

Advice to decision maker on coal mining project

IESC 2018-099: Vickery Extension Project (EPBC 2016/7649 and SSD 7480) – Expansion

Requesting agency	The Australian Government Department of the Environment and Energy and The New South Wales Department of Planning and Environment
Date of request	28 September 2018
Date request accepted	28 September 2018
Advice stage	Assessment

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 the Environment and Energy and the New South Wales Department of Planning and Environment to provide advice on Vickery Coal Pty Ltd's (a subsidiary of Whitehaven Coal) Vickery Extension Project in New South Wales. This document provides the IESC's advice in response to the requesting agencies' questions. These questions are directed at matters specific to the project to be considered during the requesting agencies' 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).

Summary

The Vickery Extension Project is a proposed extension to the Vickery Coal Mine in the Gunnedah Coalfield in northwest New South Wales. The Vickery Coal mine received final approval from the state government in 2014; however, no works have commenced at the site since 2014. The proposed project will increase the mine disturbance area, the size of the Western Emplacement (waste rock emplacement), the volume of coal mined and the production rate (the currently approved rate of 4.5 million tonnes per annum (Mtpa) will increase to an average rate of 7.2 Mtpa) at the Vickery Coal Mine. The proposed project will decrease the number of final voids in the landscape to two (currently five historical voids exist with three voids proposed for the approved mine) and will not include mining previously planned at the Blue Vale pit.

The proposed project is adjacent to the highly productive Upper Namoi Alluvial aquifer within the Namoi River catchment. A water supply borefield is proposed to extract water from the Upper Namoi Alluvial aquifer. This water source is also extensively used for agricultural production.

The IESC notes that a number of the studies completed for this project such as the surface water assessment and the studies to determine the extent of the alluvium have been completed to a high standard. The proponent should be commended for these studies and for obtaining peer reviews of many of the major reports provided in the impact assessment.

Key potential impacts from this project are:

- groundwater drawdown from mining operations, primarily in the Maules Creek Formation (part of the Gunnedah-Oxley Basin MDB Groundwater Source in the Murray-Darling Basin Porous Rock Groundwater Source Water Sharing Plan) that may affect groundwater availability and aquifer interactions, and
- groundwater drawdown mainly associated with the proposed water supply borefield in the Alluvial Groundwater Source (located in Zone 4 of the Upper and Lower Namoi Groundwater Sources Water Sharing Plan) that may affect groundwater availability and the dynamics of surface water-groundwater interactions.

The groundwater extraction volumes predicted by the proponent are generally within the allocations for both aforementioned groundwater sources currently held by Whitehaven Coal of which the proponent, Vickery Coal Pty Ltd, is a subsidiary.

The IESC has identified areas in which additional work is required to assess the materiality of impacts, as detailed in this advice. These are summarised below.

- Further transient predictive model simulations are needed to examine a greater range of variability in hydraulic conductivity and specific storage. This information is needed to improve the current understanding of potential variability of drawdown impacts that could occur and to further support the proponent's statements that seepage losses from both the Upper Namoi Alluvium and the Namoi River will be limited given the intensive use of these water resources.
- Maps are needed that illustrate the distribution of potential groundwater-dependent ecosystems (GDEs), particularly terrestrial ones, superimposed on contours of estimated depths to the water table (in metres below ground level) both pre-mining and at maximum predicted drawdown. These maps should also show the locations of bores used to estimate the water table depths. These maps are needed to fully understand potential impacts to GDEs.
- An appropriate risk analysis (e.g. Serov et al. 2012) of the potential impacts of groundwater drawdown to GDEs is required, along with proposed mitigation strategies if impacts cannot be avoided.
- Because the direction of surface water-groundwater exchange in the river bed and banks strongly affects biogeochemical processes in the sediments, more information is needed on how groundwater drawdown may alter spatial and temporal patterns of surface water-groundwater exchanges in the Namoi River.
- Further geochemical analyses should be undertaken using a range of environmental conditions (especially pH) that are representative of what may occur at the project site, particularly as the solubility and bioavailability of metals depends on water chemistry.
- Monitoring of surface water quality should be improved by increasing the frequency of monitoring and the range of analytes.

- More information is needed regarding the potential for localised increases in erosion and changes to flood characteristics associated with construction activities and infrastructure (e.g. rail spur) that could impact the state-listed 'Lowland Darling River Aquatic Ecological Community'.

