



**Baralaba South Project  
Environmental Impact Statement**

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ATTACHMENT 4

**Independent Expert Scientific Community  
Guidelines Reconciliation**

## Baralaba South Project Independent Expert Scientific Committee Reconciliation Table

Information requirements	Section referenced
<b>Description of proposal</b>	
<p>Provide a regional overview of the proposed project area including a description of the geological basin:</p> <ul style="list-style-type: none"> <li>(a) coal resource;</li> <li>(b) surface water catchments;</li> <li>(c) groundwater systems;</li> <li>(d) water-dependent assets; and</li> <li>(e) past, present and reasonably foreseeable coal mining and CSG developments</li> </ul>	Sections 9.3, 9.10.
Describe the statutory context, including information on the proposal’s status within the regulatory assessment process and any applicable water management policies or regulations	Sections 9.1 and 9.7.
Describe the proposal’s location, purpose, scale, duration, disturbance area, and the means by which it is likely to have a significant impact on water resources and water-dependent assets.	Sections 9.2, 9.3, 9.8, 9.9 and 9.10.
Describe how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.	Sections 9.8.2 and 9.10.1. Appendix A (section 3.1). Appendix B (section 1.4).
<b>Risk assessment</b>	
Identify and assess all potential environmental risks to water resources and water-related assets, and their possible impacts. In selecting a risk assessment approach consideration should be given to the complexity of the project, and the probability and potential consequences of risks.	Section 9.8.6, 9.10.6, 9.13.5 and 9.14.4.  Appendix A (sections 7.0 and 8.0).  Appendix B (sections 5.0, 7.0 and 8.0).  Appendix H (section 6.5).  Appendix I (sections 3.3.1 and 4.1.2).
<p>Assess risks following the implementation of any proposed mitigation and management options to determine if these will reduce risks to an acceptable level based on the identified environmental objectives.</p> <p>Incorporate causal mechanisms and pathways identified in the risk assessment in conceptual and numerical modelling. Use the results of these models to update the risk assessment.</p>	Section 9.8.6, 9.10.6, 9.13.5 and 9.14.4.  Appendix A (sections 7.0 and 8.0).  Appendix B (sections 5.0, 7.0, 8.0 and 9.1).  Appendix H (section 6.5).  Appendix I (sections 3.3.1 and 4.1.2).
<p>The risk assessment should include an assessment of:</p> <ul style="list-style-type: none"> <li>(a) all potential cumulative impacts which could affect water resources and water-related assets, and</li> </ul>	Section 9.8.4, 9.10.4, 9.13.5 and 9.14.3.  Section 9.8.5, 9.10.5, 9.13.6 and 9.14.4.

