

Advice to decision maker on coal mining project

IESC 2022-137: Ashton Coal Operations Ravensworth Underground Mine (EPBC 2022/09208) Expansion

Requesting agency	The Australian Government Department of Climate Change, Energy, the Environment and Water
Date of request	4 November 2022
Date request accepted	7 November 2022
Advice stage	Referral

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The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the IESC) provides independent, expert, scientific advice to the Australian and state government regulators on the potential impacts of coal seam gas and large coal mining proposals on water resources. The advice is designed to ensure that decisions by regulators on coal seam gas or large coal mining developments are informed by the best available science.

The IESC was requested by the Australian Government Department of Climate Change, Energy, the Environment and Water to provide advice on Ashton Coal Operation Pty Ltd's Ashton Coal Operations Ravensworth Underground Mine in New South Wales. This document provides the IESC's advice in response to the requesting agency's questions. These questions are directed at matters specific to the project to be considered during the requesting agency's assessment process. This advice draws upon the available assessment documentation, data and methodologies, together with the expert deliberations of the IESC, and is assessed against the IESC Information Guidelines (IESC, 2018).

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3 **Summary**

4 Ashton Coal Operations Pty Ltd (ACOL) is seeking to re-open and extract state-approved but unmined
5 coal resources at the Ravensworth Underground Mine (RUM), which has been in care and maintenance
6 since October 2014. This proposed modification (the 'project') is located approximately 17 km northwest
7 of Singleton in the New South Wales Hunter Valley, an area of extensive current and historical open-cut
8 and underground coal mining.

9 The project will involve multi-seam longwall mining, with operations covering an area of approximately
10 421 hectares and extending mining operations until 2032. It will extract 19.4 million tonnes (Mt) of run-of-
11 mine coal at a rate of 7 Mt per annum (Mtpa). ACOL intends to transfer and manage the extracted coal,

12 water and gas at the Ashton Coal Project (ACP), adjacent to the project. This will involve the use of
13 existing infrastructure at the RUM such as shafts, bores, pumps and pipelines.

14 The IESC considers that the proposal documentation is inadequate as it is largely limited to the difference
15 in impacts associated with the mine layout that was approved for the RUM in 1996. It does not provide
16 sufficient evidence or detail to reliably evaluate the quality of the work or to provide confidence in the
17 conclusions drawn about the potential impacts of the project. From the limited information provided, key
18 potential impacts are:

- 19 • groundwater drawdown, contributing to cumulative drawdown in the region that may adversely
20 affect groundwater-dependent ecosystems (GDEs);
- 21 • altered surface-water hydrology due to subsidence up to 5.9 m and cracking potentially greater
22 than 1 m predicted above the mining area. The use of multi-seam mining and the presence of
23 overlying backfill is likely to contribute to a high degree of localised variability across the site; and
- 24 • further decreases in groundwater and surface water quality should there be subsidence-induced
25 seepage or embankment failure associated with the onsite storage dams.

26 The IESC has identified several areas in which additional documentation and work is required to address
27 the key potential impacts, as detailed in this advice. These are summarised below.

- 28 • Further evaluation is needed on potential impacts on runoff, recharge and flooding processes
29 associated with altered surface water-groundwater connectivity pathways from subsidence
30 associated with the project.
- 31 • To increase confidence in the groundwater model, further work is required which should include,
32 at a minimum, a revised model boundary, clarity on boundary conditions and hydrogeological data
33 used in the model, greater detail on the incorporation of historical and approved future mining
34 projects and a sensitivity and uncertainty analysis.
- 35 • Information on the water and sediment quality of the onsite storage dams is required to help inform
36 an analysis of the potential impacts of potential leaks and spills from these dams.
- 37 • The proponent should provide an ecohydrological conceptual model that illustrates likely impact
38 pathways and ecological responses, focussing on potential cumulative changes to groundwater
39 quantity and quality and surface flows in the project area and downstream.
- 40 • More detailed Trigger Action Response Plans (TARPs) are needed, including specific remedial
41 actions for dieback of riparian vegetation in response to altered groundwater levels or quality, in
42 addition to an early warning management system for the management of subsidence-related
43 impacts.

44 **Context**

45 The Ashton Coal Operations Ravensworth Underground Mine (the 'project') is a proposed modification of
46 the existing state-approved RUM located approximately 17 km northwest of Singleton in the Hunter
47 Valley, New South Wales. The project is located within an area of extensive current and historical open-
48 cut and underground coal mining.