Context

The project would involve extraction of up to 10 Mtpa of run-of-mine (ROM) coal (increased from 4.5 Mtpa for the approved project) through open-cut mining. Coal products would include semi-soft metallurgical coal, pulverised coal injectate and thermal coal. The total resource extracted will increase to 179 Mt under the proposed project (from 135 Mt for the approved project). The proposed extension would have a disturbance footprint of approximately 984 ha in addition to the disturbance area of the approved mine. The project includes construction of a rail spur connecting to the Werris Creek-Mungindi line, a train load-out facility, a coal handling and preparation plant (CHPP) and a borefield with pipes to connect to the mine. The water extraction point on the Namoi River and associated infrastructure are part of the currently approved project.

Although the Vickery Extension Project occurs within a landscape that has already been largely modified by land clearing for agriculture, it is adjacent to an area of remnant bushland, the Vickery State Forest. A number of low order and intermittent streams drain from this bushland into and across the project area. While these creeks and drainage lines represent only a small fraction of the habitats available in the region, their value to local aquatic and terrestrial biodiversity does not appear to have been fully considered. Restoration of the area following mine closure is likely to be more successful if it is possible to maintain the physical and biological integrity of streamlines within the project area.

Response to questions

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

Question 1: Groundwater

a. Does the IESC agree that the Vickery Extension Project is unlikely to exceed the minimal impact considerations in the *NSW Aquifer Interference Policy*, or result in significant impacts on the highly productive Upper Namoi Alluvium over and above those for the approved project and/or Whitehaven's existing entitlements?

b. Does the IESC recommend any specific measures to mitigate and manage the identified impacts to groundwater resources?

1. The groundwater model predictions provided by the proponent indicate that the impacts from the project will be within the minimal impact considerations of the *NSW Aquifer Interference Policy*, and will not result in any significant impacts to the highly productive Upper Namoi Alluvium. Planned extractions will generally be within existing groundwater entitlements held by Whitehaven Coal. The IESC suggests that consideration and discussion of the issues outlined below would further increase confidence in the accuracy and validity of the groundwater impact assessment.
 - a. The groundwater model developed for this project has used considerable historical time-series data for calibration and validation processes. These processes have resulted in generally good agreement between observations and predictions (noting limitations regarding replication of seasonal changes due to pumping, the timing of which can be difficult to accurately incorporate in the model) which increases confidence in the reliability of the model predictions. However, the IESC notes some limitations with the groundwater model.
 - i. The model complexity and size limit the usability of the model for sensitivity and uncertainty analysis. The model design is cited by the proponent as preventing a quantitative uncertainty analysis, limiting such an analysis to a qualitative scenario-based approach. The IESC

considers that a scenario-based approach to uncertainty analysis is suitable as it is commensurate with the relatively low risks from the project. However, additional model runs extending the scenarios and parameterisations as outlined below would increase confidence in the model predictions.

