarised in Section 13.5.1 below. The report is included as Appendix G to this report.</p>

13.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to biodiversity, and Hume Coal's responses are presented in Table 13.2 below. A detailed response to recommendations R19, is provided in Section 13.5.1.

Table 13.2 Response to Independent Planning Commission recommendation – Biodiversity

Reference number	IPC's recommendation	Hume Coal response
R19	The Applicant is to undertake further technical assessment on the impacts on private gardens, exotic trees and native vegetation from a declining water table	<p>Potential impacts to terrestrial vegetation associated with creeks, rivers and swamps were assessed within a revised GDE assessment in Section 13.3 of the RTS Main Report. This assessment was prepared to the satisfaction of the Department, former OEH and the IPC. No further assessment of native vegetation is required.</p> <p>Additional information relating to rooting depths Section 13.5.1 demonstrates that other native tree species will also not be significantly impacted by a drawdown of up to 10 mbgl in the two areas of terrestrial vegetation identified as high risk during prolonged periods of drought.</p> <p>A 'Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens' has been undertaken to address concerns relating to the impacts of water table decline on planted exotic garden and trees. The findings of this report are summarised in Section 13.5.1 below. The report is included as Appendix G to this report.</p>

13.5.1 Detailed response to R19

i Impacts of water table drawdown to native vegetation

Given the Department, former OEH and the IPC are satisfied with the information provided up to this point regarding biodiversity impact on native species, further GDE assessment on native vegetation has not been undertaken for this IPC response report.

ii Rooting depths of native species

The root zone of a eucalypt (up to 10 mbgl) was provided as an example of a native species dominant within the plant community types present in the terrestrial study area. The methodology used to determine ecosystem drawdown risk was described as follows in the RTS, Section 13.3 and was also used earlier in the EIS:

‘Given the facultative (opportunistic) use of groundwater by terrestrial vegetation, an ecosystem drawdown risk is defined as the level of reduction in groundwater availability for terrestrial vegetation during periods of long drought. Based on the above water table drawdown matrix, a low to moderate ecosystem drawdown risk is predicted where the water table height is predicted to stay within the root zone of eucalypts (ie up to 10 mbgl), while a high ecosystem drawdown risk is predicted where the water table level falls below 10 mbgl’.

A community member submission noted that while the EIS makes mention of the lowering of the water table and minimal effect on the root zone of the few naturally occurring Eucalypts, it makes no mention of how it will affect all the remaining trees.

The previous assessment specifically referenced the lowering of the water table and minimal effect on Eucalypts, while it did not specifically mention impacts on all other trees. Root systems tend to be shallower and wider in dry and hot climates, and deeper and narrower in cold and wet climates, except for trees (Schenk and Jackson 2002). The root systems of many woody trees and shrubs typically extend vertically and laterally into the soil retrieving water and nutrients from both deep and shallow soil layers. Shallow root systems are favoured over deeper root systems as the energy required for the plant to maintain shallow roots is lower (Stygoecologia 2013). Accordingly, the RTS assessment also represents the potential impacts on other native trees and shrubs.

As demonstrated here, the methodology used to determine ecosystem drawdown risk based on a root zone of up to 10 mbgl is appropriate given the opportunistic use of groundwater by native trees in the creeks within the study area.

iii Impacts to planted exotic gardens and trees

Potential impacts to planted exotic gardens and trees due to potential water table drawdown are discussed with the ‘Groundwater Dependence Assessment for Cultural Heritage Landscapes and Planted Gardens’, Appendix G of this IPC response report.

14 Economic (R20, R21, R22)

14.1 Introduction and background

14.1.1 Environmental impact statement

In February 2017, an economic impact assessment (EIA) was prepared for the EIS by BAEconomics (BAE 2017) in accordance with the Secretary's Environmental Assessment Requirements (SEARs) and with reference to various guidelines published by the NSW Government, in particular the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* published in 2015 (the 2015 Guidelines). The EIA was presented in Appendix Q of the Hume Coal Project EIS. The EIA also included assessment of the Berrima Rail Project.

The EIA (BAE 2017) concluded that the Project was expected to generate direct net economic benefits of \$295 million for NSW and \$84 million for the Southern Highlands SA₃ Region. Additional disposable income of \$73 million (for NSW) and \$44 million (for the Southern Highlands SA₃ Region) would be available due to combined flow on effects. Each year of the life of the project, an estimated additional 62 full time equivalent (FTE) jobs would be available in NSW and 34 FTE jobs in the Southern Highlands SA₃ Region.

Table 14.1 Net economic benefit to NSW and Southern Highlands SA₃ Region (BAE 2017)

Direct and indirect costs	NPV, AU\$ M real 2016	Direct and indirect benefits	NPV, AU\$ M real 2016
Greenhouse gas emissions	\$19	Royalties	\$114
Loss of agricultural value	\$2	NSW share of company income tax	\$27
		Employment benefits: disposable income, personal income taxes, Medicare payments	\$156
		Taxes on production and imports: payroll taxes, shire rates, land taxes and levies	\$19
Total direct and indirect costs	\$21	Total direct and indirect benefits	\$316
Net benefits to NSW			\$295
Loss of agricultural value added	\$2	Employment benefits: disposable income	\$85
		Taxes on production and imports: shire rates	\$1
Total direct and indirect costs	\$2	Total direct and indirect benefits	\$86
Net benefits to Southern Highlands SA₃ Region			\$84

Notes: Totals may not sum precisely due to rounding. NPVs derived using an annual discount rate of 7 per cent.
Source: BAEconomics 2017 analysis.

14.1.2 Response to submissions

Statutory and community submissions in support of the Project noted the significant employment and economic benefits the project would provide. Some submissions raised concerns and objections to the outcomes of the EIA on the basis that it was not representative of the economy of the Southern Highlands region, and that impacts to some industries were not represented or understated. Other submissions raised concerns over foreign ownership, property values, and the economic viability of the project.

In December 2017, BIS Oxford Economics (BISOE) undertook an independent peer review of the EIA 2017. The review was commissioned by the DPI. Although there were some disagreements between the economists, BISOE confirmed the view of BAEconomics that the project is of net economic benefit to NSW.

In June 2018, Chapter 20 of the RTS responded to the statutory and community submissions, as well as the BISOE independent peer review.

In October 2018, BAEconomics prepared an Updated EIA to take into account recent coal price and exchange rate forecasts, an updated mining schedule, operating and capital costs and the newly released Technical Notes supporting the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (the 2018 Technical Notes).

The Updated EIA (BAE 2018) concluded that the Project was expected to generate direct net economic benefits of \$373 million for NSW and \$107 million for the Southern Highlands SA₃ Region. Additional disposable income of \$149 million (for NSW) and \$54 million (for the Southern Highlands SA₃ Region) would be available due to combined flow on effects. Each year of the life of the project, an estimated additional 22 full time equivalent (FTE) jobs would be available in NSW and 24 FTE jobs in the Southern Highlands SA₃ Region.

Table 14.2 Net economic benefit to NSW and Southern Highlands SA₃ Region (BAE 2018)

Direct and indirect costs	NPV, AU\$ M real 2018	Direct and indirect benefits	NPV, AU\$ M real 2018
Greenhouse gas emissions	\$0.1	Royalties	\$132
Loss of agricultural value	\$2	NSW share of company income tax	\$32
		Employment benefits: disposable income, personal income taxes, Medicare payments	\$188
		Tax on production and imports: payroll taxes, shire rates, land taxes and levies	\$24
Total direct and indirect costs	\$2	Total direct and indirect benefits	\$375
Net benefits to NSW			\$373
Loss of agricultural value added	\$1.7	Employment benefits: disposable income	\$105
		Taxes on production and imports: shire rates	\$1
Total direct and indirect costs	\$1.7	Total direct and indirect benefits	\$109
Net benefits to Southern Highlands SA₃ Region			\$107

Notes: Totals may not sum precisely due to rounding. NPVs derived using an annual discount rate of 7 per cent.

Source: BAEconomics 2018 analysis.

14.1.3 Independent Planning Commission response

Hume Coal engaged BAEconomics to review the IPC assessment report, in light of the earlier EIAs. Many of the concerns and recommendations expressed by BISOE in 2017 simply require provision of more detailed information and justification for assumptions. The BAE (2020) revised EIA is provided in Appendix H.1.

The revised EIA contains an updated cost benefit analysis, sensitivity analysis and local effects analysis. Additional breakdown is included in the estimates of NSW net economic benefits to allow comparison between strict and broad application of the 2015 Guidelines. The BISOE concerns about transparency in relation to project costs, revenues, employment numbers and sourcing, and externalities are addressed.

The revised EIA (BAE 2020) concluded that the Project was expected to generate direct net economic benefits to NSW of \$192 million (or \$290 million, if employment benefits and taxes are included). Additional disposable income of \$28-\$38million for the Southern Highlands SA₃ Region would be available due to combined flow on effects. Each year of the life of the project, an estimated additional 37-51 FTE jobs would be available in the Southern Highlands SA₃ Region.

Table 14.3 Net economic benefit to NSW (BAE 2020)

Direct and indirect costs	NPV, AU\$ 2018 millions	Direct and indirect benefits	NPV, AU\$ 2018 millions
Items prescribed in the 2015 Guidelines:			
External effects (GHG)	\$0.1	Royalties	\$148
Loss of agricultural value	\$0.9	NSW share of company income tax	\$45
		Economic benefit to NSW landholders	N/A
		Economic benefit to NSW suppliers	N/A
		Net producer surplus	\$0
Total direct and indirect costs	\$1	Total direct and indirect benefits	\$193
Net benefits to NSW			\$192
Items reflecting a broader interpretation of the Guidelines:			
		Economic benefit to NSW workers	\$63
		Land taxes	\$1
		Local government rates	\$1
		Payroll taxes	\$18
		NSW share of personal income taxes	\$14
		NSW share of Medicare payments	\$1
		Total direct and indirect benefits	\$98
Net benefits to NSW			\$290

Notes: Totals may not sum precisely due to rounding.
Source: BAEconomics 2020 analysis.

14.2 Independent Planning Commission recommendations

The IPC made three recommendations in relation to economics, these are:

- R20** - The additional information provided by the Applicant, including the Updated Economic Impact Assessment prepared by BA Economics in October 2018, should be peer reviewed to determine:
 - whether the concerns and recommendations in the Economic Impact Assessment Review dated December 2017 prepared by BIS Oxford Economics (BISOE 2017) have been adequately justified, including concerns about transparency in relation to project costs, revenues and externalities; and
 - the implications and reasonableness of changes/assumptions in the Updated Economic Impact Assessment including the change to the project description from that in the Hume Coal Environmental Impact Statement and any cost implications.

Following the peer review, if the net economic benefit of the project remains uncertain and there are outstanding concerns about the assumptions and/or information, a further Economic Impact Assessment should be prepared that is consistent with the recommendations in BISOE 2017 (as set out in pages 1-3 of the Executive summary of BISOE 2017) and any further recommendations of the peer review.
- R21** - The Department should address whether assumptions in the Updated Economic Impact Assessment in regard to employment numbers and percentage of unskilled workers and whether these come from outside the local area are consistent with the assumptions used in the Social Impact Assessment
- R22** - The Applicant is to address the residual economic uncertainties, regardless of the strict interpretation of the 2015 Guidelines and Treasury Guidelines.