Information requirements	Section referenced
(b) mitigation and management options which the proponent could implement to reduce these impacts.	Appendix A (sections 8.14 and 10.0). Appendix B (sections 1.7 and 7.0). Appendix H (sections 6.4 and 6.5). Appendix I (section 4.1.2).
<b>Groundwater—context and conceptualisation</b>	
Describe and map geology at an appropriate level of horizontal and vertical resolution including:  (a) definition of the geological sequence(s) in the area, with names and descriptions of the formations and accompanying surface geology, cross-sections and any relevant field data.  (b) geological maps appropriately annotated with symbols that denote fault type, throw and the parts of sequences the faults intersect or displace.  (c) Define and describe or characterise significant geological structures (e.g. faults, folds, intrusive) and associated fracturing in the area and their influence on groundwater – particularly groundwater flow, discharge or recharge.  (d) Site-specific studies (e.g. geophysical, coring/ wireline logging etc.) should give consideration to characterising and detailing the local stress regime and fault structure (e.g. damage zone size, open/closed along fault plane, presence of clay/shale smear, fault jogs or splays).	Section 9.10.1.  Appendix B (sections 2.4 and 5.1.4).
Discussion on how this fits into the fault’s potential influence on regional-scale groundwater conditions should also be included.	Section 9.10.1.  Appendix B (sections 2.4 and 5.1.4).
Provide site-specific values for hydraulic parameters (e.g. vertical and horizontal hydraulic conductivity and specific yield or specific storage characteristics including the data from which these parameters were derived) for each relevant hydrogeological unit. In situ observations of these parameters should be sufficient to characterise the heterogeneity of these properties for modelling	Section 9.10.1 and 9.10.2.  Appendix B (section 3.6).
Provide time series level and water quality data representative of seasonal and climatic cycles.	Section 9.10.2.  Appendix B (sections 3.1 and 4.2).
Provide data to demonstrate the varying depths to the hydrogeological units and associated standing water levels or potentiometric heads, including direction of groundwater flow, contour maps, and hydrographs. All boreholes used to provide this data should have been surveyed.	Section 9.10.2.  Appendix B (section 3.0).
Provide hydro chemical (e.g. acidity/alkalinity, electrical conductivity, metals, and major ions) and environmental tracer (e.g. stable isotopes of water, tritium, helium, strontium isotopes, etc.) characterisation to identify sources of water, recharge rates, transit times in aquifers, connectivity between geological units and groundwater discharge locations.	Section 9.10.2.  Appendix B (sections 3.7 and 4.0).
Describe the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.  Assess the frequency (and time lags if any), location, volume and direction of interactions between water resources, including surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.	Sections 9.10.1, 9.10.2 and 9.10.4.  Appendix B (sections 3.3, 3.7 and 5.1).
Groundwater – analytic and numeric modelling	

Information requirements	Section referenced
Provide a detailed description of all analytical and/or numerical models used, and any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Section 9.10.3. Appendix B (sections 6.0 and 7.0).
Undertaken groundwater modelling in accordance with the Australian Groundwater Modelling Guidelines (Barnett <i>et al.</i> 2012), including independent peer review.	Section 9.10.3. Appendix B (sections 6.0 and 6.15). Attachment 7.
Calibrate models with adequate monitoring data, ideally with calibration targets related to model prediction (e.g. use baseflow calibration targets where predicting changes to baseflow).	Section 9.10.3. Appendix B (section 6.7).
Describe each hydrogeological unit as incorporated in the groundwater model, including the thickness, storage and hydraulic characteristics, and linkages between units, if any.	Section 9.10.1. Appendix B (sections 2.4.3, 3.0 and 5.0).
Describe the existing recharge/discharge pathways of the units and the changes that are predicted to occur upon commencement, throughout, and after completion of the proposed project.	Section 9.10.1 and 9.10.4. Appendix B (sections 5.0).
Describe the various stages of the proposed project (construction, operation and rehabilitation) and their incorporation into the groundwater model. Provide predictions of water level and/or pressure declines and recovery in each hydrogeological unit for the life of the project and beyond, including surface contour maps for all hydrogeological units.	Sections 9.10.5 and 9.10.4. Appendix B (sections 7.1, 7.2, 7.6.1, 7.6.2 and 7.11.1).
Identify the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.	Section 9.10.4. Appendix B (section 7.9).
Undertake model verification with past and/or existing site monitoring data.	Section 9.10.5.4. Appendix B (sections 6.11 and 6.12).
Provide an explanation of the model conceptualisation of the hydrogeological system or systems, including multiple conceptual models if appropriate. Key assumptions and model limitations and any consequences should also be described.	Sections 9.10.1 and 9.10.3. Appendix B (sections 1.3.2, 5.0, 6.2.1, 6.15 and 7.12).
Consider a variety of boundary conditions across the model domain, including constant head or general head boundaries, river cells and drains, to enable a comparison of groundwater model outputs to seasonal field observations.	Section 9.10.3. Appendix B (section 6.5).
Undertake sensitivity analysis and uncertainty analysis of boundary conditions and hydraulic and storage parameters, and justify the conditions applied in the final groundwater model (see Middlemis and Peeters [in press]).	Sections 9.10.3.3 and 9.10.5.4. Appendix B (sections 6.2, 7.2, and 7.3 to 7.9).
Provide an assessment of the quality of, and risks and uncertainty inherent in, the data used to establish baseline conditions and in modelling, particularly with respect to predicted potential impact scenarios.	Section 9.10.3.4. Appendix B (section 7.3 and 7.12).
Undertake an uncertainty analysis of model construction, data, conceptualisation and predictions (see Middlemis and Peeters [in press]).	Section 9.10.3.4. Appendix B (sections 6.2 and 7.3).
Provide a program for review and update of models as more data and information become available, including reporting requirements.	Section 9.10.5.

