

Advice to decision maker on coal mining project

Proposed action: Springsure Creek Coal Project (EPBC 2010/5782) – New Development

Requesting agency	Department of the Environment
Date of request	8 November 2013
Date request accepted	11 November 2013
Advice stage	Assessment

Advice

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (the Committee) was requested to provide advice on the Springsure Creek Coal Project in Queensland which is being assessed by the Department of the Environment (the Department) in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This advice draws upon aspects of information in the Draft Environmental Impact Statement on Matters of National Environmental Significance (Commonwealth draft EIS), as well as the Queensland Draft Environmental Impact Statement (Queensland draft EIS) and Supplementary Environmental Impact Statement (Queensland supplementary EIS), together with the expert deliberations of the Committee. The project documentation and information accessed by the Committee are listed in the source documentation at the end of this advice.

The proposed project is a new underground longwall coal mine, producing up to 11 Mtpa of product coal over the 40 year proposed life of the mine. The proposed project is located in the Comet River catchment of the Fitzroy Basin, 47 km south-east of Emerald and 37 km north-east of Springsure, overlying the central Bowen Basin. As well as the 10,736 ha mine footprint, the Commonwealth referral includes the associated infrastructure corridor (702.5 ha) and train load out facility (182.1 ha). The corridor is approximately 200 m wide and 40 km long and the train load out facility includes coal stockpiles, a coal handling plant and water storages.

The Committee, in line with its Information Guidelines¹, has considered whether the proposed project assessment has used the following:

Relevant data and information: key conclusions

Data and information that would increase confidence in the proponent's assessments includes:

- Water inputs, stores and outputs on a regional scale;
- Surface water monitoring data to enable local water quality objectives to be determined;
- Local data which verifies the hydraulic characteristics of each hydrostratigraphic unit and any variation in these parameters across the proposed project area. Field data on the Rewan Formation is key and has not been provided; and
- Information related to the extent of hydrological interactions between water sources; including the role of faults in transmitting groundwater flow.

Application of appropriate methodologies: key conclusions

Key methodologies and assessments needed to assess the proposed project that are not presented or have not been applied appropriately include:

- Detailed numerical groundwater modelling, incorporating groundwater drawdown and dewatering volumes over time for each hydrostratigraphic unit for the life of the project and until recovery;
- A cumulative impact assessment incorporating operating and proposed developments;
- A defined mine water discharge strategy;
- A risk assessment covering the impacts of the proposed project on surface and groundwater resources and dependent ecosystems;
- A complete site water balance which allows assessment of the impacts of the proposed water management strategy under seasonal climate variation and over various stages of mine development and the resultant impacts on receiving environments; and
- A representative stygofauna survey.

These assessments would assist with validation of and increase confidence in the proponent's impact assessments and mitigation proposals. The Committee notes that some of these methodologies may be incorporated into future versions of the project assessment documentation.

Reasonable values and parameters in calculations: key conclusions

The hydraulic parameters used to model the Rewan Formation are not based on local field data. Given this lack of local data, the model sensitivity and the large range of hydraulic parameters from literature for this formation across the Bowen Basin, the Committee notes that there is considerable uncertainty in the values used for hydraulic parameters of the Rewan Formation.

The Committee's advice in response to the Department's specific questions is provided below.

Question 1: The proponent has stated that as the nearest mines (including Rolleston and Minerva) are not within the same sub-catchment a cumulative impact is not expected. Does the Committee agree with this statement? If not, what information is needed from the proponent to support the claim?

1. The proponent's conclusions about lack of cumulative impacts to groundwater through drawdown are not supported by sufficient evidence. Conclusions should be supported by broader scale drawdown information, for example, a map of the predicted or actual drawdown extents for existing and proposed coal seam gas and coal mining developments in the region.
2. The variable hydraulic properties and heterogeneity of the Rewan Formation across the region are key factors in determining cumulative impacts to groundwater. Given the wide range of hydraulic parameters for the Rewan Formation from literature and other proposals on which the Committee has provided advice, it is possible that this formation may be more permeable and heterogeneous than modelled by the proponent. If this is the case, groundwater impacts from the proposed project may be less localised and could be regionally significant.
3. The asserted lack of cumulative drawdown does not preclude cumulative impacts to groundwater. Cumulative impacts such as changes to the regional groundwater flow regime, enhanced

recharge or connectivity should also be considered. There is also the potential for significant cumulative impacts to surface water quality and quantity within the catchment, as a result of subsidence, planned or emergency discharges and loss of catchment area.