14.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

The revised EIA (BAE 2020) included as Appendix H1 addresses the IPC's recommendations to prepare a further economic impact assessment if review against the BISOE 2017 peer review concerns and recommendations, so warrants changes to the updated EIA (BAE 2018). Many of the concerns and recommendations expressed by BISOE in 2017 simply require provision of more detailed information and justification for assumptions.

Further details on the assessment methods used to undertake the revised EIA are presented in Appendix H.1.

14.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to economics, and Hume Coal's responses are presented in Table 14.4 below.

Table 14.4 Response to Independent Planning Commission findings– Economic

Reference number	IPC's finding	Hume Coal response
369	The Commission notes that that the EIA was peer reviewed by BISOE 2017, which found that the EIA is well researched and (with some exceptions) well-presented but raised concerns related to the consistency of aspects of the EIA with the 2015 Guidelines and the NSW Treasury (2017) NSW Government Guide to cost benefit analysis (Treasury Guidelines).	Application of the guidelines are discussed in Section 3.6 of Appendix H.1.
370	The Commission understands that BISOE 2017 also raised concerns about transparency in the description of Project costs and revenues and that there was ambiguity about the size of externalities, which is not explicitly quantified in the EIA and is internalized into the Project costing. These factors could further reduce the net benefit of the Project.	Additional information has been provided within the revised EIA (BAE 2020) in Appendix H.1. Project costs and revenues are addressed in Sections 3.2, 3.3, 3.4, 3.8 and Appendix H.1. Externalities are addressed in Section 3.8 of Appendix H.1.
371	The Scope of Work issued by the Department for BISOE 2017 included a requirement to assess the consistency of the EIA with relevant Government guidelines including the 2015 Guidelines and the Treasury Guidelines. The EIA states that it is consistent with relevant Government guidelines. BISOE 2017 notes that: <i>"While the Treasury Guidelines refer to government initiatives and indicate that these initiatives are not intended to replace agency-specific advice, they also note that they are intended to encourage a common analytical approach to CBA across NSW Government (p. 6). In this context, the Treasury Guidelines (p. 6) also refer to the NSW Government (2015), Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals as publicly available sector specific guidelines."</i>	Application of the guidelines are discussed in Section 3.6 of Appendix H.1.

Table 14.4 Response to Independent Planning Commission findings– Economic

Reference number	IPC's finding	Hume Coal response
372	The Commission notes that the concerns and recommendations in BISOE 2017 have not been thoroughly addressed in the subsequent documents submitted by the Applicant. In particular, the Updated EIA is based on the same interpretation of the 2015 Guidelines and Treasury Guidelines and contains the same lack of transparency about the Project costs and revenues. The Updated EIA has not been peer reviewed and therefore the additional information regarding externalities, including groundwater and GHG emissions and other changes such as the Project description have not been reviewed. Similarly, the estimated net benefit of the Project, based on different assumptions regarding coal price forecasts, delays in mine schedule and updated capital and operating costs, has not been reviewed.	Honorary Professor Andrew Stoeckel, of the Centre for Applied Macroeconomic Analysis at the Australian National University undertook an independent peer review of the BAE economic impact assessment update undertaken in October 2018. This peer review was undertaken in response to recommendation R20, its purpose to determine whether the concerns and recommendations raised in BISOE 2017 had been adequately addressed. This report is included as Appendix H.2 to this IPC response report. Hon. Prof. Stoeckel concluded that the 2018 update of the EIA had satisfactorily addressed the concerns and recommendations of the review by BISOE, and that the requirements of recommendation R20 had been met.
373	The Commission notes that the Department's PAR includes a net economic benefit of NPV \$373 million based on the Updated EIA but refers to the estimate of net economic benefit in BISOE 2017 of NPV \$127 million. The BISOE 2017 amount is based on the EIA figures and would need to be revised to reflect the Updated EIA.	Noted. The revised EIA (BAE 2020) provides a revised estimate of net economic benefit to NSW of \$192 million per strict application of the 2015 guidelines (or \$290 million, if employment benefits and taxes are included).
374	The Commission finds that whilst that the Applicant and Department have considered and assessed the impacts on economics, at this stage of its assessment the Commission finds that it is not satisfied with the level of information and assessment provided. Consequently, the Commission finds that there are residual uncertainties about the quantum of net economic benefit to NSW that would result from the Project. These uncertainties go beyond the uncertainties that would relate to all mining projects such as commodity price, exchange rate fluctuations and geological uncertainty. The uncertainties relate to the interpretation of the 2015 Guidelines and Treasury Guidelines, which significantly impact on the estimated net benefits of the Project. The application of these guidelines would need to be clarified by the Department prior to any further economic assessment being undertaken.	Noted. This is addressed in detail in response to R22 in Table 14.5 and Section 14.5.3.
375	There are also uncertainties about the capital and operating costs of the Project, which have not been made available due to concerns about commercial confidentiality. While this may be valid in relation to any public distribution of this information, the concerns should not preclude independent peer review with appropriate confidentiality agreements in place. Similarly, the assumptions and costing regarding externalities should be available for independent review.	Table 3.6 of the revised EIA (BAE 2020) in Appendix H outlines costs incurred by Hume Coal to date to mitigate external effects up to (but not including) 2020 (AU\$ 2018).
376	The costs also need to be considered of any changes to the Project in response to matters such as mine design to address safety, any future requirement for a water treatment plant, impacts from changes to the water table on trees, landscapes and agriculture outside the Project area, additional "make good" measures including potential legal costs and if access to properties for exploration is refused.	There is no future requirement for a water treatment plant, this provision has been removed from the proposal. There will be no significant impact from changes to the water table on trees, landscapes or agriculture as demonstrated in Chapter 13 and Appendix G. Externalities for the project have been estimated in Table 3-5 of Appendix H.1.

Table 14.4 Response to Independent Planning Commission findings– Economic

Reference number	IPC's finding	Hume Coal response
377	Assumptions in the EIA and Updated EIA in relation to employment numbers and percentage of unskilled workers and whether these come from outside the local area should also be reviewed for consistency with the assumptions used in the Social Impact Assessment.	This concern was included in R21 and is addressed in Section 14.5.2 of this IPC response report.
378	These uncertainties need to be resolved before the economic benefits of the Project can be weighed against the potential impacts of the Project on the environment and the community.	Noted.

14.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to economics, and Hume Coal's responses are presented in Table 14.5 below. Detailed responses to recommendations R20, R21 and R22 are provided in Section 1.1.1, Section 14.5.2 and Section 14.5.3.

Table 14.5 Response to Independent Planning Commission recommendations – Economic

Reference number	IPC's recommendation	Hume Coal response
R20	<p>The additional information provided by the Applicant, including the Updated Economic Impact Assessment prepared by BA Economics in October 2018, should be peer reviewed to determine:</p> <ul style="list-style-type: none"> i. whether the concerns and recommendations in the Economic Impact Assessment Review dated December 2017 prepared by BIS Oxford Economics (BISOE 2017) have been adequately justified, including concerns about transparency in relation to project costs, revenues and externalities; and ii. the implications and reasonableness of changes/assumptions in the Updated Economic Impact Assessment including the change to the project description from that in the Hume Coal Environmental Impact Statement and any cost implications. <p>Following the peer review, if the net economic benefit of the project remains uncertain and there are outstanding concerns about the assumptions and/or information, a further Economic Impact Assessment should be prepared that is consistent with the recommendations in BISOE 2017 (as set out in pages 1-3 of the Executive summary of BISOE 2017) and any further recommendations of the peer review.</p>	<p>BAEconomics have prepared a revised EIA (BAE 2020) to address the recommendations and concerns of BISOE and the IPC. This is provided in Appendix H.1.</p> <p>The revised EIA (BAE 2020) provides a revised estimate of net economic benefit to NSW of \$192 million per strict application of the 2015 guidelines (or \$290 million, if employment benefits and taxes are included).</p> <p>The 'economic benefit to NSW workers' of \$63 million NPV, coal royalties, company income and other tax payments have been itemised in the broader interpretation of the 2015 Guidelines, and are addressed in Sections 3.6, 3.2, 3.3 and 3.4 respectively of Appendix H.1.</p> <p>Net producer surplus is shown as zero in the NSW net economic benefit summary and is addressed in Section 3.4 of Appendix H.1.</p> <p>Table 3.5 - Predicted external effects and mitigation strategies (including external effects attributable to BRP) and Table 3.6 - Costs incurred by Hume Coal to date to mitigate external effects up to (but not including) 2020 (AU\$ 2018) have been included in the revised EIA in Appendix H.1. These tables together with the discounted cash flow analysis in Appendix C of the revised EIA aim to provide a greater degree of transparency to the costing of mitigation external effects (or externalities).</p> <p>State-wide flow-on effects have been removed from revised EIA (BAE 2020) in Appendix H.1.</p> <p>Honorary Professor Andrew Stoeckel, of the Centre for Applied Macroeconomic Analysis at the Australian National University undertook an independent peer review of the BAE economic impact assessment update undertaken in October 2018. This peer review was undertaken in response to recommendation R20, its purpose to determine whether the concerns and recommendations raised in BISOE 2017 had been adequately addressed. This report is included as Appendix H.2. Hon. Prof.</p>

Table 14.5 Response to Independent Planning Commission recommendations – Economic

Reference number	IPC's recommendation	Hume Coal response
R21	The Department should address whether assumptions in the Updated Economic Impact Assessment in regard to employment numbers and percentage of unskilled workers and whether these come from outside the local area are consistent with the assumptions used in the Social Impact Assessment	<p>Stoeckel concluded that the 2018 update of the Project had satisfactorily addressed the concerns and recommendations of the review by BISOE, and that the requirements of recommendation R20 had been met.</p> <p>The underlying assumptions used in both the revised EIA and the updated SIA are the same.</p> <p>The assumptions in the revised EIA with respect to employment numbers, percentage of unskilled workers and whether these come from outside the local area are consistent with the updated SIA, and also the original SIA presented in the EIS.</p> <p>While there are some similarities in the SIA and the revised EIA, they serve a different purpose. The SIA uses LGA as its primary data source as this dataset best represents those most likely to be impacted (directly and indirectly) from the project. The reason is most people will reside, socialise, interact and access services within the LGA and those services are most likely provided within that geographic location. Additionally, Hume will be adopting a policy where workers need to reside 45 minutes from site, which further requires the SIA to assess the impacts using LGA level data. Conversely, the revised EIA necessitates a broader geographic area due to:</p> <ul style="list-style-type: none"> c. relevant guidelines; and d. to more accurately gauge the economic activity as a result of the project. <p>This is particularly important in terms of the supply chain. The SIA refers to the revised EIA, the same as other technical reports, when assessing the regional procurement ie SA3 level data.</p> <p>This is addressed further in Section 14.5.2 and the revised EIA (BAE 2020) in Appendix H.1.</p>
R22	The Applicant is to address the residual economic uncertainties, regardless of the strict interpretation of the 2015 Guidelines and Treasury Guidelines.	<p>The revised EIA follows the approach set out in the 2015 guidelines and seeks to provide a greater degree of transparency across all aspects of the EIA. An additional 11 tables contain information on royalty calculation, income tax calculation, net producer surplus calculation, predicted external effects, costs incurred to date to mitigate external effects, groundwater licences required and held, recorded prices for groundwater licence transfers within the Sydney Nepean Groundwater Source Zones 1 and 2, project emissions valuations, direct labour inputs (FTE averages of operational workforce, FY2023 to FY 2042), net income increase (annual), analysis of direct expenditures (excluding labour), predicted external effects and a LEA summary.</p> <p>The CBA has been presented excluding employee benefits and additional information to outline costs, revenues and externalities is provided. The estimated net benefit to NSW from the Hume Coal Project (including the Berrima Rail Project) would be \$192 NPV.</p>

14.5.1 Detailed response to R20

Many of the concerns and recommendations expressed by BISOE in 2017 simply require provision of more detailed information and justification for assumptions; in response to this BAE (2020) prepared a revised EIA, this is provided in Appendix H.1.