49 The RUM was approved by the NSW Department of Planning and Environment (DPE) in 1996 prior to the
50 introduction of the 'water trigger', and forms part of the larger Ravensworth Mine Complex, including
51 open-cut operations. ACOL operates the neighbouring ACP, including the Ashton Underground Mine
52 (AUM), the completed North East Open Cut and the approved but not yet commenced South East Open
53 Cut.

54 The AUM and RUM share a common mining lease boundary and are approved under their respective
55 development consents to extract resources from similar coal seams. Due to economic constraints, the
56 RUM was placed into care and maintenance in 2014.

57 The proponent seeks to integrate the two projects and recover an additional 19.4 Mt of approved but
58 unmined semi-soft coking coal until 2032 using longwall mining methods. The longwall configuration has
59 been changed slightly, with some of the newly proposed longwalls slightly shorter and narrower than
60 those previously approved; however, there is little change between the proposal and the already state-
61 approved RUM.

62 The proposal involves the following activities.

- 63 • Multi-seam longwall mining in the Pikes Gully and Middle Liddell coal seams within a
64 development footprint of 421 hectares.
- 65 • Transfer of run-of-mine coal to the neighbouring ACP via connected underground workings.
- 66 • Extension of mining until 2032 with no change to the production rate (7 Mtpa).
- 67 • Establishment and use of gas, ventilation and water-management infrastructure, including shafts,
68 bores, pumps and pipelines.
- 69 • Transfer of water and gas from the project to the neighbouring ACP.

70 Groundwater resources in the project area occur in the alluvium associated with the Hunter River,
71 Bayswater and Bowmans creeks, and the deeper Permian coal seams. In the highly fragmented
72 vegetation matrix of the Hunter Valley, Bowmans Creek and its associated riparian vegetation probably
73 provide important ecological connectivity between Wollemi National Park and areas north of the project
74 area, including Ravensworth State Forest and Mount Royal National Park and its foothills. Riparian zones
75 in and near the project area may also provide habitat for EPBC Act-listed koala (*Phascolarctos cinereus*),
76 spotted-tailed quoll (*Dasyurus maculatus*), large-eared pied bat (*Chalinolobus dwyeri*) and grey-headed
77 flying fox (*Pteropus poliocephalus*). Green and golden bell frogs (*Litoria aurea*) are likely to occur in
78 Bowmans Creek and other aquatic habitats (primarily farm dams).

79 The proponent received approval from the NSW DPE for a modification of the existing development
80 consent (DA 104/96 Mod 11) in July 2022 and seeks further approval from the Australian Government
81 under the EPBC Act. This advice draws upon the limited information presented in the referral
82 documentation.

83 The IESC notes that the information in the referral documentation does not discuss impacts associated
84 with a no-action scenario relative to current mining, and much of the assessment documentation is limited
85 to the difference in impacts associated with the mine layout that was approved for the RUM in 1996.

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87 **Response to questions**

88 The IESC's advice in response to the requesting agency's specific questions is provided below.

89 Question 1: Does the IESC consider the decision maker can have confidence in the impact assessment,
90 modelling and impact predictions provided? In particular, potential subsidence impacts (including the
91 potential for vegetation dieback), changes to surface water flows and quality, and impacts to groundwater
92 dependent ecosystems. If not, what additional data and information should be provided?

- 93 1. The documentation provided to the IESC is insufficient to determine whether the decision maker can
94 have confidence in predicted potential impacts associated with the project.