Information requirements	Section referenced
	Appendix B (sections 9.1.3 and 9.1.4)
Provide information on the magnitude and time for maximum drawdown and post-development drawdown equilibrium to be reached.	Section 9.10.4. Appendix B (section 7.6).
<b>Groundwater—impacts to water resources and water-dependent assets</b>	
<p>Provide an assessment of the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts. Consider and describe:</p> <ul style="list-style-type: none"> <li>(a) any hydrogeological units that will be directly or indirectly dewatered or depressurised, including the extent of impact on hydrological interactions between water resources, surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.</li> <li>(b) the effects of dewatering and depressurisation (including lateral effects) on water resources, water-dependent assets, groundwater, flow direction and surface topography, including resultant impacts on the groundwater balance.</li> <li>(c) the potential impacts on hydraulic and storage properties of hydrogeological units, including changes in storage, potential for physical transmission of water within and between units, and estimates of likelihood of leakage of contaminants through hydrogeological units.</li> <li>(d) the possible fracturing of and other damage to confining layers.</li> <li>(e) for each relevant hydrogeological unit, the proportional increase in groundwater use and impacts as a consequence of the proposed project, including an assessment of any consequential increase in demand for groundwater from towns or other industries resulting from associated population or economic growth due to the proposal.</li> </ul>	Sections 9.10.4 and 9.10.6. Appendix B (sections 7.0, 8.0 and 9.0).
Describe the water resources and water-dependent assets that will be directly impacted by mining or CSG operations, including hydrogeological units that will be exposed/partially removed by open cut mining and/or underground mining.	Sections 9.10.4 and 9.10.6. Appendix B (sections 3.0, 4.0 and 5.0). Appendix H (section 6.2).
For each potentially impacted water resource, provide a clear description of the impact to the resource, the resultant impact to any water-dependent assets dependent on the resource, and the consequence or significance of the impact.	Sections 9.10.4 and 9.10.6. Appendix B (sections 5.0, 7.0 and 8.0).
Describe existing water quality guidelines, environmental flow objectives and other requirements (e.g. water planning rules) for the groundwater basin(s) within which the development proposal is based.	Section 9.10.1. Appendix B (sections 1.8 and 4.1).
Provide an assessment of the cumulative impact of the proposal on groundwater when all developments (past, present and/or reasonably foreseeable) are considered in combination.	Section 9.10.4.10. Appendix B (section 1.7, 7.1 and 7.2). Appendix H (section 6.3).
Describe proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	Section 9.10.5. Appendix B (section 9.1).
Provide a description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	Sections 9.10.5. Appendix B (section 9.1). Appendix H (section 6.4).