This section briefly discusses the findings of the revised EIA within light of the key BISOE 2017 recommendations and recommendation R20i and ii.

i Cost Benefit Analysis (CBA)

The BISOE 2017 review found 'that the CBA is well-researched and (with some exceptions) well presented. The work is obviously the product of considerable effort and much of the approach is reasonable. Close attention has been paid to the stipulations laid down in the NSW Government (2015) Guidelines for the economic assessment of mining and coal seam gas proposals ("the Guidelines") in many (though not all) instances'.

BISOE recommended 'Employment benefits (and associated tax benefits) either be removed from the CBA or a better justification should be made for the existence (and claimed size) of such benefits. In addition, there should be an acknowledgement of the existence of shadow price of unemployed labour even if such costs cannot be quantified' (BISOE 2017, p.2).

Section 3.6 of the revised EIA (BAE 2020) in Appendix H.1 provides an in-depth review of the conceptual issues relating to economic benefits to workers, including incremental wages paid to the Hume workforce and additional employment generated by the project. In order to address BISOE concerns about departure from the 2015 Guidelines, the resulting benefits have been calculated and reported separately. In the broader interpretation of the 2015 Guidelines the 'economic benefit to NSW workers' is estimated as \$63 million, see Table 14.3 above.

BISOE recommended 'Project costs and revenues and the composition of the Net Producer Surplus be more transparently indicated, along the lines suggested in the Guidelines (Table 3.5, p.11)', (BISOE 2017, p.2).

Coal royalties are calculated in Section 3.2 of the revised EIA (BAE 2020) in Appendix H.1. The calculations and assumptions are transparent and tabulated. Net coal royalties payable by the Hume Coal mine are \$148 million NPV, accounting for the estimated \$8 million NPV refund for the Evandale property.

Company income and other tax payments are calculated in Section 3.3 of the revised EIA (BAE 2020) in Appendix H.1. The calculations of company income tax and assumptions are transparent and tabulated. The net NSW share of company income tax is \$45 million NPV. The following income and other tax payments have been excluded from the net economic benefits to NSW according to strict application of the 2015 Guidelines. However if a broader interpretation of the 2015 Guidelines is taken, then other net economic benefits to NSW would occur from personal income tax (\$14 million NPV), payroll tax (\$18 million NPV), local government rates (\$1 million NPV) and land tax (\$1 million NPV); these are itemised in Table 14.3 above.

Net producer surplus is addressed in Section 3.4 of the revised EIA (BAE 2020) in Appendix H.1. The 2015 Guidelines specify that the net producer surplus attributable to NSW is the economic rent attributable to NSW owners of capital, which depends on the Australian share of the project's ownership. Hume Coal's ultimate parent company, POSCO, is listed on Korean and US stock exchanges. Whilst it is possible that NSW residents own shares in POSCO (both directly and via superannuation funds and index funds), this information is not available, and the profits attributable to residents of New South Wales arising from the project are not likely to be material in the scope of this CBA. For the purpose of this analysis, it has therefore been assumed that no share of project profits would accrue to NSW residents. The net economic benefit to NSW from net producer surplus is therefore shown as zero.

Externalities are spill overs (positive or negative) from the production of a good or service and these are addressed in Section 3.8 of the revised EIA (BAE 2020) in Appendix H.1. Following the BISOE and IPC recommendation for a greater degree of transparency in terms of the costings relating to mitigation of external effects, BAE has produced Table 3.5 - Predicted external effects and mitigation strategies (including external effects attributable to BRP) and Table 3.6 - Costs incurred by Hume Coal to date to mitigate external effects up to (but not including) 2020 (AU\$ 2018). Additionally, going forward, Hume expects to incur \$380,000 per annum in groundwater, surface water, air quality monitoring, licence fees and other environmental monitoring costs. These costs have been incorporated in the discounted cash flow analysis in Appendix C the revised EIA.

BISOE recommended 'The flow on effects at the State-wide level be removed from the EIA Summary, to be consistent with the stipulations of the CBA guidelines issued by NSW Treasury (2017)', (BISOE 2017, p.2).

Subject to the BISOE 2017 review 'state-wide flow-on effects' have been removed from revised EIA (BAE 2020) in Appendix H.1.

ii Local effects analysis (LEA)

The BISOE 2017 review also found 'The LEA is likewise well-presented and researched, with considerable attention being paid to detail in areas such as the local housing market, tourism, agriculture, externalities and assessment of flow-on effects. The discussion here is well thought out and reasonable'.

BISOE stated: 'Employment benefits - These would again appear to be overestimated for many of the same reasons as in the CBA. A re-estimate by BIS Oxford Economics, adhering more closely to the stipulations in the Guidelines, suggests the overestimation is in the order of 13 percent', (BISOE 2017, p.3).

BISOE states 'non-labour expenditures are not quantified, which means that one potentially important area of benefits is actually omitted. Though the reasons for this are discussed in the LEA, there may be scope to re-examine the issue', (BISOE 2017, p.3).

Additional analysis of direct expenditures (excluding labour) that could be sourced locally, i.e. from suppliers based in Bowral, Marulan, Moss Vale and Medway was undertaken by Hume Coal and BAE; and included in Section 5.2 of the revised EIA (BAE 2020) in Appendix H.1. In summary, approximately \$147 million in expenditure for materials and services for pit-top ROM materials and approximately \$203 million in expenditure for materials and services for CHPP to FOB, could be sourced locally.

iii Independent peer review

Honorary Professor Andrew Stoeckel, of the Centre for Applied Macroeconomic Analysis at the Australian National University undertook an independent peer review of the BAE economic impact assessment update undertaken in October 2018. This peer review was undertaken in response to recommendation R20, its purpose to determine whether the concerns and recommendations raised in BISOE 2017 had been adequately addressed. This report is included as Appendix H.2.

Hon. Prof. Stoeckel concluded that the 2018 update of the Project had satisfactorily addressed the concerns and recommendations of the review by BISOE, and that the requirements of recommendation R20 had been met. The report stated that refinements to the estimates of employment benefit, transparency of estimates and justification of flow-on effects were reasonable and justifiable, and that the estimate of Net Economic Benefits to NSW are the best basis to form part of the decision of whether the project should be allowed to proceed. It went on to state that the NSW guidelines had been followed for the discount rate with specified sensitivity results and that use of a lower discount rate (which would be more reflective of current and forecast economic developments) could mean substantially higher net benefits to the NSW community.

14.5.2 Detailed response to R21

It is noted that recommendation R21 is addressed to the Department, further information has been provided here to assist the Department in their review.

In order to undertake an economic 'local effects analysis' (LEA) the 2015 Guidelines require the applicant to adopt a study area for the LEA that matches a SA₃ geographical definition. In the case of this project, the relevant SA₃ area is the 'Southern Highlands SA₃ Region'.

Section 5.1.2 – 'Share of the operational workforce that are local residents' of the revised EIA (BAE 2020) states that attributing income benefits to the local region requires assumptions to be made about the share of the workforce expected to reside in the Southern Highlands SA₃ Region; and that the assumptions made in the revised EIA are consistent with those developed in the SIA presented for the EIS and also the updated SIA. The revised EIA (BAE 2020) is provided in Appendix H.1.

To estimate local economic benefits BAE focused on the operational workforce. Where the construction workforce is concerned, the SIA assumes that 90 per cent of construction personnel will temporarily relocate to the local region, so that only 10 per cent

of the workforce would be recruited locally. For the purpose of estimating local employment benefits for the LEA, BAE have not considered local construction workers.

Hume Coal has publicly committed to recruit from the local area and reiterates this commitment as part of the IPC response phase. There are a large number of workers with the relevant experience residing in the LGA. Hume has also committed to training people without the necessary skills from the LGA. However, to enable the SIA to consider the potential impacts associated with the Project workforce during operations, the SIA considers two local recruitment scenarios (both in EIS and updated SIA for the IPC response), these are:

- Scenario 1 (High local recruitment): In Year 1 of the project, 70 per cent of experienced workers would be recruited from outside the SA₃ Region and the remaining 30 per cent would be locally recruited. At peak of operations, 70 per cent of the workforce would be recruited locally.
- Scenario 2 (Low local recruitment): In Year 1 of the project, 70 per cent of experienced workers would be recruited from outside the SA₃ Region and the remaining 30 per cent would be locally recruited. At peak of operations, 50 per cent of the workforce would be recruited locally.

BAE (2020) note that Scenario 1 (High local recruitment) is more realistic, given that the existing skills base in heavy manufacturing and that training programs provided by Hume Coal are expected to increase the potential to recruit local workers.

The base assumptions in the SIA were then used by BAE (2020) to derive the respective shares of the workforce deemed to live in the workforce catchment area, on the basis that peak production would be reached in FY 2026. Full details of the derived figures are provided in Section 5.1.2 of Appendix H.1.

Given that the various localities considered within a 45-minute driving distance of the project do not strictly align with the Southern Highlands SA₃ Region, further adjustments to the derived figures need to be made. An assessment of the respective populations suggests that the population in the Southern Highlands SA₃ Region accounts for around 53 per cent of the population in the workforce catchment area. BAE have then approximated the share of the workforce in the workforce catchment area that is 'local' (in the sense that they live in the SA₃ Region) on the basis of these relative populations. On that basis, BAE (2020) estimate that:

- in Scenario 1 (High local recruitment), on average 93 FTEs (175 people living in the workforce catchment area x 53 per cent) would be deemed local; and
- in Scenario 2 (Low local recruitment), on average 68 FTEs (128 people living in the workforce catchment area x 53 per cent) would be deemed local.

14.5.3 Detailed response to R22

In clause 374 of the IPC assessment report the Commission finds *'that whilst the Applicant and Department have considered and assessed the impacts on economics, at this stage of its assessment the Commission finds that it is not satisfied with the level of information and assessment provided. Consequently, the Commission finds that there are residual uncertainties about the quantum of net economic benefit to NSW that would result from the Project. These uncertainties go beyond the uncertainties that would relate to all mining projects such as commodity price, exchange rate fluctuations and geological uncertainty. The uncertainties relate to the interpretation of the 2015 Guidelines and Treasury Guidelines, which significantly impact on the estimated net benefits of the Project. The application of these guidelines would need to be clarified by the Department prior to any further economic assessment being undertaken'*.