- 95 2. More specific areas requiring clarification or justification with additional data and information are
96 outlined below.
- 97 3. It is unclear whether sufficient data from field observations in the project area have been used to
98 determine groundwater flow directions. The groundwater monitoring locations shown in the
99 documentation (Yancoal 2020a, Figure 8, p. 52) were limited to the original AUM, and are insufficient
100 to support model results for the proposed modification that is located to the west of the area of
101 groundwater monitoring. As model calibration was based on groundwater level monitoring from the
102 AUM and a monthly water balance model from metered pumping data at AUM, the IESC considers
103 additional groundwater-level monitoring across the area of proposed RUM mining is necessary to
104 increase confidence in the calibration. Multi-level groundwater monitoring data are required in key
105 strata, including two years of baseline data within and adjacent to the proposed longwalls, especially
106 the western and southern sides.
- 107 4. Additional work, or reporting, required is set out below.
- 108 a. The sources of hydraulic data (including hydraulic conductivity, specific yield and storativity) were
109 not reported. It is therefore unclear whether the data used were derived from site-specific data
110 and whether hydrogeological layers were adequately represented.
- 111 b. Recharge and evapotranspiration rates used in the groundwater model were also not provided. It
112 is unclear whether site-specific data were derived and how changes to recharge rates for
113 backfilled areas such as Narama open-cut mine and from subsidence were incorporated.
- 114 c. The location of the model boundary has not been justified by the proponent. The IESC is
115 concerned that the boundary limit chosen is inappropriate for exploring impacts associated with
116 the project because the observed maximum drawdown contours extend past the western
117 boundary of the model (AGE 2022a, Figure 5.4 – 5.6, pp. 20 – 22).
- 118 i. Additionally, the boundary conditions applied to the project have not been described. Further
119 detail regarding the representation of the limit domain, rivers and mined areas is required.
- 120 ii. The proponent should provide additional figures that display the full extent of drawdown within
121 the model boundary. The limited areas shown in Figures 5.4 – 5.6 (AGE 2022a, pp. 20 – 22)
122 do not display cumulative drawdown observations for the full groundwater model, preventing
123 cumulative impacts from being fully understood.
- 124 d. Historical and future approved mining operations have been incorporated into the groundwater
125 model to assist in identifying cumulative impacts and to isolate impacts associated with the
126 modification. However, the IESC is not clear which operations have been included and is
127 concerned that the model domain has limited the ability of the groundwater model to adequately
128 assess cumulative impacts from surrounding mining projects (such as Hunter Valley Operations).
129 Further clarification is needed concerning the historical and future approved mining operations
130 considered in the model.
- 131 e. Faulting does not appear to be investigated or incorporated into the groundwater assessment.
132 However, documentation for the previous Ashton modification identifies fault zones and an
133 igneous dyke within the project area (Yancoal 2020b, Plan No. 6). The risk of geological features
134 influencing the groundwater regime, particularly shallow alluvium, have not been identified and
135 characterised (see Murray and Power, 2021). Commensurate with risk, geological structures may
136 need to be incorporated into the groundwater model and assessed to evaluate potential
137 connectivity with shallow systems.
- 138 f. An independent peer review into the groundwater model was provided by Dr Noel Merrick of
139 HydroAlgorithmics, with feedback primarily concerned with fracture model implementation. As the

140 fracture model was not described within the groundwater assessment, it is unclear to the IESC
141 whether the spatial extent and variability of cracking has been represented appropriately within
142 the groundwater model.

143 g. The proponent has not provided a sensitivity analysis or uncertainty analysis for the groundwater
144 model (cf. Middlemis and Peeters 2018). Such analysis should be provided to increase
145 confidence in the groundwater assessment and risk associated with identified potential impacts.
146 The IESC notes that the previous iteration of the model indicated the use of sensitivity analysis,
147 with sensitivity observed to changes in hydraulic conductivity (AGE 2020e, p. 11) resulting in
148 reductions to calibrated recharge values. Such results emphasise the need for clarification on
149 hydraulic conductivity data and the inadequacies associated with the parameters and calibration
150 of the groundwater model described above.

151 5. For the reasons discussed in Paragraph 4, the IESC is concerned that the inadequacies with the
152 groundwater modelling and documentation reduce confidence in the impact assessment. As a result,
153 while the project will likely contribute to cumulative impacts to groundwater resources in the region
154 through further depressurisation of the Permian coal seams and the alluvium, the extent of these
155 impacts on GDEs cannot be adequately assessed based on the current documentation.