- ii. The proponent has undertaken a scenario-based analysis to examine uncertainty in model predictions relating to vertical hydraulic conductivity but the full results were not presented. The results of that analysis should be provided along with results from an additional analysis examining horizontal hydraulic conductivity to show how different hydraulic conductivity values alter the extent and magnitude of drawdown and predicted changes to baseflow.
 - iii. The proponent should undertake further transient predictive model simulations to investigate the full range of plausible parameterisations for specific storage. As specific storage is a critical parameter for determining the extent and magnitude of drawdown the proponent needs to provide clarification of, and justification for, the values used in the groundwater model. The IESC notes that the specific storage values used in the alluvial areas of model layer two could be unrealistically high. This may cause the predicted extent and magnitude of drawdown to be under estimated and could result in non-compliance with the *NSW Aquifer Interference Policy*.
 - iv. The peer review of the groundwater model noted that the applied evapotranspiration rates and volumes appear to be low, which may be compensated for by the application of low recharge in the calibration (EIS, Attachment 4, p. 5). The IESC notes that compensation in this manner is only suitable under a narrow subset of conditions. Further justification of the values and the approach used is needed to confirm if, and how, these values impact model predictions.
 - v. Groundwater model boundaries in Figure 35 (EIS, Appendix A, p. 106) show that a general head boundary condition has been applied in the west of the model adjacent to a no-flow boundary. The proponent should justify why these two boundary conditions have been applied at adjacent locations.
- b. Calculations of the potential changes to water quality in the Namoi River due to leakage from the Blue Vale void (to be used as a store for mine water) were provided based on a long-term average salt load in the Namoi River and a median discharge volume for a nearby gauging station on the Namoi River. The estimated leakage volume (derived from the groundwater model) from the void should be reviewed given the uncertainties around the parameterisation of the groundwater model discussed in the preceding paragraphs. Additional calculations should then be undertaken examining the range of salt loads and discharge volumes which could occur in the receiving environment (e.g. the Namoi River) during leakage. This information is needed to understand if changes to water quality within the receiving environment will always be within the minimal impact considerations of the *NSW Aquifer Interference Policy*.
 - c. Documentation provided has identified that Whitehaven Coal currently holds 396 shares (water allocation; EIS, Appendix A, p. 55) in the Upper Namoi Alluvium Zone 4. The proponent needs to confirm that these shares are for the exclusive use of the proposed project and are not required at any other Whitehaven Coal operation.
 - d. The IESC notes that in two of the extreme climate scenarios investigated for the site water balance, the proponent may not hold sufficient water allocations in the Upper Namoi Alluvium for the maximum volume of water required from the proposed borefield. The proponent suggests that options such as the use of chemical dust suppressants could significantly reduce predicted water use, or further water allocations could be purchased for short periods to allow operations to continue. If these or other options are unsuccessful, the proponent will need to temporarily alter operations to ensure that water usage remains within the allocations.

- i. Further information on the use of chemical dust suppressants should be provided and considered in the project risk assessment. This would include the proposed chemicals, typical application rates, and an assessment of the chemicals including the likelihood that they will enter the environment (e.g. soil, groundwater or surface water) and the potential persistence and toxicity of these chemicals or their breakdown products.
 - e. The proponent has provided several maps of the extent and magnitude of groundwater drawdown at multiple stages of the proposed project. However, it is unclear which, if any, of these maps shows the maximum extent of predicted drawdown. The proponent should either clarify which map identifies this and when maximum drawdown is expected to occur, or provide such a map. This map is important for determining potential impacts to GDEs, and how far and when groundwater drawdown could extend below the Upper Namoi Alluvium and hence areas and times where seepage from that aquifer could potentially occur.
 - f. To better understand the distribution of, and possible impacts to, potential GDEs, particularly terrestrial GDEs, the proponent should provide maps (for both baseline and maximum drawdown cases) clearly showing potential GDEs, the estimated depth to the water table (in metres below ground level rather than the water table elevation) and the locations of bores used to estimate the water table depth. Appropriate risk analysis (e.g. Serov et al. 2012) of the potential impacts of groundwater drawdown to GDEs is required, along with proposed mitigation strategies if impacts cannot be avoided.
 - g. As stygofauna are known to occur in the Namoi River alluvium, the proponent sampled ten bores and collected four stygofauna taxa from three bores in the alluvial aquifer. One bore (GW2) had the highest abundance and diversity of stygofauna and is within the vicinity of the proposed borefield where drawdown in the alluvial aquifer is predicted to be approximately 2 m (EIS, Appendix A, Figure 62, p. 128). Based on the coarse taxonomic level adopted by the proponent, the stygofauna taxa were considered widespread and therefore of low conservation value. However, given the predicted drawdown it would be appropriate to sample the alluvium more intensely with a finer taxonomic resolution to confirm that short range endemic stygofauna (Eberhard et al. 2009) will not be impacted in this high-value GDE (see paragraph 2j).
2. The IESC has a number of suggested improvements for mitigation and management of potential impacts from the proposed project. These are discussed below.
- a. The proponent proposes a groundwater monitoring program using the existing monitoring network. It is unclear from the documentation provided which bores will be monitored. There is a large number of bores shown in Figure 16 (EIS, Appendix A, p. 87), and it may be unnecessary for the proponent to monitor all the bores shown. Bores which will be monitored, and the parameters to be measured, need to be clearly identified so that it can be determined that the spatial and depth coverage will be suitable. The locations for the two proposed bores to monitor for leaching from the Western Emplacement should also be clearly identified so it can be determined if these bores will be sufficient.
 - b. If the proposed borefield is installed, then additional monitoring bores (with monitoring at multiple screened depths) will need to be installed to monitor potential impacts in both the Upper Namoi Alluvium and the Maules Creek Formation in the vicinity of the borefield.
 - c. Groundwater quality monitoring is proposed; however, the parameters to be analysed are limited to several physico-chemical parameters, major ions and five metals/metalloids (aluminium, arsenic, molybdenum, selenium and iron). Hydrocarbons and additional metals should be monitored, particularly as the groundwater quality data and the geochemical analysis results (discussed further in the response to Question 2) show that concentrations of some metals could be or are already elevated (compared to ANZG 2018 guideline values for aquatic ecosystem