R22 requires the applicant to address the residual economic uncertainties, regardless of the strict interpretation of the 2015 Guidelines and Treasury Guidelines.

The revised EIA follows the approach set out in the 2015 guidelines in response to recommendation R22, discussing conceptual and practical issues as they arise, including those relating to inconsistencies with the NSW Treasury Guidelines. This approach results in a revised EIA with a greater degree of transparency across all aspects of the EIA, responding to the concerns of BISOE, DPIE and the IPC, and including explanations of assumptions and tabulation costs, revenues and externalities.

The revised EIA includes an additional 11 tables with additional information on royalty calculation, income tax calculation, net producer surplus calculation, predicted external effects, costs incurred to date to mitigate external effects, groundwater licences required and held, recorded prices for groundwater licence transfers within the Sydney Nepean Groundwater Source Zones 1 and 2, project emissions valuations, direct labour inputs (FTE averages of operational workforce, FY2023 to FY 2042), net income increase (annual), analysis of direct expenditures (excluding labour), predicted external effects and a LEA summary.

BISOE (2017) indicated in the executive summary to their peer review, if the cost benefit analysis (CBA) were amended to exclude employment benefits and if revenues, costs and externalities were provided, then 'the project will still record positive net lifetime economic benefits of \$127 million'.

Following the recommendations of BISOE the CBA provided in the revised EIA in Appendix H.1 has excluded employee benefits and provided additional information to outline costs, revenues and externalities. The estimated net benefit to NSW from the Hume Coal Project (including the Berrima Rail Project) would be \$192 NPV.

15 Nature of the coal market (R23)

15.1 Introduction and background

The Southern Coalfield is the only significant source of quality hard metallurgical or coking coal in NSW. The EIS and RTS described the nature of the market for coal, in particular coking coal, driven by growing steel producers such as India and other South and South East Asian countries.

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.

15.2 Independent Planning Commission recommendations

The one recommendation from the Commission regarding the nature of the market for coal was:

- **R23** - *The Applicant or the Department, or both of them, should review the market for coking coal, including the most recent forecasts by the Australian Government.*

15.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

Hume Coal engaged Wood Mackenzie, a reputed market research consultancy to review supply and demand factors and forecasts for the Australian domestic and global seaborne metallurgical coal markets.

15.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to the nature of the market for coal, and Hume Coal's responses are presented in Table 15.1 below. Detailed responses to items 383, 384, 385 and 386 are provided in Section 15.5.1 and Appendix I.

Table 15.1 Response to Independent Planning Commission findings– Nature of the market for coal

Reference number	IPC's finding	Hume Coal response
383	The supply of coking coal from NSW is small. The southern coalfield is the only coalfield in NSW producing hard coking coal. Production in recent years has been falling.	<p>There is currently about 3 Mtpa of metallurgical coal contracted to the domestic market, which will rise slightly as Tahmoor South is commissioned, before dropping off as Dendrobium and then Metropolitan cease production with reserve depletion.</p> <p>As a result of this declining supply outlook, Australia's steelmakers are likely to start contracting new production in the coming years to shore up supply for their mills. This can either come from the redirection of coal from currently operating mines that was otherwise destined for the export market, or from new projects.</p> <p>Given its location, Hume coal is well placed to service the Port Kembla steel works when it looks to source new coal supply due to its freight advantage.</p>
384	Semi hard coking coal, which Hume Coal would produce, is expected to trade at 80 to 90% of Queensland hard coking coal price. This discount to the hard-coking coal price was not used in the economic evaluation of the Project. A much lower price was used than is currently being realised.	Assumptions on Project costs and revenues, including the expected price of coal, are addressed in Sections 3.2, 3.3, 3.4, 3.8 of Appendix H1 and in Appendix H2.

Table 15.1 Response to Independent Planning Commission findings– Nature of the market for coal

Reference number	IPC's finding	Hume Coal response
385	<p>According to the Resources and Energy Quarterly, December 2018, Office of the Chief Economist, the Commonwealth Department of Industry, Innovation and Science:</p> <p><i>"There is growing demand for coking coal. World steel production is forecast to increase by 1.8 per cent annually from 1,689 million tonnes in 2017 to 1,780 million tonnes in 2020. Higher production will be led by growth in India and other emerging markets, while production in China - which represents half of world production — is expected to be steady in 2019 and taper in 2020, driven by an expected slow-down in economic activity.</i></p> <p><i>Emerging markets (excluding China) are forecast to increase steel production by 2.5 per cent each year, from 328 million tonnes in 2017 to 345 million tonnes in 2020. Higher production will be driven by the ongoing expansion of India's steel-making capacity. India's steel production is forecast to grow by 6.7 per cent annually, to reach 123 million tonnes in 2020. Higher consumption will be driven by rising consumption in India and other parts of Asia. India's increased steel consumption is driven by rapid urban population growth, substantial government investment in infrastructure, housing and urban development, and its growing manufacturing sector.</i></p> <p><i>India's metallurgical coal imports have surged in 2018, driven by the ongoing expansion of the domestic steel sector. Metallurgical coal imports grew to 45 million tonnes in the year to September, an increase of 19 per cent year-on-year. India is forecast to overtake China as the world's largest importer of metallurgical coal in 2020, with India's imports forecast to grow steadily over the next two years, to reach 71 million tonnes in 2020. India has limited domestic reserves of metallurgical coal, and will need to increase imports to support the rapid growth of its domestic steel industry.</i></p> <p><i>While the traditional importers in the Asian market — China, Japan and South Korea — will continue to dominate the seaborne market, import growth from these countries is forecast to remain largely subdued. Many countries are building up their steel capacity to meet demand from the construction sector, driven by large infrastructure projects. In particular, Vietnam, Indonesia and Malaysia have substantial additions to blast-furnace steel capacity, which will support the demand for metallurgical coal.</i></p> <p><i>There is also increasing demand for Australian thermal coal in the medium term. Australia's thermal coal export earnings totalled \$7.2 billion in the September quarter of 2018, increasing by 34 per cent year-on-year. The strong growth in export earnings was driven by high prices and growth in export volumes, which increased by 4.1 per cent year-on-year. Australia's thermal coal export earnings are forecast to grow from \$23 billion in 2017–18 to a new record of \$26 billion, before declining to \$20 billion in 2019–20."</i></p>	<p>Noted. These findings were independently corroborated by a market report by Wood Mackenzie included as Appendix I.</p>

Table 15.1 Response to Independent Planning Commission findings– Nature of the market for coal

Reference number	IPC's finding	Hume Coal response
386	<p>The International Energy Agency (2018) World Energy Outlook stated that:</p> <p><i>“India and south east Asia are expected to be the key drivers of growth in coal use, with demand in those regions projected to more than double between 2017 and 2040”.</i></p> <p><i>“Among the coal exporting countries, only Australia is projected to substantially ramp up coal production, supported by locational advantage to growing Asian markets and a high quality resource base”</i></p>	Noted. These findings were independently corroborated by a market report by Wood Mackenzie included as Appendix I.

15.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to the nature of the market for coal, and Hume Coal's responses are presented in Table 15.2 below. A detailed response to recommendation R23 is provided in Section 15.5.1.

Table 15.2 Response to IPC recommendations – Nature of the market for coal

Reference number	IPC's recommendation	Hume Coal response
R23	The Applicant or the Department, or both of them, should review the market for coking coal, including the most recent forecasts by the Australian Government.	The market for metallurgical coal is driven by the demand for steel. Globally, the demand for steel is forecast to increase, driven in particular by increased urbanisation in South and South-east Asian countries.

15.5.1 Detailed response to R23

i Demand

Overall global seaborne metallurgical coal demand is expected to rise from 318 Mt in 2019 to 421 Mt by 2040 (1.3% compounded annual growth rate (CAGR)). Although there is expected to be a 103 Mt rise in demand by 2040, only 13 Mt of this is expected by 2023, with Asian demand remaining flat over this period. From 2023 to 2040, the demand for imported metallurgical coal is expected to rise by 90 Mt, almost completely driven by India's forecasted growth.

Demand across the developed economies of Japan, South Korea and Taiwan is expected to fall between 2020 and 2040 due to low economic growth, demographics and competition from other countries in the export steel market.

China's steel production (and consequential need for metallurgical coal) is expected to peak at 999 Mt in 2020 as a result of government stimulus, before dropping to approximately 880 Mt by 2040. Over the long term, depletion of China's high-quality metallurgical coal reserves will result in an increase in imports of high-quality metallurgical coal, with Australia continuing to supply the majority of China's metallurgical coal imports in the future.

India is expected to be the primary source of global growth of metallurgical coal between 2020 and 2040, with the demand for steel production driven by a large and expanding population, low urbanisation rates and a burgeoning middle class. Steel production is expected to rise from 111 Mt in 2019 to 286 Mt in 2040. This increase is supported in the short term by the Indian Government's US\$3.5B infrastructure fund which aims to increase access to affordable housing by funding housing projects.

Australia's domestic steel market has declined through the 2000s, with imports increasingly displacing domestic supply. However, investment in the 3 Mtpa Port Kembla Steelworks and 1.25 Mtpa Whyalla Steelworks is expected to drive an increased demand for metallurgical coal from 4.8 Mt in 2020 to 5.5 Mt in 2040 as output increases and efficiency improvements are made.

ii Supply

The global supply of metallurgical coal is expected to increase to meet demand. In 2019, more than half of global metallurgical coal demand was met by supply from Australia. Australia is forecast to maintain its market share between 2020 and 2040, continuing to dominate supply and accounting for approximately 60% of the total during that period. Most long-term demand growth for metallurgical coal is expected to be driven by India, and Australia has a geographic advantage to capture a large share of that business, compared to Russia, the United States and Canada. Australia's metallurgical coal exports are expected to rise from 184 Mt in 2020 to 246 Mt by 2040.

There is currently about 3 Mtpa of metallurgical coal contracted to Australia's domestic market. This will rise slightly as the Tahmoor South coal mine is commissioned, before dropping off as Dendrobium and Metropolitan coal mines cease production due to reserve depletion. Australia's steelmakers are likely to contract new production to ensure supply for their mills. This can either come from the redirection of coal from currently operating mines that was otherwise destined from the export market, or from new projects.

Given its location and freight connections, the Hume Coal Project is well placed to service the steelworks at Port Kembla when it looks to source a new coal supply.

iii Pricing

Global metallurgical coal prices spiked in 2017 as a result of disruption to supply from Queensland mines following Cyclone Debbie, which damaged export infrastructure. Since then, global metallurgical coal prices have fallen back to lower levels. The Chinese coal supply and demand dynamics are likely to see prices shift and settle at a lower long-term level in China, which will lead to a continued price decrease until the mid-2020s, after which prices will stabilise. From the mid-2020s, the growth in demand for metallurgical coal is expected to reverse the decline in prices, with new supply required to fill the market. This will result in prices rising to incentivise new, higher cost projects and elevating prices through to 2040.

16 Social impact (R24, R25)

16.1 Introduction and background

16.1.1 Environmental impact statement

A social impact assessment (SIA) was undertaken by EMM Consulting in 2017 as part of the EIS for the Project. The SIA was prepared in accordance with the SEARs and relevant statutory assessment requirements, guidelines and policies at the time the assessment was prepared.