156 6. Updates to the proponent's groundwater model are required to accurately predict project-alone and
157 cumulative impacts to GDEs from alluvial drawdown. The IESC does not have confidence in the
158 current impact predictions which may be underestimated. Further, no GDE assessment has been
159 provided besides noting the locations of river red gum (*Eucalyptus camaldulensis*) stands. However,
160 given the thickness and extent of the Bowmans Creek alluvium, and a depth to groundwater of
161 approximately 7 m, riparian vegetation (e.g., *Casuarina glauca*, *Eucalyptus tereticornis*) along this
162 watercourse may access groundwater (including facultatively). Field verification is needed of
163 groundwater use by these potential GDEs and, if dependence is demonstrated, baseline data on
164 ecological condition and composition of the GDEs should be collected. Alluvial groundwater is also
165 likely to sustain flows or pools during dry periods, providing aquatic connectivity and refugia. The
166 IESC considers that cumulative impacts to GDEs (e.g., reduced riparian vegetation health, aquatic
167 connectivity and pool permanency) are possible and may contribute to habitat fragmentation of the
168 region's vegetation matrix. These GDEs occur in a stressed landscape where even small incremental
169 impacts could move regimes closer towards or over ecological tipping points.

170 7. Additional drawdown in the Bowmans Creek alluvium may have impacts on interstitial fauna and
171 ecological processes in its hyporheic and parafluvial zones where surface water and groundwater
172 exchange, influencing rates of microbial activity, organic matter decomposition and nutrient
173 transformation within the saturated sediments. The Hunter River and its tributaries have an active
174 hyporheic zone with a diverse invertebrate fauna that responds to altered surface water-groundwater
175 exchange (Hancock 2006). Stygofauna are also present in the alluvium of the Hunter River and its
176 tributaries (Hancock and Boulton 2009) and, as an obligate GDE, they are likely to be affected by
177 groundwater drawdown. Therefore, in addition to groundwater model updates, the proponent should
178 characterise these subterranean GDEs (methods in Doody *et al.* 2019) and, where possible, quantify
179 project-specific and cumulative impacts.

180 8. If groundwater drawdown is more severe than predicted, impacts on baseflow and associated
181 ecologically important low-flow components in Bowmans Creek may be more significant than
182 currently assumed. The proponent should re-evaluate the effects of drawdown on the flow regime of
183 Bowmans Creek once the concerns around the groundwater modelling have been addressed
184 (Paragraph 4).

185 9. The IESC considers the subsidence review to be fit-for-purpose and agrees with the
186 recommendations for additional assessments of geotechnical stability of the storages and fly ash

- 187 emplacement in the Void 5 dam. However, there is some additional information or work that is
188 required.
- 189 a. Altered hydrology resulting from cracking and surface deformation (e.g., on backfill), particularly
190 associated with multi-seam mining effects, may contribute to ponding, reduced flow and
191 increased erosion and sedimentation in local watercourses. Potential impacts associated with the
192 substantial cracking and surface deformation expected above the mining area should be
193 evaluated.
- 194 b. Information should be provided on the potential impacts of subsidence on ecologically important
195 flow components (e.g., the number of zero-flow days and the frequency and duration of low-flow
196 spells) in Bowmans Creek.
- 197 c. To characterise the movement of water at the site post-subsidence, the proponent should provide
198 a hydraulic/flood assessment relevant to the project. Potential changes to flood behaviour due to
199 subsidence and ponding should also be considered.
- 200 d. Potential subsidence impacts on the Narama Dam, Inpit Storage Dam and Void 5 Ash Dam,
201 including fracturing and cracking of the base or dam wall, requires further consideration,
202 particularly the risks of downstream impacts to surface and groundwater from potential failure.
203 The proponent should collect data on the quality of water and sediment in storage dams, evaluate
204 the potential aquatic environmental impacts of contaminants in seepage and/or spills and assess
205 the environmental consequences of fly ash contamination.
- 206 e. The subsidence review acknowledges the potential for spontaneous combustion to occur
207 throughout mining operations due to the interaction of subsidence-based cracking with
208 combustible backfill above the mining area (SCT 2021 p. 22). The proponent should provide
209 information on the potential aquatic environmental impacts of contaminants that may be produced
210 or mobilised by spontaneous combustion.
- 211 10. Given the proximity of other coal-mining projects, the IESC notes that most impacts from the project
212 on groundwater resources and other water-dependent assets are likely to be cumulative. Cumulative
213 impacts on hydrological regimes, water quality, GDEs, aquatic biota and EPBC Act-listed species
214 have not been adequately described to enable a detailed assessment of potential impacts. An
215 ecohydrological conceptual model should be developed to help identify potential impact pathways
216 and quantify the likely local and cumulative extents of the project's impacts on water resources and
217 water-dependent assets.

218 Question 2: Have the impacts of wastewater discharges to receiving waters been adequately described
219 and assessed?