Information requirements	Section referenced
<b>Groundwater—data and monitoring</b>	
Provide sufficient data on physical aquifer parameters and hydrogeochemistry to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes.	Sections 9.10.1 and 9.10.2. Appendix B (sections 3.6 and 4.0). Appendix H (sections 3.0 and 4.0).
Develop and describe a robust groundwater monitoring program using dedicated groundwater monitoring wells – including nested arrays where there may be connectivity between hydrogeological units – and targeting specific aquifers, providing an understanding of the groundwater regime, recharge and discharge processes and identifying changes over time.	Sections 9.10.2 and 9.10.5. Appendix B (sections 3.1, 9.1.1 and 9.1.3).
Develop and describe proposed targeted field programs to address key areas of uncertainty, such as the hydraulic connectivity between geological formations, the sources of groundwater sustaining GDEs, the hydraulic properties of significant faults, fracture networks and aquitards in the impacted system, etc., where appropriate.	Sections 9.10.2 and 9.10.5. Appendix B (section 9.1.1 and 9.1.3).
Provide long-term groundwater monitoring data, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.	Section 9.10.2. Appendix B (sections 3.1 and 4.2).
Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZG 2018) and relevant legislated state protocols (e.g. Qld Government 2013).	Sections 9.10.2 and 9.10.5. Appendix B (sections 4.2 and 9.1).
<b>Surface water—context and conceptualisation</b>	
Describe the hydrological regime of all watercourses, standing waters and springs across the site including:  (a) geomorphology, including drainage patterns, sediment regime and floodplain features  (b) spatial, temporal and seasonal trends in streamflow and/or standing water levels  (c) Spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals, metalloids and radionuclides), and  (d) current stressors on watercourses, including impacts from any currently approved projects.	Section 9.8.2. Appendix A (sections 2.1, 2.3 and 2.4). Appendix C (section 4.4.1). Appendix D (section 3.5).
Describe the existing flood regime, including flood volume, depth, duration, extent and velocity for a range of annual exceedance probabilities. Provide flood hydrographs and maps identifying peak flood extent, depth and velocity. This assessment should be informed by topographic data that has been acquired using lidar or other reliable survey methods with accuracy stated	Section 9.9.3. Appendix C (section 4.4.1).
Provide an assessment of the frequency, volume, seasonal variability and direction of interactions between water resources, including surface water/ groundwater connectivity and connectivity with sea water	Section 9.8.2. Appendix A (sections 2.1, 2.3 and 2.4).
<b>Surface water—analytical and numeric modelling</b>	
Provide conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.	Sections 9.8.1 and 9.8.2. Appendix A (section 6.0).
Use methods in accordance with the most recent publication of Australian Rainfall and Runoff (Ball <i>et al.</i> 2016)	Section 9.8.1.

Information requirements	Section referenced
	Appendix C (section 3.4).
Develop and describe a program for review and update of the models as more data and information becomes available	Section 9.8.5. Appendix A (section 10.1).
Describe and justify model assumptions and limitations, and calibrate with appropriate surface water monitoring data	Section 9.8.1. Appendix A (section 6.1).
Provide an assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios	Section 9.8.1. Appendix A (sections 6.0, 6.2, 6.3.4 and 6.4). Appendix C (section 6.13).
Provide a detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Sections 9.8.3 and 9.9.2. Appendix A (section 6.1). Appendix C (4.3).
<b>Surface water—impacts to water resources and water-dependant assets</b>	
Describe all potential impacts of the proposed project on surface waters. Include a clear description of the impact to the resource, the resultant impact to any assets dependent on the resource (including water-dependent ecosystems such as riparian zones and floodplains), and the consequence or significance of the impact. Consider:  (a) impacts on streamflow under the full range of flow conditions.  (b) impacts associated with surface water diversions.  (c) impacts to water quality, including consideration of mixing zones.  (d) the quality, quantity and ecotoxicological effects of operational discharges of water (including saline water), including potential emergency discharges, and the likely impacts on water resources and water-dependent assets.  (e) landscape modifications such as subsidence, voids, post rehabilitation landform collapses, on-site earthworks (including disturbance of acid-forming or sodic soils, roadway and pipeline networks) and how these could affect surface water flow, surface water quality, erosion, sedimentation and habitat fragmentation of water-dependent species and communities.	Sections 9.8.4 and 9.8.6. Appendix A (section 6.2, 7.3, 7.4 and 8.0). Appendix C (section 6.0). Appendix D (section 4.0).
Discuss existing water quality guidelines, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.	Section 9.8.2. Appendix A (sections 2.8.5 and 3.3).
Identify processes to determine surface water quality guidelines and quantity thresholds which incorporate seasonal variation but provide early indication of potential impacts to assets.	Sections 9.8.2 and 9.8.3. Appendix A (section 3.3).
Propose mitigation actions for each identified significant impact.	Sections 9.8.5 and 9.9.6. Appendix A (section 10.0).
Describe the adequacy of proposed measures to prevent or minimise impacts on water resources and water-dependent assets.	Sections 9.8.5. Appendix A (section 10.0).
Describe the cumulative impact of the proposal on surface water resources and water-dependent assets when all developments (past, present and reasonably foreseeable) are considered in combination.	Section 9.8.4. Appendix A (section 8.14).