The SIA involved a social risk assessment based on baseline data and community consultation data. It revealed the net social outcome for the Project overall to be positive, while the negative social impacts tended to be more localised or of shorter duration and lower magnitude. The social risk assessment concluded that the negative impacts were outweighed by the positive impacts, with the positive impacts demonstrating benefits of long duration and benefit to the whole region. The SIA provided management and mitigation measures to be incorporated into the Project design to mitigate negative impacts and enhance positive impacts.

16.1.2 Response to submissions

Statutory and community submissions raised concerns about the scope and accuracy of the assessment. The RTS presented the accepted standards and guidelines that were reviewed and considered in the preparation of the SIA, as well as the systematic process that was used for the assessment.

The submissions contended that the Project is already having a negative social impact of the local community, citing the physical and mental impact of the Project on residents, the impacts on the certainty of the economic and social future of the community, and the incompatibility of the values of the community with the reality of the Project. The RTS acknowledged the existence of concern for some community members given the uncertainty of the potential impacts of the Project on the community. A consideration of both the positive and negative potential impacts was presented in the RTS.

Concerns related to employment and the Project workforce were also raised in the submissions. The RTS presented data related to unemployment in the area, the composition of the construction and operational workforces, and the flow-on benefits of employment by the Project, as well as the commitment to a residential workforce by Hume Coal. No additional mitigation measures were proposed.

16.1.3 Independent Planning Commission response

An updated SIA (Appendix J) was prepared for this IPC response report. The updated SIA was prepared in accordance with the Department's *Social Impact Assessment Guidelines – September 2017* and took into consideration the revised Economic Impact Assessment to ensure consistency between assumptions used in both updated assessments. The updated SIA addressed issues related to relevant excerpts of the Project submissions, health data, and workforce data. The updated SIA also incorporated both the Hume Coal Project and the Berrima Rail Project.

16.2 Independent Planning Commission recommendations

The IPC made two recommendations in relation to the social impact assessment, these are:

- **R24** - The Applicant should consider updating its Social Impact Assessment in accordance with the Department's 'Social Impact Assessment Guidelines – September 2017' and ensure consistency with the assumptions of the revised Economic Impact Assessment.
- **R25** - The Department, regardless of any further assessment provided by the Applicant, should assess the Project in accordance with its 'Social Impact Assessment Guidelines – September 2017' and report on the findings of this assessment in its Final Assessment Report.

16.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

The updated SIA addresses the IPC's recommendation that Hume Coal update the assessment in accordance with the '*Social Impact Assessment Guidelines – September 2017*', and to ensure consistency with the updated economic impact assessment, which has also been developed in accordance with the IPC findings and recommendations.

The findings of the original SIA have been added to and amended according to the changes reflected in the inclusion of the Berrima Rail Project in the assessment, the updating of social baseline data and statistics, and the assessment of impacts not previously considered. Where necessary, this SIA also addresses items presented in the IPC assessment report that informed the IPC findings and assessment that the applicant feels are erroneous, unsubstantiated or are otherwise worthy of response.

Further details on the assessment methods used to undertake the SIA is presented in Appendix J.

16.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to social impacts, and Hume Coal's responses are presented in Table 16.1 below. A detailed response to item 400 is provided in Section 16.4.1.

Table 16.1 Response to Independent Planning Commission's findings– Social impact

Reference number	IPC's finding	Hume Coal response
400	While the technical compliance of matters such as noise, air quality etc has been considered the social impacts on those people most affected by the mine have not been assessed. Furthermore, the assumptions in the SIA in relation to employment numbers and percentage of unskilled workers and whether these come from outside the local area should also be reviewed by the Department for consistency with the assumptions used in the Economic Impact Assessment as well as the demographics of the proposed workforce and potential impacts on existing employment in other industries in the local area.	Issues related to the social impacts on the people most affected by the mine/most vulnerable persons is addressed in Section 16.4.1 of this report and Section 7 of Appendix J. Issues related to employment numbers, proportions of unskilled workers, and non-local workers is addressed in Section 16.4.1 of this report and Section 3.3 and Section 7.9 of Appendix J. Issues related to the demographics of the proposed workforce and the potential impacts on existing employment and other industries in the local area is addressed in Section 16.4.1 of this report and Section 7.1.1 to Section 7.1.6, and Section 7.3.3. to 7.3.4 of Appendix J.

16.4.1 Detailed response to item 400

Assessment of the potential social impacts arising from the Project has been conducted using a variety of baseline sources and data revealed through a range of community consultation tools, using both quantitative and qualitative data as indicated in the *Social Impact Assessment Guideline*. The updated SIA demonstrates the potential vulnerable groups and associated potential impacts linked to the surroundings component of the SIA definition, as well as the social impacts related to the natural environment.

The Updated SIA also includes updated workforce data, and assesses the way of life impacts, including the impacts associated with the demographics of the proposed workforce and the potential impacts related to employment and industries within the local area, as well as population change impacts on access to and use of infrastructure, services and facilities arising from non-resident and resident increases access to and use of infrastructure. It also provides an indication of the cumulative impacts related to the project, including the spatial, temporal, and linked impacts as described in the *Social Impact Assessment Guideline*.

The social risk assessment identifies the potential for both positive and negative impacts, as well as the risk of the impacts being mitigated/unmitigated for negative impacts and enhanced/unenhanced for positive impacts.

16.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to social impacts, and Hume Coal's responses are presented in Table 16.2 below. Detailed responses to recommendations R24 and R25 are provided in Section 16.5.1 and Appendix J.

Table 16.2 Response to Independent Planning Commission's recommendations – Social impact

Reference number	IPC's recommendation	Hume Coal response
R24	The Applicant should consider updating its Social Impact Assessment in accordance with the Department's 'Social Impact Assessment Guidelines – September 2017' and ensure consistency with the assumptions of the revised Economic Impact Assessment.	<p>The underlying assumptions used in both the revised EIA and the updated SIA are the same, as outlined in Section 14 of this report.</p> <p>The SIA has been updated in accordance with the <i>Social Impact Assessment Guidelines – 2017</i>. The SIA has also taken into consideration the revised Economic Impact Assessment to ensure consistency between assumptions used in both updated assessments. Information related to the application of the <i>Social Impact Assessment Guidelines – 2017</i> is included in Section 16.5.1 of this report and Appendix J.</p>
R25	The Department, regardless of any further assessment provided by the Applicant, should assess the Project in accordance with its 'Social Impact Assessment Guidelines – September 2017' and report on the findings of this assessment in its Final Assessment Report.	This is a matter for DPIE when undertaking its assessment of the Project. However, to assist DPIE, the updated SIA has been prepared in accordance with the <i>Social Impact Assessment Guideline – 2017</i> .

16.5.1 Detailed response to R24

The updated SIA identifies the *Social Impact Assessment Guideline – 2017* as the primary assessment guideline with which this SIA was conducted. It demonstrates the definitions and matters presented in the SIA guideline and their application in the creation of an SIA framework and identifies the primary SIA principles, and assists in the determination of the level of social risk posed by social impacts based on the consequence and likelihood of the potential impacts, as outlined in Section C3 of the *Social Impact Assessment Guideline – 2017*.

The linkages between the issues raised in submissions/consultation and in analysis of the updated social baseline and the SIA matters presented in the *Social Impact Assessment Guideline – 2017* are considered throughout the updated SIA report. The updated SIA applies a wide range of engagement techniques implemented throughout the assessment process and justifies their purpose in social impact assessment as outlined in Section 2.3 of the *Social Impact Assessment Guideline – 2017*. Additional evidence from relevant stakeholders has also been included.

The updated SIA modified the assessment to demonstrate the potential impacts based on the key links to social impact definition and the SIA matters outlined within the *Social Impact Assessment Guidelines – 2017* and demonstrates the opportunity to promote better development outcomes through a focus on minimising negative social impacts and enhancing positive social impacts.

The assumptions in the revised EIA with respect to employment numbers, percentage of unskilled workers and whether these come from outside the local area are consistent with the updated SIA, and also the original SIA presented in the EIS.

While there are some similarities in the updated SIA and the revised EIA, they serve a different purpose. The SIA uses LGA as its primary data source as this dataset best represents those most likely to be impacted (directly and indirectly) from the project. The reason is most people will reside, socialise, interact and access services within the LGA and those services are most likely provided within that geographic location. Additionally, Hume will be adopting a policy where workers need to reside 45 minutes from site, which further requires the SIA to assess the impacts using LGA level data. Conversely, the EIA necessitates a broader geographic area due to:

- (a) relevant guidelines; and
- (b) to more accurately gauge the economic activity as a result of the project.

This is particularly important in terms of the supply chain. The SIA refers to the revised EIA, the same as other technical reports, when assessing the regional procurement, ie SA3 level data.

17 Statutory environmental planning instruments (R26)

17.1 Introduction and background

The Project requires approval under Division 4.1 of Part 4 of the EP&A Act and the EPBC Act.

The EIS provided an assessment of the project against the Commonwealth and NSW regulatory and policy framework that was enacted at the time of writing. There were no changes to relevant aspects of the Commonwealth and NSW regulatory and policy framework needing to be assessed as part of the RTS.

17.2 Independent Planning Commission recommendations

The IPC made one recommendation in relation to statutory planning instruments, this is:

- **R26** - *The Department should provide an updated and detailed assessment of all relevant components under Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report.*

17.3 Approach for responding to IPC assessment, findings and recommendations

Part 3 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) outlines additional matters which must be considered by a consent authority when evaluating development applications for mining, including:

- non-discretionary development standards for mining;
- compatibility of proposed mine, petroleum production or extractive industry with other land uses;
- consideration of voluntary land acquisition and migration policy;
- compatibility of proposed development with mining, petroleum production or extractive industry;
- natural resource management and environmental management;
- resource recovery;
- transport; and
- rehabilitation.

To address R26, Hume Coal has provided further information to support the assessment of the project against Part 3 of the Mining SEPP. This additional information has been combined with the response to R29 and provided in Table 17.1 and Appendix K.2 of this report.

17.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to statutory environmental planning instruments, and Hume Coal's responses are presented in Table 17.1 below.