protection). Additional parameters to be monitored should include: boron, copper, lead, antimony, tin, zinc, silver, cobalt, nickel and mercury.

- d. Only pH and electrical conductivity (EC) are proposed to be monitored in groundwater twice yearly, with other parameters monitored once annually. Groundwater quality monitoring for all parameters should occur more frequently than annually (at least seasonally for all parameters and potentially continuously for EC and temperature in the water table aquifer) given the high value of the Upper Namoi Alluvial aquifer and the large number of users.
- e. The groundwater monitoring plan, when developed, should include appropriate site-specific level and water quality guideline values and triggers. The plan should also include a trigger action response plan (TARP) which clearly outlines the actions and responses that will be taken, in a timely manner, when a trigger value is exceeded.
- f. Groundwater ultimately discharges to local surface water systems in the project region. As such, relevant water quality objectives should include the 95% species protection guideline values for slightly to moderately disturbed aquatic ecosystems as outlined in ANZG (2018) and not only for stock and domestic, and irrigation objectives. When developing water quality objectives for groundwater for the project, these aquatic species protection guideline values need to be considered and the most conservative guideline values for each contaminant (either aquatic ecosystem, stock and domestic or irrigation) used.
- g. The frequency of monitoring for groundwater levels could be increased from quarterly manual observations through the use of data loggers. This could improve future groundwater models by identifying any variations in recharge assumptions, confining conditions within shallow layers and verifying specific storage values.
- h. Monitoring should continue post-mining given that the extent and magnitude of groundwater drawdown will continue to increase post-mining.
- i. The proponent proposes to update the groundwater model after five years. In the meantime, groundwater level observations should be regularly compared with model predictions. A robust set of statistical criteria should be determined to identify when there is significant variation of observations from predictions. If these criteria are exceeded, an investigation should be initiated to determine if a full model review needs to be commenced and appropriate actions taken.
- j. The IESC notes that the Namoi River (a GDE) adjacent to the project forms part of the state-listed 'Lowland Darling River Aquatic Ecological Community'. This listing means that all native fish and other aquatic animals within its boundaries have the status of endangered species (NSW DPI 2007). For that reason, risk assessments need to be especially detailed and include assessments of alluvial stygofauna (see paragraph 1g).
- k. The IESC suggests that potential impacts to the EPBC Act-listed Murray Cod (*Maccullochella peelii*) could be further reduced if construction activities (e.g. building the rail crossing) in the Namoi River are avoided or limited during higher winter/spring flows which are a cue for breeding for this species. To reduce potential impacts to the state-listed eel-tailed catfish (*Tandanus tandanus*), construction activities likely to disturb gravel bed spawning sites in the Namoi River should be avoided where possible, especially when temperatures are optimal (20–24°C) for spawning for this species (EIS, App. A, p. 53).

Question 2: Surface water and flooding

- a. Does the IESC agree that the Vickery Extension Project is unlikely to result in a significant change to surface water impacts (water quantity and quality) over and above those for the approved project and/or Whitehaven's existing entitlements?

b. Does the IESC agree that the EIS provides reasonable estimations of the likely flood-related impacts to surrounding properties and the wider Namoi River floodplain?

c. Does the IESC recommend any specific measures to mitigate and manage the identified surface water and/or flood-related impacts?