- 220 11. Although the proponent does not propose to have any controlled water releases, the IESC notes that
221 water from the RUM will be piped back to the Ashton water management infrastructure. Uncontrolled
222 releases may occur from the Ashton Process Water Dam into Bettys Creek (Yancoal 2020a p. 15),
223 especially under climate and operational conditions that may differ from the past ten years. The
224 proponent should consider the potential environmental impacts on aquatic biota and riparian
225 vegetation of any spills. This is especially relevant given that the process water is untreated and its
226 water quality is not monitored or reported.

227 Question 3: Are effective strategies to avoid, mitigate or reduce the likelihood, extent and significance of
228 impacts, including cumulative impacts to significant water-related resources provided? If not, what
229 mitigation, monitoring, management or offsetting measures should be considered?

- 230 12. Until the limitations of the groundwater assessment and provided documentation (as discussed in the
231 response to Question 1) are addressed so that the project's potential individual and cumulative
232 impacts are clearer, the IESC considers that the proponent cannot reliably identify the most effective
233 strategies to avoid, mitigate or reduce their likelihood, extent and significance. Assuming these
234 limitations have been addressed and the relevant impacts have been identified, the following
235 paragraphs suggest mitigation, monitoring and/or management measures, along with several
236 refinements to proposed management plans and TARPs that would enhance timely responses and
237 their effectiveness.
- 238 13. To ensure that predicted impacts are appropriately considered, the updated water management plan
239 must align with impacts associated with the proposed modification. Trigger levels for groundwater
240 drawdown should consider the additional drawdown anticipated for the modification.
- 241 14. The groundwater level and quality monitoring bores associated with RUM are not shown in the
242 documentation. It is therefore unclear to the IESC whether there is sufficient monitoring within the
243 modification area, which is essential for ensuring that effective management strategies are in place. It
244 is also not clear whether current monitoring at RUM occurs at a sufficient frequency or includes a
245 complete suite of analytes.
- 246 15. The proponent has included an assessment of cumulative drawdown impacts, but clarification is
247 needed that all cumulative impacts have been considered. The cumulative assessment should
248 include a discussion of all impacts to water resources due to drawdown, including GDEs, riparian
249 vegetation and surface waters.
- 250 16. It is not possible to comment on the efficacy of any mitigation strategies on surface water resources
251 as no information has been provided on the impacts of subsidence on ecologically important flow
252 components (e.g., the number of zero-flow days and the frequency and duration of low-flow spells) in
253 Bowmans Creek.
- 254 17. The proponent has provided TARPs for several environmental values including water quality, aquatic
255 biota, terrestrial GDEs and threatened fauna. These TARPs were developed for the existing Ashton
256 mine operations. The IESC is satisfied that the monitoring regimes associated with these TARPs are
257 generally adequate for capturing potential impacts from the project, but that further detail should be
258 provided in the response plans, particularly if metals are only monitored annually and response times
259 rely on consecutive exceedances. Example mitigation strategies were included in some, but not all,
260 response measures. The proponent should develop example mitigation strategies for all plausible
261 and material impacts, including specific strategies for remediating riparian vegetation dieback in the
262 event of cumulative alluvial drawdown. The proponent should also compare stream health data with
263 groundwater level and water quality data to allow for a more complete analysis of potential impact
264 pathways. As riparian vegetation along Bowmans Creek has major connectivity value, it is unlikely
265 that offsetting could meaningfully compensate for the loss of this habitat.
- 266 18. The IESC agrees (GSS 2012, pp. v and 54, citing SCT 2012; SCT 2021 p. 23) that the significance of
267 impacts of subsidence on fly-ash and tailings dams should be evaluated, and if necessary, pore
268 pressure monitored as part of an assessment of geotechnical stability. One option may be to
269 substantially dewater the tailings dam to mitigate the potential impacts of subsidence (SCT 2021 p.
270 52).
- 271 19. The proponent has indicated that subsidence management at the site will be undertaken in
272 accordance with the existing 2013 RUM Subsidence Management Plan (SMP) for DA 104/96 Mod 9
273 (Yancoal 2022d p. 17 and 27) and has committed to incorporate any necessary revisions (Yancoal
274 2022 p. 34). As this document has not been provided, the IESC is unable to comment on its
275 adequacy but notes that the revision should specifically address impacts associated with the project,
276 as detailed in Paragraph 5. The ACP subsidence TARP has also been adopted for the site (Yancoal

277 2022h p. 1). Triggers in this TARP are largely reactive to impacts already observed well beyond
 278 predicted values, and the IESC suggests that the proponent adopts a site-specific TARP with an
 279 appropriate early-warning management system to ensure impacts are managed before potentially
 280 adverse effects are realised.