Information requirements	Section referenced
Provide an assessment of the risks of flooding (including channel form and stability, water level, depth, extent, velocity, shear stress and stream power), and impacts to ecosystems, project infrastructure and the final project landform.	Section 9.9.5. Appendix C (section 6.0). Appendix D (section 4.0).
<b>Surface water—data and monitoring</b>	
Identify monitoring sites representative of the diversity of potentially affected water-dependent assets and the nature and scale of potential impacts, and match with suitable replicated control and reference sites (BACI design) to enable detection and monitoring of potential impacts.	Sections 9.8.3 and 9.8.5. Appendix A (section 10.2).
Ensure water quality monitoring complies with relevant National Water Quality Management Strategy (NWQMS) guidelines (ANZG 2018) and relevant legislated state protocols (e.g. Qld Government 2013).	Section 9.8.3. Appendix A (section 10.2).
Identify data sources, including streamflow data, proximity to rainfall stations, data record duration and describe data methods, including whether missing data have been patched.	Section 9.8.3. Appendix A (sections 2.2, 2.4, 2.2, 2.5.3, 6.1.1, 6.1.8 and 6.1.9).
Develop and describe a surface water monitoring program that will collect sufficient data to detect and identify the cause of any changes from established baseline conditions and assess the effectiveness of mitigation and management measures. The program will: <ul style="list-style-type: none"> <li>(a) include baseline monitoring data for physico-chemical parameters, as well as contaminants (e.g. metals)</li> <li>(b) comparison of physico-chemical data to national/regional guidelines or to site-specific guidelines derived from reference condition monitoring if available, and</li> <li>(c) identify baseline contaminant concentrations and compare these to national guidelines, allowing for local background correction if required.</li> </ul>	Section 9.8.3 and 9.8.5. Appendix A (sections 2.5 and 10.2).
Describe the rationale for selected monitoring parameters, duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor large-scale impacts.	Appendix A (sections 2.5 and 10.2).
Develop and describe a plan for ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate	Section 9.8.5. Appendix A (sections 2.5 and 10.2).
Identify dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of the proposed project and beyond.	Section 9.8.5. Appendix A (sections 2.5 and 10.2).
<b>Water-dependent assets—context and conceptualisation</b>	
Identify water-dependent assets, including: – water-dependent fauna and flora and provide surveys of habitat, flora and fauna (including stygofauna) (see Doody <i>et al.</i> [in press]). – public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource.	Sections 9.8.3, 9.10.2, 9.12.1, 9.12.2, 9.13.4 and 9.14.2. Appendix A (section 3.2). Appendix B (sections 3.0 and 4.0). Appendix G (section 4.0). Appendix H (section 4.0). Appendix I (section 4.0).