3. The surface water and flood modelling predictions presented by the proponent indicate that the proposed project is unlikely to have a significant impact on surface water quantity and quality, and that impacts are likely to be consistent with those predicted for the approved project. Water requirements are likely to be within the existing entitlements held by Whitehaven Coal in most circumstances. Specific issues that could be given further consideration are outlined below.
- a. The results of the proponent's water balance model confirm that the project is likely to extract water from the Namoi River, supplemented with some groundwater extraction (EIS, Appendix B). The results suggest that the proponent's existing surface water allocations will be sufficient, even during dry years, provided full allocations are available. The proponent has undertaken a commendably thorough sensitivity analysis of the water balance model, incorporating climate variability, future climate change scenarios and parameter uncertainty (related to runoff characteristics of mine surfaces). The thoroughness of the analysis and the effective use of independent reviewers increases confidence in the reliability of the model predictions. The analysis reveals that the predictions are sensitive to assumptions about the fraction of incident rainfall that will become runoff; efforts made to collate and utilise the limited information relevant to these assumptions are commended.
 - b. If Whitehaven Coal's surface water licences are not sufficient, the proponent proposes to use dust suppression chemicals, which can reduce the water required for dust suppression by half (EIS, Appendix B, p. 96). Irwin et al. (2008) showed that impacts from some surfactants and organics used as dust suppressants are likely to be limited for surface water and groundwater quality. Acute toxicity to invertebrates and fish and chronic toxicity to micro algae were also assessed, however, chronic toxicity to invertebrates and fish was not assessed. The proponent should provide the information outlined in paragraph 1d (i) for the dust suppressants potentially to be used and if data on chronic toxicity to aquatic organisms is not available, consider undertaking direct toxicity assessments according to ANZECC/ARMCANZ (2000).
 - c. The project has the potential to affect water quality through controlled and uncontrolled discharge from sediment dams. Discharges are expected twice per year under median climatic conditions, with overflows predicted once in three years under the same conditions. The only water quality criterion proposed for discharge water is suspended solids (up to 50 mg/L). Although other parameters are proposed to be monitored in sediment dams, no guideline values for these other parameters are proposed for the discharges. The IESC considers that environmental protection would be enhanced if limits were also placed on contaminant concentrations in release water, particularly for aluminium, molybdenum and arsenic which are noted to be elevated (compared to various ANZG 2018 guideline values) in the water storages of nearby Whitehaven Coal mines. Based on the geochemical assessment, silver, mercury and boron should also be monitored in sediment dams. Limits should be consistent with the most conservative of the guideline values for either aquatic ecosystem protection or irrigation (given downstream irrigation use) in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018).
 - d. The direction of surface water-groundwater exchanges across the bed and banks of most alluvial rivers strongly influences the rates and types of biogeochemical processes (e.g. nitrogen transformation, dissolved carbon dynamics) in the bed sediments (Boano et al. 2014). Changes to surface flow or the effects of groundwater drawdown may reverse the direction of surface water-groundwater exchange, alter the locations of upwelling and downwelling zones, or even cause repeated reversals of surface water-groundwater exchange over time. Given the

significance of these biogeochemical processes to river water quality, especially during low flows, more information is needed on how these exchanges may be affected by the proposed project.

4. The EIS provides a reasonable estimation of the likely flood-related impacts arising from the proposed project. The proponent has prepared separate TUFLOW models for the Namoi River and tributaries to the Namoi River which were calibrated based on flood hydrographs from the 1955 and 1988 flood events. The analyses prompt the following comments.
 - a. The flood frequency analysis of the Namoi River at Gunnedah provides estimates of the 1% annual exceedance probability (AEP) flood that are likely to be overestimated (i.e. are conservatively high). This inference is based on the assumption that the Cunnane plotting position has been used to estimate the sample exceedance probability of the 1955 event (such that it is assigned an exceedance probability that is very close to 1% AEP), and that the historical period relevant to this maximum is 61 years (that is, that a larger event occurred in 1954). Records have been kept at that site since 1891 and thus it should be possible to identify more precisely the period over which the 1955 event was considered to be the highest event. Any increase in this period over 61 years will result in a lower 1% AEP estimate. Given this, any mitigation works designed to accommodate the 1% AEP flood will provide protection against rarer flood events.
 - b. Conversely, the probable maximum flood (PMF) for the Namoi River at Gunnedah is most likely an underestimate. The proponent has estimated the PMF as being three times larger than the 1% AEP flood, though no evidence is provided in support of the factor of three adopted. Estimates of the PMF based on either south-eastern Australian (Nathan et al. 1994) or tropical Queensland (Watt et al. 2018) data indicate a PMF which is around six times the magnitude of the 1% AEP flood. The proponent's estimate is also 20% lower than observed global maxima (Herschly 2003). This may have implications for infrastructure design.
 - c. The flood estimates for the local tributaries are derived using two independent methods, namely the XP-RAFTS flood event model (configured using regional information) and the RFFE model (which is based on a statistical analysis of a large body of gauged data). It is reassuring that these two sets of estimates are in good agreement because deficiencies in this modelling could affect design of flood bunds and other infrastructure. However the IESC notes the following limitations.
 - i. No attempt has been made to use nearby gauged information from Maules and Coxs Creeks, although these sites have been used in the surface water assessment (EIS, Appendix B).
 - ii. The design rainfall information used to derive the XP-RAFTS estimates are based on 1987 rather than 2016 information. The proponent notes (EIS, Section 4.3.4) that the 2016 design rainfalls are lower than the 1987 estimates, which would suggest that the associated flood estimates are too high.
 - iii. However, these rainfalls have been applied in conjunction with the 1987 temporal patterns. It is assumed by the peer reviewer (EIS, Attachment 4) that the methodology adopted by the proponent will yield conservatively high results. As discussed in Nathan and Ling (2016), studies have demonstrated that the influence of variability in temporal patterns yields flood estimates that may be higher or lower than any one adopted pattern (even if it is derived using the average variability method).
 - d. During flood events, there is the potential for erosion, settlement or slumping associated with the rail spur. Details of proposed remedial and contingency measures are planned to be provided in the Water Management Plan (EIS, p. 4-48). It is important that this plan clearly outlines inspection regimes and feasible mitigation measures. While the results of the TUFLOW modelling