Table 17.1 Response to Independent Planning Commission findings– Statutory environmental planning instruments

Reference number	IPC's finding	Hume Coal response
432	The Commission finds that that the Applicant and Department have considered and assessed the Project against the relevant statutory framework.	As noted in Chapter 3 of the EIS, the project has been assessed against relevant statutory framework, namely the EP&A Act and EPBC Act. Since the submission of the EIS in March 2017, no material amendments to the EP&A Act or EPBC Act have occurred.
433	<p>The Commission in its assessment of the Project is satisfied that the Project is consistent with the provisions of the following EPIs:</p> <ul style="list-style-type: none"> • State Environmental Planning Policy (State and Regional Development) 2011; • State Environmental Planning Policy No 33 – Hazardous and Offensive Development; • State Environmental Planning Policy No 44 – Koala Habitat Protection; • State Environmental Planning Policy No 55 – Remediation of Land; and • State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011. <p>However, the Commission has formed the view that greater consideration of the Drinking Water SEPP and the Mining SEPP is required.</p>	<p>Consistency of the project with the EPIs listed in item 433 of the IPC report is demonstrated in section 3.6.1 of the EIS.</p> <p>Additional assessment of the project against the provisions of the Drinking Water SEPP and Mining SEPP are provided in Appendix K of this report.</p>
434	In relation to the Drinking Water SEPP the Commission finds should the proposal to impound water in the underground voids behind bulkheads be achieved and no discharge of mine related water occurs to surface waters, the Commission is satisfied that the Project can achieve the objectives of the Drinking Water SEPP. The Commission notes however that the provision of additional information may change this view.	<p>Overall, the impact of the project to surface water has been assessed as minimal and insignificant in accordance with <i>Matters of National Environmental Significance: Significant Impact Guidelines</i> (DoE 2013). The impact of mining methodology on surface water has been assessed in section 7.4 of the EIS. It has been demonstrated that water to be impounded within the underground voids behind bulkheads will not discharge into overhead surface water.</p> <p>Additional assessment of the project against the provisions of the Drinking Water SEPP is provided in Appendix K of this report.</p>
435	<p>In relation to the Project permissibility the Commission notes that pursuant to the WLEP, all the land use zones within the site prohibit mining activities, however clause 7(1) of the Mining SEPP stated that:</p> <p>Development for any of the following purposes may be carried out only with development consent:</p> <ul style="list-style-type: none"> (a) underground mining carried out on any land, (b) mining carried out: <ul style="list-style-type: none"> (i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or (d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land, 	<p>Provisions of the Mining SEPP and the <i>Wingecarribee Local Environmental Plan 2010</i> (WLEP) in relation to the project are discussed in sections 3.2.3, 3.6.1(i) and 3.6.2 of the EIS respectively.</p> <p>The project area spans land zoned E3 Environmental Management, RU2 Rural Landscape, RU3 Forestry and SP2 Infrastructure under the WLEP. The proposed activity is prohibited in these zones. Despite this, the project is permissible under the Mining SEPP, which prevails over any inconsistencies with a LEP (refer clause 5(3) of the Mining SEPP).</p> <p>The permissibility of the project under the WLEP is further discussed in Appendix K of this report.</p>
436	Based on the Material, the Commission finds that both the Hume Coal Project and Berrima Rail Project are permissible with consent pursuant to clause 7(1) of the Mining SEPP,	As noted in section 3.2.3 and 3.6.1(i) of the EIS, the project is permissible under clause 7(1) of the Mining SEPP. Since the submission of the EIS in March 2017, no material amendments to the Mining SEPP has occurred.

Table 17.1 Response to Independent Planning Commission findings– Statutory environmental planning instruments

Reference number	IPC's finding	Hume Coal response
	and accepts the assessment provided by the Department in relation to this matter.	
437	<p>In addition to permissibility, the Mining SEPP requires the consent authority to have consideration of the compatibility of the Project with other land uses (clause 12). In this regard the Commission makes the following findings:</p> <p>Clause 12 - Compatibility of proposed mine, petroleum production or extractive industry with other land uses</p> <p>Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:</p> <p>(a) consider:</p> <p>(i) the existing uses and approved uses of land in the vicinity of the development, and</p> <p>(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and</p> <p>(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and</p> <p>(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and</p> <p>(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).</p>	<p>An assessment of the project against clause 12 of the Mining SEPP is provided in section 3.6.1(i)(c) of the HCP EIS.</p> <p>The project will not significantly impact land uses which surround the proposed mine, which include industrial, forestry, environmental management, agricultural, rural residential and residential developments.</p> <p>Of particular interest, Hume Coal will continue to farm land within the Project area during and following mining. Only 2% of the Project area (117 ha of 5,051 ha) will be temporarily not used for agricultural purposes during the life of the mine.</p> <p>Further discussion of the Project's impact to these land uses has been provided in Appendix K, the:</p> <ul style="list-style-type: none"> • updated visual impact assessment (Appendix E of this report); • groundwater dependence assessment for cultural heritage landscapes (Appendix F, Annexure A of this report); • cultural landscape assessment (Appendix F, Annexure B of this report); and • Sorensen and Mereworth gardens analysis (Appendix F, Annexure C).
438	<p>From the Material provided and the locality tour conducted on 28 February 2019, the Commission finds that there are a number of existing and approved land uses within the vicinity of the Project. These land uses include, but are not limited to rural residential, hobby farms and commercial agricultural pursuits, with industrial, residential and commercial activities occurring further afield.</p>	<p>Existing land uses in proximity to the Project have been described in section 5.3.2 of the HCP EIS, which include agricultural, industrial, extractive, forestry, rural residential and residential.</p> <p>Additionally, an agricultural impact statement (AIS) was prepared for the Project and summarised in Chapter 9 of the HCP EIS. It was concluded that impacts to agricultural land and production values will be temporary, limited and minor in nature.</p>
439	<p>From the Material provided the Commission finds that the WLEP is the most relevant representation of what land uses are most likely to be considered the preferred uses of land in the vicinity of the Project. In producing a LEP, Council will:</p> <ul style="list-style-type: none"> • select zones as appropriate to the needs of the local area, informed by studies and consultation with the public and relevant agencies; • outline the zone objectives, which are used to clarify the role and function of the zone; and • determine for each zone whether to permit (with or without consent) or prohibit various land uses. 	<p>The zoning of the Project area under the WLEP has been considered in the Project's assessment and is displayed in Figure 3.2 of the HCP EIS.</p> <p>As noted in section 3.2.3 and 3.6.2 of the HCP EIS, development for the purposes of mining is prohibited within the relevant zoning of the WLEP, however the Project is permissible under clause 7(1) of the Mining SEPP which prevails over the provisions of the WLEP.</p> <p>Since the submission of the EIS in March 2017, no amendments to land zoning under the WLEP has occurred.</p>

Table 17.1 Response to Independent Planning Commission findings– Statutory environmental planning instruments

Reference number	IPC's finding	Hume Coal response
440	In considering the Mining SEPP, the Commission is required to establish whether or not the development is likely to have a significant impact on the preferred uses of land. Regardless of the permissibility exemptions afforded to mining pursuant to clause 7 of the Mining SEPP, the WLEP has sought to exclude mining as a permissible use in all zones within the vicinity of the site. The nature of the existing surrounding land uses and those permissible under the WLEP are clearly different to the Project	<p>The Project will not significantly impact land uses which surround the proposed mine, which include industrial, forestry, environmental management, agricultural, rural residential and residential developments.</p> <p>Of particular interest, Hume Coal will continue to farm land within the Project area during and following mining. Only 2% of the project area (117 ha of 5,051 ha) will be temporarily not used for agricultural purposes during the life of the mine.</p> <p>Further discussion of the Project's impact to these land uses has been provided in Appendix K.</p>
441	Based on the Material, the Commission finds that the preferred land uses are those which are consistent with the existing locality and future land use direction as outlined in the WLEP.	<p>See response above.</p> <p>As described in section 5.3.2 of the EIS, land uses within and adjacent to the Project area have been considered as part of the Project's environmental impact assessment.</p> <p>This includes agricultural, industrial, extractive, forestry, rural residential and residential.</p> <p>Further discussion of the Project's impact to these land uses has been provided in Appendix K.</p>
442	Based on the Material currently before it, the Commission finds that at this stage the Project may create negative impacts on the preferred land uses. As discussed in the sections above there are uncertainties about the extent of the impacts of the Project and further information is required to determine whether it would be "significant" or can be mitigated to the extent that it is acceptable.	See response to item 440 above.
443	Based on the Material, and for the reasons cited above the Project is a land use that is different to the surrounding existing uses and to those uses that are permissible in WLEP. The Project is likely to generate impacts that are beyond those that would be generated by the preferred land uses. The Commission finds that the Project may be incompatible with these land uses.	See response to item 440 above.
444	Based on the Material, the Commission accepts that there could be significant public benefits derived from job creation and the revenue and expenditure generated as a result of the Project. The public of NSW could also benefit from increased Government expenditure directly resulting from mining royalties. However, based on the Material, the extent of the economic benefits of the Project remain unclear. Furthermore, there remain uncertainties about the impacts of the Project, including its social impact. The Commission, at this stage, is therefore unable to evaluate the respective public benefits of the Project and the surrounding land uses.	<p>Public benefits, including job creation, is considered in the SIA completed for the Project, which is summarised in Chapter 20 of the EIS and presented in full in Appendix R to the EIS.</p> <p>The proposed workforce for all phases of the project is noted in section 20.1 of the EIS. This will increase the employment rate and uptake of skills in the local community amongst other beneficial impacts.</p> <p>Further consideration of public benefits have been considered in the updated SIA which is contained in Appendix J of this IPC response report.</p> <p>Economic benefits, including revenue and expenditure generated from the Project, are considered in the Economic Impact Assessment Report (refer Appendix Q of the EIS) prepared for the project and summarised in section 19.3 of the EIS.</p> <p>Further consideration of economic benefits has been considered in the updated economic assessment which is contained in Appendix H.1 of this IPC response report.</p>

Table 17.1 Response to Independent Planning Commission findings– Statutory environmental planning instruments

Reference number	IPC's finding	Hume Coal response
		The revised EIA (BAE 2020) concluded that the Project was expected to generate direct net economic benefits to NSW of \$192 million (or \$290 million, if employment benefits and taxes are included).
445	The Commission considers it important, when evaluating and comparing the respective public benefits of the Project and the existing and proposed land uses identified within the vicinity of the Project, to highlight that whilst both the Project and other land uses generate benefits, noting the limitations of current information about economic assessments and impacts, there is a significant difference in the nature of these land uses and subsequent benefits that make any direct comparison challenging.	The public benefits of the Project in relation to socio-economic factors have been considered in chapters 19 and 20 of the EIS. This is based upon an SIA and Economic Impact Assessment Report which were prepared to support the project's EIS. In response to the IPC's recommendations, revised EIA and SIA have been prepared for this particular stage and appended as Appendix H.1 and Appendix J of this report. It should also be noted that the Project's impact on the biophysical environment has been considered through all stages of the application.
446	However, based on the Material, the Commission's provisional view is that the preferred land uses are sustainable in the long term and will play a significant role in the future growth and development of the Southern Highlands region. The Commission considers that this is an important and relevant distinction in evaluating the public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii). As with the other matters addressed in this Report, further consideration of this issue will need to be given as further information becomes available.	See response to item 445 above.
447	Based on the Material, the Commission finds that not all measures proposed to avoid or minimise impacts, and therefore incompatibility have, at this stage been satisfactorily resolved.	As part of the IPC stage, additional commentary has been provided in and appended to this report to address any outstanding environmental, economic and social impacts.
448	Based on the Material before it, and the critical information that the Commission is seeking from both the Applicant and the Department, at this stage of the process the Commission finds that the Project may not be consistent with clause 12 of the Mining SEPP. However, the Commission's findings represent its preliminary views at this stage of the assessment process and notes that its views may change as a result of the provision of additional information in response to this Report, information provided to the Commission independently of this Report, additional matters raised in undertaking its final assessment of the Project, or other relevant factors.	Consistency of the project against clause 12 of the Mining SEPP is considered in section 3.6.1(i) of the EIS. In addition, the application of the Mining SEPP is further discussed in Appendix K. of this report.
449	At this stage of its assessment the Commission finds that it is not satisfied with the overall level of assessment provided by the Department regarding Part 3 of the Mining SEPP because the Department has not provided a detailed assessment within the Department's PAR of other relevant requirements, in particular clause 14 in relation to natural resource management and environmental management, including greenhouse gas emissions.	Noted.