Information requirements	Section referenced
Identify GDEs in accordance with the method outlined by Eamus <i>et al.</i> (2006). Information from the GDE Toolbox (Richardson <i>et al.</i> 2011) and GDE Atlas (CoA 2017a) may assist in identification of GDEs (see Doody <i>et al.</i> [in press]).	Sections 9.13 and 9.14. Appendix H (sections 3.0, 4.0 and 5.0).
Describe the conceptualisation and rationale for likely water-dependence, impact pathways, tolerance and resilience of water-dependent assets. Examples of ecological conceptual models can be found in Commonwealth of Australia (2015).	Section 9.14.2. Appendix H (sections 3.0, 4.0 and 5.0).
Estimate the ecological water requirements of identified GDEs and other water-dependent assets (see Doody <i>et al.</i> [in press]).	Sections 9.14.2. Appendix H (section 5.0).
Identify the hydrogeological units on which any identified GDEs are dependent (see Doody <i>et al.</i> [in press]).	Sections 9.14.2. Appendix H (section 2.0).
Provide an outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.	Sections 9.8.3 and 9.10.2. Appendix A (sections 2.6, 3.2, 3.3 and 6.0). Appendix B (sections 7.0, 8.0 and 9.0). Appendix H (section 3.0).
Describe the process employed to determine water quality and quantity triggers and impact thresholds for water-dependent assets (e.g. threshold at which a significant impact on an asset may occur).	Sections 9.8.5 and 9.10.5. Appendix A (sections 2.8.5, 3.3 and 3.1.5). Appendix B (sections 3.0 and 4.0).
<b>Water-dependant assets—impacts, risk assessment and management of risks</b>	
Provide an assessment of direct and indirect impacts on water-dependent assets, including ecological assets such as flora and fauna dependent on surface water and groundwater, springs and other GDEs (see Doody <i>et al.</i> [in press]).	Sections 9.8.4, 9.10.4, 9.13.5 and 9.14.3. Appendix A (section 7.3 and 8.0). Appendix B (sections 7.0 and 8.0). Appendix D (section 4.0). Appendix H (section 6.0). Appendix I (section 4.0).
Describe the potential range of drawdown at each affected bore, and clearly articulate of the scale of impacts to other water users	Section 9.10.4. Appendix B (section 7.0).
Indicate the vulnerability to contamination (e.g. from salt production and salinity) and the likely impacts of contamination on the identified water-dependent assets and ecological processes.	Sections 9.8.4 and 9.10.4. Appendix B (section 8.0). Appendix H (section 6.2.5).
Identify and consider landscape modifications (e.g. voids, on-site earthworks, and roadway and pipeline networks) and their potential effects on surface water flow, erosion and habitat fragmentation of water-dependent species and communities.	Sections 9.8.4, 9.10.4, 9.13.5 and 9.14.3. Appendix A (section 8.10). Appendix B (section 7.0). Appendix D (section 4.0).

Information requirements	Section referenced
Provide estimates of the volume, beneficial uses and impact of operational discharges of water (particularly saline water), including potential emergency discharges due to unusual events, on water-dependent assets and ecological processes	Sections 9.8.1 and 9.8.4. Appendix A (sections 8.3, 8.4, 8.10 and 8.14).
Assess the overall level of risk to water-dependent assets through combining probability of occurrence with severity of impact.	Sections 9.8.4, 9.10.4, 9.13.5 and 9.14.3. Appendix A (section 8.14). Appendix B (sections 7.0, 8.0 and 9.0). Appendix H (section 6.0). Appendix I (sections 4.0 and 5.0).
Identify the proposed acceptable level of impact for each water-dependent asset based on leading-practice science and site-specific data, and ideally developed in conjunction with stakeholders.	Sections 9.8.4, 9.10.4, 9.13.5 and 9.14.3. Appendix A (section 3.3). Appendix H (sections 1.3, 3.0, 4.0).
Propose mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	Sections 9.8.5, 9.10.5, 9.13.6 and 9.14.4. Appendix A (section 10.0). Appendix B (section 9.0). Appendix H (section 6.4).
<b>Water-dependant assets—data and monitoring</b>	
Identify an appropriate sampling frequency and spatial coverage of monitoring sites to establish pre-development (baseline) conditions, and test potential responses to impacts of the proposal (see Doody <i>et al.</i> [in press]).	Sections 9.8.1, 9.8.5, 9.10.3 and 9.10.5. Appendix A (sections 2.5.1 and 10.2) Appendix B (sections 3.0, 4.0 and 9.1)
Consider concurrent baseline monitoring from unimpacted control and reference sites to distinguish impacts from background variation in the region (e.g. BACI design, see Doody <i>et al.</i> [in press])	Sections 9.8.1, 9.8.5, 9.10.3 and 9.10.5. Appendix A (sections 2.5.1 and 10.2) Appendix B (sections 3.0, 4.0 and 9.1).
Develop and describe a monitoring program that identifies impacts, evaluates the effectiveness of impact prevention or mitigation strategies, measures trends in ecological responses and detects whether ecological responses are within identified thresholds of acceptable change (see Doody <i>et al.</i> [in press]).	Sections 9.8.5 and 9.10.5. Appendix B (sections 3.0, 4.0 and 9.1). Appendix G (section 6.1). Appendix H (section 6.4).
Describe the proposed process for regular reporting, review and revisions to the monitoring program.	Sections 9.8.5 and 9.10.5.
Ensure ecological monitoring complies with relevant state or national monitoring guidelines (e.g. the DSITI guideline for sampling stygofauna (Qld Government 2015).	Sections 9.8.5 and 9.10.5.