4. An adequate cumulative impact assessment should:
 - a. Cover geographic and temporal boundaries large enough to include all potentially significant impacts on the water resources. For example; surface water impacts should be considered across the Comet River Catchment, which covers an area of 17,294 km²;
 - b. Identify past, present, and reasonably foreseeable actions, including development proposals, programs and policies, likely to impact on the water resources of concern. The Committee considers that all operating coal mines within this catchment have the potential to contribute to cumulative impacts, including Rolleston, Minerva and Blackwater South, which are located within an approximate 50 km radius. Any coal seam gas exploration or production activity, as well as coal mining developments that are undergoing assessment such as Meteor Downs South (EPBC 2013/6799) should also be considered;
 - c. Compile the hydraulic data and groundwater modelling from other projects considered within the cumulative impact assessment to assess the integrity of the Rewan Formation and impacts to groundwater on a regional scale;
 - d. Utilise appropriately robust and repeatable methodologies to determine the significance of impacts; and
 - e. Determine mitigation, monitoring and management measures to avoid or minimise and report on potential cumulative impacts.

Question 2: Are the numerical and conceptual groundwater models presented in Main Document, section 6 of Attachment A, adequate to predict the impacts on groundwater? If not discuss what information is missing?

5. The groundwater section of the Main Document of the Commonwealth draft EIS is not supported by a groundwater technical report. Inclusion of additional information in the project assessment documentation, such as the independent peer review of the groundwater model, would increase confidence in the proponent's groundwater models.
6. The Committee considers that the groundwater conceptual model is not supported by sufficient evidence. The level of confidence in the groundwater conceptualisation would increase with additional groundwater baseline data in the proposed project area, including:
 - a. Packer tests or core permeability test results to verify hydraulic assumptions in the hydrogeological conceptualisation. In particular, the Rewan Formation is known to have variable hydraulic parameters, faulting and variable thickness. In the conceptualisation, the hydraulic properties of the formation have been determined based on regional estimates, not local field data;
 - b. Seasonal trends for groundwater level and quality in each hydrostratigraphic unit; and
 - c. Investigations into faulting across the proposed project area and an assessment of the role of faults in transmitting or impeding groundwater flow.
7. Confidence in the numerical groundwater model presented is low, due to the following factors:
 - a. Limited data for calibration, future stresses more than five times the calibration stresses, and extended predictive timeframes compared to existing data;

- b. Model boundaries that appear to be arbitrary; as they are not based on defined natural features and are unlikely to be accurately represented by no through-flow;
 - c. The overuse of no-flow boundaries means that evapotranspiration may be over-influenced by the model design. This is an issue as the model evapotranspiration output is used as a proxy for assessing impacts to groundwater dependent ecosystems; and
 - d. The high model sensitivity to the integrity of the Rewan Formation.
8. The Committee recommends that the groundwater modelling include:
- a. Data from field investigations into the hydraulic conductivity of the Rewan Formation and role of faulting in transmitting or impeding groundwater flow across the proposed project area;
 - b. A range of model runs to account for the uncertainty of the hydraulic parameters in the Rewan Formation. As the model is highly sensitive to the vertical hydraulic conductivity of the Rewan Formation and values in literature span across several orders of magnitude, it is recommended that the uncertainty scenarios also consider variations in vertical hydraulic conductivity of multiple orders of magnitude;
 - c. Additional data from deeper formations, with a reconsideration of flow paths through the Rewan and Bandanna Formations to inform the groundwater conceptualisation and model boundaries or boundary conditions;
 - d. A streamflow component and an assessment of impacts on this parameter to assist in determining impacts to groundwater dependent ecosystems;
 - e. Actual recharge and evapotranspiration patterns based on local data; and
 - f. Groundwater drawdown over time curves and dewatering volumes for each hydrostratigraphic unit across the project life and until equilibrium is reached for the base case and all uncertainty scenarios.

Question 3: Does the numerical and conceptual groundwater models presented in Main Document, section 6 of Attachment A, present any concerns that may impact upon water resources or any other matters of national environmental significance?