Date of advice	14 December 2022
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Source documentation provided to the IESC for the formulation of this advice	<p>Ashton Coal Operations 2022. <i>Referral of the Ashton Coal Operations Ravensworth Underground Mine.</i></p> <p>Australasian Groundwater and Environmental Consultants (AGE) 2022a. <i>Ashton-Ravensworth Integration Modification Groundwater Review.</i> Prepared for Ashton Coal Operations Pty Ltd.</p> <p>Australasian Groundwater and Environmental Consultants (AGE) 2022b. <i>Ashton-Ravensworth Integration Modification Groundwater Review Post Mining Modelling Predictions.</i> Prepared for Ashton Coal Operations Pty Ltd.</p> <p>GSS Environmental 2012. <i>Ravensworth Underground Mine Liddell Seam Project – Environmental Assessment.</i> Prepared for Resource Pacific Pty Ltd.</p> <p>Hunter ECO 2022. <i>Biodiversity Assessment.</i> Prepared for Ashton Coal Operations Pty Ltd.</p> <p>SCT 2021. <i>Ravensworth Underground Mine Subsidence Review.</i> Prepared for Ashton Coal Operations Pty Ltd.</p> <p>Umwelt 2010. <i>Ravensworth Operations Project Ecological Assessment.</i> Prepared for Ravensworth Operations Pty Ltd.</p> <p>Yancoal 2020a. <i>Water Management Plan – Ashton Coal Project.</i> Version 11.</p> <p>Yancoal 2020b. <i>Ashton Coal Mine Longwalls 205-208 Extraction Plan.</i></p> <p>Yancoal 2020c. <i>Ashton Coal Project Biodiversity Management Plan.</i> Version J.</p> <p>Yancoal 2020d. <i>Ashton Coal Project Biodiversity Offset Management Plan.</i> Version A10.</p> <p>Yancoal 2022a. <i>Ashton-Ravensworth Underground Mine Integration Modification – EPBC Act Referral Description.</i></p> <p>Yancoal 2022b. <i>Yancoal Policy – Environment and Community Relations.</i></p> <p>Yancoal 2022c. <i>Ashton-Ravensworth Underground Mine Integration Project - Assessment of Potential Impacts on Protected Flora and Fauna.</i></p> <p>Yancoal 2022d. <i>Ashton-Ravensworth Underground Mine Integration Modification – Ravensworth Underground Mine Modification Report.</i></p> <p>Yancoal 2022e. <i>Ashton-Ravensworth Underground Mine Integration Modification – Ravensworth Underground Mine Submissions Report.</i></p>
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Yancoal 2022f. *Ravensworth Underground Mine EPBC Referral*.

Yancoal 2022g. *EPBC 2022/09208 Ashton Coal Operations Ravensworth Underground Mine*.

Yancoal 2022h. *Summary of Existing Monitoring, Management and Remediation*.

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IESC 2018. *Information Guidelines for proponents preparing coal seam gas and large coal mining development proposals* [Online]. Available at: <https://www.iesc.gov.au/sites/default/files/2022-07/iesc-information-guidelines-may-2018.pdf>

Middlemis H and Peeters L 2018. *Information Guidelines Explanatory Note: Uncertainty analysis – guidance for groundwater modelling within a risk management framework* [Online]. Report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of Environment and Energy, Commonwealth of Australia 2018. Available at: <https://www.iesc.gov.au/sites/default/files/2022-07/information-guidelines-explanatory-note-uncertainty-analysis.pdf>.

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SCT 2021. *Ravensworth Underground Mine Subsidence Review*. Prepared for Ashton Coal Operations Pty Ltd.

Yancoal 2020a. *Water Management Plan – Ashton Coal Project. Version 11.*

Yancoal 2020b. *Ashton Coal Mine Longwalls 205-208 Extraction Plan.*

Yancoal 2022d. *Ashton-Ravensworth Underground Mine Integration Modification – Ravensworth Underground Mine Modification Report.*

Yancoal 2022h. *Summary of Existing Monitoring, Management and Remediation.*

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