Information requirements	Section referenced
<b>Water, salt balance and water quality</b>	
Provide a quantitative site water balance model describing the total water supply and demand under a range of rainfall conditions and allocation of water for mining activities (e.g. dust suppression, coal washing etc.), including all sources and uses	Section 9.8.1. Appendix A (sections 5.4 and 6.2).
Describe the water requirements and on-site water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	Section 9.8.1. Appendix A (sections 5.3, 5.4 and 6.2).
Provide estimates of the quality and quantity of operational discharges under dry, median and wet conditions, potential emergency discharges due to unusual events and the likely impacts on water-dependent assets.	Section 9.8.4 and 9.8.5.8. Appendix A (6.2.2, 6.2.3 and 6.2.4).
Provide salt balance modelling that includes stores and the movement of salt between stores and takes into account seasonal and long-term variation.	Section 9.8.4. Appendix A (section 6.0).
<b>Cumulative impacts—context and conceptualisation</b>	
Provide cumulative impact analysis with sufficient geographic and temporal boundaries to include all potentially significant water-related impacts.	Sections 9.8.4, 9.10.4, 9.13.5, and 9.14.3. Appendix A (sections 7.3, 7.4, 7.5 and 8.14). Appendix B (sections 1.7, 7.1 and 7.2). Appendix H (section 6.3). Appendix I (section 4.0).
Consider all past, present and reasonably foreseeable actions, including development proposals, programs and policies that are likely to impact on the water resources of concern in the cumulative impact analysis. Where a proposed project is located within the area of a bioregional assessment consider the results of the bioregional assessment.	Section 9.8.4, 9.10.4, 9.13.5, and 9.14.3. Appendix A (sections 7.3, 7.4, 7.5 and 8.14). Appendix B (sections 1.7, 7.1 and 7.2). Appendix H (section 6.3). Appendix I (section 4.0).
<b>Cumulative impacts—impacts</b>	
Provide an assessment of the condition of affected water resources which includes: (a) identification of all water resources likely to be cumulatively impacted by the proposed development (b) a description of the current condition and quality of water resources and information on condition trends (c) identification of ecological characteristics, processes, conditions, trends and values of water resources (d) adequate water and salt balances, and (e) identification of potential thresholds for each water resource and its likely response to change and capacity to withstand adverse impacts (e.g. altered water quality, drawdown).	Section 9.8.4, 9.10.4, 9.13.5, and 9.14.3. Appendix A (sections 2.6, 2.7, 2.8, 3.2, 3.3 and 6.0). Appendix B (section 1.7). Appendix H (section 6.3). Appendix I (section 4.0).
Assess the cumulative impacts to water resources considering:	Section 9.8.4, 9.10.4, 9.13.5 and 9.14.3.