9. There are potentially significant impacts to surface and groundwater resources as a result of the proposed project, due to depressurisation of the coal seam and subsidence. Impacts as a result of subsidence include changes to aquifer structure, a reduction in streamflow of up to 30%, ponding, erosion and sedimentation, potential streambed cracking and loss of riparian vegetation. These are further outlined in Question 5.
10. Drawdown impacts are expected within the coal seams and overlying units, but the most significant impacts are likely to occur as a result of drawdown in the tertiary basalt and alluvium due to the number of other water users and high potential to support groundwater dependent ecosystems within these units.
- a. The Tertiary Basalt is the major aquifer within the region and has the greatest number of groundwater users. Under the uncertainty scenario presented in the Commonwealth draft EIS, the maximum drawdown in the Tertiary Basalt is modelled to be in excess of 5.5 m and occurs at year 50. Existing water levels in bores in the Basalt will be drawn down by up to four metres, or up to 14% of saturated thickness. The proponent commits to 'making good' impacts on unusable bores, consistent with the provisions under the Queensland *Water Act 2000*.

- b. Deep-rooted vegetation that uses groundwater, such as Brigalow (*Acacia harpophylla*), may experience changes in key ecological processes as a result of change in groundwater availability including growth, reproduction, recruitment, mortality and even changes in ecosystems structure and function². The assessment of impacts to groundwater dependent vegetation would benefit from a spatial representation of the depth to groundwater and its seasonal variability, along with the location of threatened ecological communities and predicted drawdown contours.
- c. The Committee considers that the level of uncertainty in groundwater modelling means that these impacts need to be re-evaluated following the modifications to the groundwater models recommended in response to Question 2.

Question 4: Does the Committee have any concerns regarding the predicted levels of drawdown and does it agree with predictions that these drawdown levels will recover over time? Is the recovery time an acceptable outcome?

11. The Committee provides the following advice with respect to predictions of drawdown and recovery:
 - a. The predicted levels of drawdown are of concern where the drawdown may impact on groundwater dependent assets, such as riparian vegetation, or other bores. Any predicted quantitative impacts should be treated with uncertainty given the lack of confidence in the groundwater modelling.
 - b. Groundwater levels can be expected to eventually recover to a new equilibrium and based on the information available, this is likely to be hundreds of years. However, the Committee has a low level of confidence in the accuracy of predicted recovery timeframes, given that predictions are well beyond the period of observations on which the groundwater model is calibrated. The time taken for the groundwater system to reach a new equilibrium depends largely on the properties of the overburden. This is demonstrated in the time to reach maximum drawdown for the base case (150 years) versus the uncertainty case (50 years). Deformation of overburden strata as a result of subsidence will permanently alter the properties of overlying aquifers and in some cases the post-mining water levels will exceed pre-mining levels due to enhanced hydraulic conductivity.

Question 5: Will subsidence have significant impacts on downstream surface water and groundwater quality and quantity?

12. There are potentially significant impacts to groundwater quantity as a result of deformation above extracted longwall panels, which can be expected to result in permanent changes to aquifer structure and a new groundwater equilibrium, with higher heads for some parts of the aquifers. Whilst these changes are likely to be largely confined within the mining lease area, fractures, as a result of deformation, may extend through water table aquifers and impact groundwater dependent ecosystems.
13. Impacts to surface water quantity include a reduction in streamflow of up to 30%, including complete capture of flows during low rainfall years, ponding and changes in peak flows due to both the loss of some overland flows and the reduction in storage capacity of existing dams resulting in increased through-flows.
 - a. Potential impacts as a result of changes to the surface flow regime to users further downstream, particularly in a cumulative sense, have not been addressed. In particular, changes to the inundation regime for wetlands covered by State Planning Policy 4-11 (wetlands in the Fitzroy Basin, protected due to impacts on the Great Barrier Reef), including the wetland two kilometres to the east of the proposed project site, have not been considered.

- b. There is the potential for surface tension cracks, or streambed cracking as a result of subsidence, but its likelihood or consequence has not been assessed in the project assessment documentation. Surface or streambed cracking may result in a significant loss of surface flows to groundwater.
 - c. Brigalow trees (as well as other species) may be affected by prolonged ponding of surface waters above extracted longwall panels. The proponent expects that dieback of younger individuals may occur at depths greater than 1.2 m. The Committee recommends that the proponent consider mitigation or remediation strategies including consideration of the mine design to limit subsidence above longwall panels where listed communities occur.
 - d. Significant changes to the flow regime and geomorphological change could lead to bank instability and loss of riparian vegetation, including listed ecological communities such as Brigalow.
14. Changes in surface water flow patterns may have impacts on stream geomorphology, leading to water quality issues associated with erosion and sedimentation. Increases in sediment load in multiple creeks, which already exhibit turbidity beyond regional water quality objectives, are likely as a result of the proposed project.
15. Recognising that the proponent's subsidence modelling is based on assumptions which overestimate impacts; the assessment of subsidence impacts remains uncertain due to:
- a. Insufficient discussion in the project assessment documentation of all parameters relevant to understanding the subsidence profile, including horizontal displacement, curvature and strain, as well as the consideration of subsidence parameters in a cumulative, total and transient sense;
 - b. Insufficient assessment of subsidence in the surface cracking zone and far-field effects; and
 - c. The potential for the chain pillars to yield at depths of cover beyond 350 m.