17.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to statutory environmental planning instruments, and Hume Coal's responses are presented in Table 17.2 below.

Table 17.2 Response to Independent Planning Commission recommendations – Statutory environmental planning instruments

Reference number	IPC's recommendation	Hume Coal response
R26	The Department should provide an updated and detailed assessment of all relevant components under Part 3 of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report.	Recommendation R26 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.

18 Ecologically sustainable development (public interest) (R27, R28)

18.1 Introduction and background

The EIS provided an assessment of the project against the Commonwealth and NSW regulatory and policy framework that was enacted at the time of writing which included an assessment of the Project against the objects of the EP&A Act and by virtue of this, the compatibility with Ecologically Sustainable Development (ESD) as defined by the Commonwealth Government's 1992 National Strategy for Ecologically Sustainable Development.

There were no changes to the EP&A Act needing to be assessed as part of the RTS.

18.2 Independent Planning Commission recommendations

The IPC made two recommendations in relation to public interest:

- **R27** - *The Applicant should update its consideration of the objects of the Environmental Planning and Assessment Act 1979 and utilise the definition of 'Ecologically Sustainable Development' from the Protection of the Environment Administration Act 1991.*
- **R28** - *The Department should provide an updated and detailed assessment of the public interest, the objects of the Environmental Planning and Assessment Act 1979 and 'Ecologically Sustainable Development' with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report, including the further information recommended in this Report by the Commission.*

18.3 Approach for responding to Independent Planning Commission assessment, findings and recommendations

The definition of ESD under the Commonwealth Government's 1992 National Strategy for Ecologically Sustainable Development is "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 assessment of the Project against this definition of ESD, as presented in the EIS, is still considered valid.

The definition of ESD under the NSW *Protection of the Environment Administration Act 1991* further defines ESD to include:

- a) the precautionary principle — namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- b) inter-generational equity — namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;
- c) conservation of biological diversity and ecological integrity — namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration;
- d) improved valuation, pricing and incentive mechanisms —namely, that environmental factors should be included in the valuation of assets and services, such as:
 - i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;

- ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and
- iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

To address R27, Hume Coal has provided further information to support the assessment of the Project against the principles of ESD. This additional information has been combined with the response to R28 and provided in Appendix K.2 of this report.

18.4 Analysis and response to Independent Planning Commission's findings

The summary of the IPC findings relating to ESD, and Hume Coal's responses are presented in Table 18.1 below.

Table 18.1 Response to Independent Planning Commission findings – Ecologically sustainable development

Reference number	IPC's finding	Hume Coal response
473	The Commission finds that that the Applicant and Department have considered and assessed the Project against the public interest and the objects of the EP&A Act. However, the Commission has given further consideration to the public interest, the objects of the EP&A Act and the principles of ESD, and in this regard the Commission makes the following findings:	As noted in section 3.2 of the EIS, the project has been assessed against the provisions of the EP&A Act, including the concept of ESD (refer section 24.6 of the EIS). Since the submission of the EIS in March 2017, no material amendments to the EP&A Act have occurred.
474	Under section 1.3 of the EP&A Act, the relevant objects applicable to the Project are: a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources, b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment, c) to promote the orderly and economic use and development of land, e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats, f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage), g) to promote good design and amenity of the built environment, h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants, i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State, and j) to provide increased opportunity for community participation in environmental planning and assessment.	Relevant objectives of the EP&A Act are considered in section 3.2.4 of the EIS, including an assessment of consistency of the project against these objectives. This is further discussed in Appendix K.2.
475	A relevant object of the EP&A Act to the Project is the facilitation of ESD. The Commission notes that section 6(2) of the Protection of the Environment Administration Act 1991 (the POEA Act) states that ESD requires the effective	An assessment of the project against the principles of ESD is provided in section 24.6 of the EIS, including the precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing

Table 18.1 Response to Independent Planning Commission findings – Ecologically sustainable development

Reference number	IPC's finding	Hume Coal response
	<p>integration of social, economic and environmental considerations in its decision-making, and that ESD can be achieved through the implementation of:</p> <ul style="list-style-type: none"> (a) the precautionary principle; (b) inter-generational equity; (c) conservation of biological diversity and ecological integrity; and (d) improved valuation, pricing and incentive mechanisms. 	<p>and incentive mechanisms. Through the environmental assessment process, it has been demonstrated that the project is consistent with these principles.</p> <p>Since the submission of the EIS in March 2017, no material amendments to the EP&A Act, specifically the principles of ESD, have occurred.</p> <p>The consistency of the project with the principles of ESD is further discussed in Appendix K.</p>
476	<p>Based on the Material before it, and the critical information that the Commission is seeking to be provided by both the Applicant and/or the Department, at this stage of the process the Commission's provisional view is that due to the Material currently before it, and the extent of information being sought by this Report, there is at this stage no sound basis on which to conclude that the Project is consistent with the following objects of the EP&A Act or ESD, and therefore it may not be currently in the public interest:</p> <ul style="list-style-type: none"> a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources; b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment; c) to promote the orderly and economic use and development of land; e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats; f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage); and g) to promote good design and amenity of the built environment. 	<p>The consistency of the project with the principles of ESD and the objectives of the EP&A Act is further discussed in Appendix K.</p>
477	<p>However, the Commission's findings represent its preliminary views at this stage of the assessment process. Its views may change as a result of the provision of additional information in response to this report, information provided to the Commission independently of this report, additional matters raised in undertaking its final assessment of the Project, or other relevant factors.</p>	<p>Noted.</p> <p>Please see Appendix K for further assessment of the project against the principles of ESD, in response to recommendations made during the IPC stage.</p>
478	<p>At this stage of its assessment the Commission finds that it is not satisfied with the overall level of assessment provided by the Department regarding public interest, objects of the EP&A Act and ESD.</p>	<p>The consistency of the project with the principles of ESD and the objectives of the EP&A Act is further discussed in Appendix K.</p>

18.5 Analysis and response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to ecologically sustainable development, and Hume Coal's responses are presented in Table 18.2 below.

Table 18.2 Response to Independent Planning Commission recommendations – Ecologically sustainable development

Reference number	IPC's recommendation	Hume Coal response
R27	The Applicant should update its consideration of the objects of the Environmental Planning and Assessment Act 1979 and utilise the definition of 'Ecologically Sustainable Development' from the Protection of the Environment Administration Act 1991.	<p>An assessment of the project against the principles of ESD is provided in section 24.6 of the EIS.</p> <p>This is based upon the definition of ESD noted in the Commonwealth's 1992 National Strategy for Ecologically Sustainable Development and the EP&A Act.</p> <p>Consideration of the project against the principles of ESD, as defined in the NSW <i>Protection of the Environment Administration Act 1991</i> is provided in Appendix K.</p>
R28	The Department should provide an updated and detailed assessment of the public interest, the objects of the Environmental Planning and Assessment Act 1979 and 'Ecologically Sustainable Development' with its Final Assessment Report, based on any additional information made available since the issue of the Department's Preliminary Assessment Report, including the further information recommended in this Report by the Commission.	<p>Recommendation R28 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.</p>

19 Other matters (R29, R30)

19.1 Introduction and background

Recommendations R29 and R30 are directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided summary responses to these recommendations in Table 19.1 to assist the Department and any other regulatory agencies with their assessment of the Project.

19.2 Independent Planning Commission recommendations

The IPC made two recommendations in relation to other matters, these are:

- **R29** - *The Department should include in its Final Assessment Report to the Commission an assessment of the public benefits of the Project which give consideration of whether:*
 - i. *the economic benefits of the Project outweigh its costs to the local community (section 4.15(1)(b) of the Environmental Planning and Assessment Act 1979); and*
 - ii. *the public benefits of the Project outweigh the public benefits of other land uses (clause 12 (b) of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007).*
- **R30** - *The Department should invite relevant Government agencies to review and provide comment on any new information provided by the Applicant since the Department's Preliminary Assessment Report was published, including the content of this report. In its Final Assessment Report to the Commission, the Department should consider any further Agency feedback as well as the content of this report, the Materials, and any additional information produced in response to this Report and its recommendations.*

19.3 Response to Independent Planning Commission's recommendations

The summary of the IPC recommendations relating to other matters, and Hume Coal's responses are presented in Table 19.1 below.

Table 19.1 Response to Independent Planning Commission recommendations – Other matters

Reference number	IPC's recommendation	Hume Coal response
R29	The Department should include in its Final Assessment Report to the Commission an assessment of the public benefits of the Project which give consideration of whether: <ul style="list-style-type: none">i. the economic benefits of the Project outweigh its costs to the local community (section 4.15(1)(b) of the Environmental Planning and Assessment Act 1979); andii. the public benefits of the Project outweigh the public benefits of other land uses (clause 12 (b) of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007).	Recommendations R29 is directed to the Department of Planning, Infrastructure and the Environment. Hume Coal has provided a detailed assessment against the <i>Environmental Planning and Assessment Act 1979</i> and the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007) in Appendix K.

Table 19.1 Response to Independent Planning Commission recommendations – Other matters

Reference number	IPC's recommendation	Hume Coal response
R30	The Department should invite relevant Government agencies to review and provide comment on any new information provided by the Applicant since the Department's Preliminary Assessment Report was published, including the content of this report. In its Final Assessment Report to the Commission, the Department should consider any further Agency feedback as well as the content of this report, the Materials, and any additional information produced in response to this Report and its recommendations.	Hume Coal invites Government agencies to review and provide comment on the additional work undertaken in support of this IPC response.

20 Project evaluation

20.1 Overview

This report responds to the findings and recommendations contained in the IPC's assessment report on the Project. Principally, it addresses and responds to the findings and recommendations within the IPC assessment report directed to Hume Coal. In addition, it:

- summarises the statutory assessment process for the Project under the EP&A Act;
- provides a summary project description of the Project;
- analyses, and where necessary, responds to the 'Material Considered by the Commission' (as described in Section 7.0 of the IPC assessment report); and
- where necessary, addresses items presented in the IPC assessment report that Hume Coal feels is erroneous, unsubstantiated or are otherwise worthy of response.

20.2 Water resources

A groundwater assessment was conducted as part of the EIS for the Project. The groundwater model used to assess the impacts was independently reviewed and determined fit for purpose. The assessment concluded that the Project is predicted to result in groundwater level drawdown greater than 2 m at 93 landholder bores on 71 properties, at varying times, and that predicted impacts to other groundwater users will be insignificant. It also demonstrated that Hume Coal could 'make good' each landholder bore predicted to be impacted by the Project.

One of the most commonly raised issue in submissions on the EIS related to water resources, and in particular the potential impacts to groundwater and landholder bores. Given this, substantial additional groundwater modelling and impact assessment work was undertaken as part of the RTS. This included a revised groundwater model (RTS model) and an additional independent review of the groundwater model by DPIE's expert, Mr Hugh Middlemiss.