suggest that the impacts of the rail spur on water levels and velocities are modest, it is noted that maps of this distribution (EIS, Appendix C, section 6.4) do not appear to capture the localised influence of culvert and bridge crossings. The location of all such waterway areas need to be provided to give greater confidence in the results of the modelling.

5. The geochemical assessment (EIS, Appendix M) identified some potential issues which could affect groundwater quality and hence surface water quality given groundwater discharges to surface waters in the project region. The geochemical leach testing was undertaken with deionised water. To improve confidence in predictions, tests should be done covering the range of potential environmental conditions applicable to the project (e.g. atmospheric exposure, different leaching solution pH values and ionic concentrations reflective of anticipated conditions). Other identified potential issues are outlined below. The IESC suggests some mitigation and management measures to supplement those currently identified by the proponent.
 - a. The overburden and interburden are expected to contain enriched concentrations of arsenic, silver, boron, antimony and selenium compared to average crustal abundances. Under neutral to alkaline conditions, arsenic, molybdenum and selenium will readily leach. Surface water monitoring should include these metals.
 - b. If the overburden emplacement is constructed such that waste rock with higher sulfur content is exposed for prolonged periods to the atmosphere and moisture, acidic conditions could result. This could cause increased leaching of arsenic, cobalt, nickel, lead, selenium and zinc. The proponent proposes to blend waste rock and ensure that the surface layer ('final lift') of the waste rock emplacement does not contain any potentially-acid-forming material (EIS, Appendix M, p. 32). The IESC considers that this should be effective in mitigating the risk of acidification and associated acidic leaching. However, surface water monitoring should include sampling for arsenic, cobalt, nickel, lead, molybdenum, selenium and zinc to monitor for potential leaching.
 - c. Coal rejects will be disposed of on-site. A small proportion of the coal or coal rejects may have a very low acid-neutralising capacity. Therefore, there is a risk that some of the reject material may be acid-forming if exposed to oxidative conditions (either aerial or through leaching). Concentrations of silver, arsenic, mercury and selenium are high in the coal material and elevated concentrations of molybdenum and selenium may also occur as these are readily soluble in the expected neutral pH conditions. Surface water monitoring should include sampling for these metals.
 - d. On-site disposal of coal rejects from the CHPP is proposed. The CHPP may process coal from other Whitehaven Coal operations. A geochemical assessment of the coal rejects from the other Whitehaven Coal mines that could be disposed of at the project site is likely to already exist and should be included in this documentation. Any mitigation or special handling measures required for this material should be discussed.

Date of advice	14 November 2018
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Source documentation provided to the IESC for the formulation of this advice	<i>Vickery Extension Project Environmental Impact Statement (and appendices) 2018.</i> Whitehaven Coal. Available [online]: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7480 accessed November 2018.
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