Question 6: What does the Committee consider are the key uncertainties and risks of the project in relation to water resources?

16. There are significant uncertainties with respect to subsidence and groundwater modelling, particularly in relation to the integrity of the Rewan Formation. Further information on risks to groundwater and as a result of subsidence are provided in advice on Questions 2 to 5.
17. Due to the number of other coal developments operating or proposed within the catchment, the lack of detail about the proposed discharge strategy poses a key risk. The project assessment documentation would benefit from consideration of impacts to the regional water balance and a clear explanation of the proposed discharge strategy, assessment of its operation under various climatic scenarios and at various stages of mine development. The Committee recommends that the discharge strategy reflect Fitzroy Model Water conditions and their requirements.
18. The ecology appendix to the Commonwealth draft EIS states that there is no alluvium present within the project area, but this is inconsistent with the hydrogeological conceptualisation. As such, impacts on ecological assets within the alluvium have not been appropriately considered and this poses a significant risk.
19. The proposed project presents a risk to downstream water quality, particularly with respect to turbidity as a result of erosion, sedimentation and bank instability over the subsided landform. The project assessment documentation would benefit from predictions of additional sediment loads across the site and downstream and an assessment of impacts on water related assets, as well

as determination of trigger levels and mitigation and remediation strategies where necessary for the control of sediment and erosion.

Question 7: Are there any likely impacts that the proponent has not considered that might lead to changes in surface and/or groundwater dynamics that may support other water dependent matters of national environmental significance?

20. Impacts to water dependent matters of national environmental significance, including listed ecological communities, as a result of groundwater drawdown and changes to surface hydrology, have been discussed in advice on Questions 3, 5 and 6. The Committee considers that further impacts in addition to those previously described to matters of national environmental significance from changes to water dynamics as a result of the proposed project are unlikely.

Question 8: Are there additional measures and commitments required to monitor, mitigate and manage impacts resulting from changes to surface and groundwater resources?

21. In general, mitigation and management measures proposed in the project assessment documentation are broad and not related to any trigger levels. Insufficient detail has been provided on the circumstances in which proposed mitigation and monitoring actions would be applied. Delays in developing management plans could pose a short-term risk if impacts are greater or occur sooner than expected. Priority actions include:

- a. Development of a detailed subsidence monitoring plan to validate subsidence predictions, monitor, mitigate and update predictions as required;
- b. Further studies and updates to groundwater modelling, as recommended in advice on Question 2 with a further independent peer review of these updates;
- c. Determination of local water quality objectives and ongoing monitoring to detect any potential impacts; and
- d. Investigation into and monitoring of groundwater dependent ecosystems within and surrounding the proposed project area. Appropriate mitigation and management measures should be determined for any groundwater dependent wetlands, vegetation and stygofauna.

Date of advice 12 December 2013

Source documentation available to the Committee in the formulation of this advice

Springsure Creek Coal Pty Ltd, 2013a. Springsure Creek Coal Mine Project Draft Environmental Impact Statement. February 2013.

Springsure Creek Coal Pty Ltd, 2013b. Springsure Creek Coal Mine Project Final Environmental Impact Statement. June 2013.

Springsure Creek Coal Pty Ltd, 2013c. Springsure Creek Coal Project Draft Environmental Impact Statement - Matters of National Environmental Significance. September 2013.

Water Resource Australia Pty Ltd, 2013. Independent Peer Review of Groundwater Modelling for the Springsure Creek Coal Mine EIS.

**References
cited within the
Committee's
advice**

¹ Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources available at: <http://www.environment.gov.au/coal-seam-gas-mining/project-advice/pubs/iesc-information-guidelines.pdf>.

² Eamus, D., et al. 2006. Ecohydrology: Vegetation function, water and resource management. Collingwood, Victoria. CSIRO Publishing.