The revised groundwater modelling included model revision, a range of additional sensitivity analyses, and a detailed uncertainty analysis. The review undertaken by Hugh Middlemiss on behalf of DPIE 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 RTS model supported the predictions of water impacts presented in the EIS. It predicted 94 landholder bores on 72 properties will observe groundwater level drawdown greater than 2 m as a result of the Project, and the uncertainty analysis suggests the model has narrow uncertainty with inflow and drawdown predictions.

Since the RTS model, additional groundwater modelling verification and review has been undertaken as more information becomes available. This 'post-RTS' modelling is still underway and includes assessment of the watertable response to injection of surplus water, refinements to topography, influence of the interburden hydrostratigraphic unit on groundwater flow and watertable response to mining. This modelling is consistent with industry standard approach and consistent with overall continuous improvement strategies across technical disciplines and industries. The post-RTS modelling work can be made available to the NSW government either via a presentation or via a report at a later date as required.

Based on the IPC's recommendation, Hume Coal engaged an additional expert, Dr Lloyd Townley, to review the groundwater modelling work presented in the EIS and RTS. The results of this review reaffirm the results of the review undertaken by Hugh Middlemiss; that the groundwater modelling undertaken for the Project is fit for purpose and appropriate for assessing the potential impacts of the Project on groundwater users.

Further work has also been undertaken on the make good strategy presented in the RTS 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. By applying the concept of make good for landholder bores, the drawdown effects are mitigated, and a landholder's access to water for farming and other purposes are not compromised.

The perceived concerns about make good are considered throughout the RTS and the IPC process and these concerns generally fall into three categories, being:

1. Technical feasibility;
2. Ability to implement; and
3. Identification of conflict resolution pathways.

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.

20.3 Project justification and evaluation

Extensive work has been undertaken by Hume Coal to respond to the findings and recommendations within the IPC's assessment report, particularly in relation to groundwater and the mine design. This work builds on the extensive work undertaken by Hume Coal to address submissions made on the EISs for the Project. The overall outcome of this significant body of work is that no major changes to the Project are required as a result of any of the submissions on the EISs or the IPC's assessment report.

Independent expert reviews undertaken to address the recommendations of the IPC in relation to groundwater, economics and mine design have reaffirmed the outcomes of the EIS and RTS, as did the independent expert reviews of the EIS conducted on behalf of DPIE.

Therefore, the description of the Project, and the Project evaluation and justification, as presented in the EIS and RTS, remains a true and accurate reflection of the Project for which approval is sought. Notwithstanding this, the justification and evaluation of the Project is re-presented below with additional supplementary information obtained for this IPC response report.

20.3.1 Significance of the resource

Internationally there is growing demand for coking coal, which is expected to rise from 318 Mt in 2019 to 421 Mt by 2040 (1.3% CAGR). This demand is expected to be driven by India as its population, particularly its middle class, expands and it rapidly urbanises.

Domestically, while the demand for coking coal declined through the 2000s, with imports increasingly displacing domestic supply, investment in the steelworks at Port Kembla and Whyalla is expected to drive an increased demand for metallurgical coal from 4.8 Mt in 2020 to 5.5 Mt in 2040 as output increases and efficiency improvements are made.

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 Port Kembla and the Port Kembla coal terminal. The Project seeks to draw on these positive features.

Given its location and commonality with existing coal usage, coal from the Project is well placed to service the Port Kembla steel works when it looks to source new coal supply due to its freight advantage.

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 operational peak the mine and rail project will provide approximately 300 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 \$922 million and operating expenditure will be around \$1.65 billion over the life of the mine.
- Royalties: payments to the NSW government will total around \$148 million at today's value.

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

20.3.2 Economic justification

The Project is justified economically due to the net economic benefits and the economic stimulus it will provide locally and to NSW.

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 and indirect economic benefit of the Project for NSW is estimated at \$290 million in NPV terms, comprised as follows:

- royalty payments, which are estimated at \$148 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:
 - \$272 million of net disposable income benefits;
 - \$14 million of the NSW share of personal income taxes;
 - \$45 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 \$0.9 million, need to be deducted, giving a net figure of \$290 million.

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.

20.3.3 Social justification

A comprehensive SIA was prepared for the Project and documented within the EISs. Notwithstanding this, in accordance with a recommendation from the IPC, the SIA was revised to align with guidelines on the preparation of SIAs that DPIE released after the EISs were prepared. Accordingly, the Project's social impacts have been comprehensively 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 (direct employees of Hume Coal), 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, the revised SIA 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 IPC response report which demonstrates that a credible pathway exists to 'make good' each bore that is predicted to be influenced by the project.

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 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.

20.3.4 Environmental justification

Great care has gone into planning the 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.

In summary, the Project design adopts leading practice in the coal industry 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.

20.3.5 Ecologically sustainable development

A comprehensive assessment of the Project against the principles of ESD as defined within the NSW *Protection of the Environment Administration Act 1991* has been undertaken by Hume Coal. This assessment builds on the assessment undertaken and presented in the EIS and RTS. This assessment concludes that the Project is consistent with the objectives of promoting ESD, including the precautionary principle.

20.4 Conclusion

Extensive work has been undertaken to respond to the findings and recommendations contained in the IPC's assessment report on the Project, including further independent peer reviews of the groundwater and economics assessments, and the mine design. This builds on the extensive work undertaken to address submissions on the Project through the RTS.

The overall outcome is that no major changes to the Project are required as a result of this considerable body of work. In fact, this work has reaffirmed the overall outcomes of the EIS and RTS. Therefore, the description of the project, and project evaluation and justification, as presented in the EIS and RTS, remains a true and accurate reflection of the project for which approval is sought.

The Hume Coal Project and the Berrima Rail Project, if approved, would provide a number of benefits including:

- **Provision of a high quality coking coal:** 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 by Hume Coal since 2011, showing the coal has all the necessary characteristics to produce a product that generally meets export coking coal specifications, and contains some highly attractive qualities such as ultra-low phosphorous.
- **Employment generation:** At its peak the mine will employ approximately 300 workers. This will provide substantial flow-on benefits to the region, particularly during the 19-year operational phase of the project as the workforce will be a residential workforce, from within a 45 minute commute to the mine site. The employment benefits have particular significance given that the Southern Highlands currently has the highest youth unemployment rate in NSW (Brotherhood of St Laurence 2018).
- **Economic benefits:** The proposed mine will generate direct and indirect economic benefits of \$290 million for NSW in net present value terms at a real discount rate of 7% (or nominally around 9%). Royalty payments to the NSW government will total \$148 million in net present value terms at a real discount rate of 7%. Payroll tax and other state government duties, taxes and levies are additional benefits to NSW.

Great care has been taken in planning the project so that its design minimises and mitigates potential environmental impacts. The project's design includes 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.
- Sealing panels with bulkheads after extraction and reject backfilling, which allows 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 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, both of which are currently under-utilised assets that are 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 publicly owned resource – Wongawilli Seam coal – which will be of significant benefit to the local and broader NSW communities. While the two projects have the potential to cause some adverse impacts, mitigation and/or compensation measures have been developed to address all of these and the net result is that residual impacts are considered to be minor. With all relevant factors considered, the associated benefits are considered to outweigh costs and the proposed Hume Coal Project and Berrima Rail Project are strongly justified.

21 References

Barnett, B, Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A. 2012, The Australian Groundwater Modelling Guidelines, National Water Commission

DoI 2019. Hume Coal Project, Letter containing Department of Industry (Water) additional technical advice dated 17 April 2019 to the Independent Planning Commission (IPC) about the Hume Coal Project, 24 April, 10 pp.

EMM Consulting,

2017a, Hume Coal Project Environmental Impact Statement, report to Hume Coal

2017b, Berrima Rail Project Environmental Impact Statement, report to Hume Coal

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

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

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

2018a, Hume Coal Project and Berrima Rail Project Response to Submissions report to Hume Coal

2018b, Hume Coal Project – Response to submissions revised water impact assessment report, Appendix 2. Report J14136RP2, 27 June 2018.

2018c, Critique of Pells Consulting Modelling Studies. Hume Coal Project, Response to Submissions (Appendix H, Volume 2E), 20 June 2018.

Hebblewhite B. K. 2019, *Independent Review of the NSW Government Department of Planning & Environment – State Significant Development Assessment: Hume Coal Project and Berrima Rail Project*.

HydroAlgorithmics Pty Ltd 2016. Hume Coal Project – Groundwater Impact Assessment Peer Review, 14 September, 14 pp. In Appendix J of EMM (2017a), entitled Groundwater Assessment Peer Review Reports

Hydrogeologic 2017. Hume Coal Project EIS, Independent Expert Review, Groundwater Modelling, 6 December, 19 pp.

Hydrogeologic 2018. Hume Coal Project EIS, Independent Expert Review, Groundwater Modelling, 16 October, 29 pp.

HydroSimulations 2018, Hume Coal Project – Revised Groundwater Modelling for Response to Submissions, Report HS2018/02, June 2018.

IPC 2019, Hume Coal Project & Berrima Rail Project Independent Planning Assessment Report in relation to the Minister for Planning's request dated 4 December 2018 under Section 2.9(1)(d) of the *Environmental Planning and Assessment Act 1979*, New South Wales Government Independent Planning Commission.

Jones B, 2020. *Analysis of the Wongawilli coal to Hawkesbury Sandstone succession in the Hume Coal Project area*. Sedpet Services, January 2020.

Kalf and Associates Pty Ltd (2016), KA Peer Review of Coffey Groundwater Modelling Assessment of Hume Coal Project, 12 September, 10 pp. In Appendix J of EMM (2017b), entitled Groundwater Assessment Peer Review Reports.

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

Townley, L 2020. *Review of Groundwater Modelling Undertaken for the Hume Coal Project*. Prepared for EMM Consulting Pty Ltd. GW-SW Pty Ltd. 16 March 2020.

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.

URS Australia, 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.

WaterNSW 2018. Online groundwater database located at <https://realtime.data.waternsw.com.au/water.stm>.

Appendix A

Independent review of residual issues of disagreement between Hume Coal Pty Ltd and the Department of Planning, Infrastructure and the Environment associated with the Hume Coal Project

Appendix B

Updated water technical assessment

Annexure A - DPIE water report

Annexure B - Hume Coal detailed geology report

Annexure C - Groundwater model independent expert review

Appendix C

Updated noise assessment

Appendix D

Supplementary greenhouse gas emissions and mitigations/offset assessment

Annexure A – Greenhouse gas emissions & mitigations strategy

Annexure B – Hume Coal greenhouse gas position statement

Appendix E

Updated visual impact assessment

Appendix F

Updated statement of heritage impact

Annexure A: Groundwater dependence assessment for cultural heritage landscapes and gardens

Annexure B: Cultural landscape assessment

Annexure C: Sorensen garden analysis & the garden at Mereworth

Annexure D: Supplementary historical archaeological assessment

Annexure E Summary table of archaeological sites

Appendix G

Groundwater dependence assessment for cultural heritage landscapes and gardens

Appendix H

Economic impact assessment

Economic impact assessment of the Hume Coal project

Economic impact assessment peer review

Appendix I

Hume Coal market report

Appendix J

Updated social impact assessment

Appendix K

Statutory environmental planning instruments and public interest assessment

Response to Recommendations R26 and R29

Response to Recommendations R27 and R28