Information requirements	Section referenced
<p>(a) the full extent of potential impacts from the proposed project, (including whether there are alternative options for infrastructure and mine configurations which could reduce impacts), and encompassing all linkages, including both direct and indirect links, operating upstream, downstream, vertically and laterally</p> <p>(b) all stages of the development, including exploration, operations and post closure/decommissioning</p> <p>(c) appropriately robust, repeatable and transparent methods</p> <p>(d) the likely spatial magnitude and timeframe over which impacts will occur, and significance of cumulative impacts, and</p> <p>(e) opportunities to work with other water users to avoid, minimise or mitigate potential cumulative impacts.</p>	<p>Appendix B (section 1.7). Appendix H (section 6.3). Appendix I (section 4.0).</p>
<b>Cumulative impacts—mitigation, monitoring and management</b>	
<p>Identify modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts. Evidence of the likely success of these measures (e.g. case studies) should be provided</p>	<p>Section 9.8.5, 9.10.5, 9.13.6 and 9.14.4. Appendix A (section 10.0). Appendix B (section 9.1). Appendix H (section 6.4).</p>
<p>Identify measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies</p>	<p>Section 9.8.5 and 9.10.5. Appendix A (sections 2.5.1, 10.1 and 10.2). Appendix B (section 9.1). Appendix H (section 6.4).</p>
<p>Identify cumulative impact environmental objectives.</p>	<p>Section 9.8.4, 9.10.4, 9.13.5 and 9.14.3. Appendix A (sections 2.8.5 and 3.3).</p>
<p>Describe appropriate reporting mechanisms.</p>	<p>Section 9.8.5 and 9.10.5. Appendix A (sections 10.1 and 10.2). Appendix B (section 9.1).</p>
<p>Propose adaptive management measures and management responses.</p>	<p>Section 9.8.5. Appendix A (sections 10.1 and 10.2).</p>
<b>Subsidence—underground coal mine and coal seam gas</b>	
<p>Provide predictions of subsidence impact on surface topography, water-dependent assets, groundwater (including enhanced connectivity between aquifers) and the movement of water across the landscape (See CoA 2014b; CoA 2014c). Consider multiple methods of predictions and apply the most appropriate method. Consider the limitations of each method including the adequacy of empirical data and site-specific geological conditions and justify the selected method.</p>	<p>Not applicable</p>
<p>Provide an assessment of both conventional and unconventional subsidence. For project expansions, an evaluation of past or current effects of geological structures on subsidence and implications for water resources and water-dependent assets should be provided</p>	<p>Not applicable</p>

Information requirements	Section referenced
Describe subsidence monitoring methods, including the use of remote or on-ground techniques and explain the predicted accuracy of such techniques.	Not applicable
Consider geological strata and their properties (strength/hardness/fracture propagation) in the subsidence analysis and/or modelling. Anomalous and near-surface ground movements with implications for water resources and compaction of unconsolidated sediment should also be considered.	Not applicable
<b>Final Landform and Voids – Coal Mines</b>	
Identify and consider landscape modifications (e.g. voids, on-site earthworks, and roadway and pipeline networks) and their potential effects on surface water flow, erosion, sedimentation and habitat fragmentation of water-dependent species and communities.	Sections 9.4, 9.8.1, 9.8.4, 9.10.3, and 9.10.4. Appendix A (section 6.3). Appendix C (section 5.0).
Assess the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.	Section 9.8.1 and 9.10.3. Attachment 6. Attachment 7. Attachment 8.
Provide an evaluation of stability of void slopes where failure during extreme events or over the long term (for example due to aquifer recovery causing geological heave and landform failure) may have implications for water quality.	Section 9.8.4 and 9.10.4. Appendix AA (sections 3.5.4 and 3.5.6). Appendix AB.
Evaluate mitigating inflows of saline groundwater by planning for partial backfilling of final voids.	Sections 9.10.4. Appendix A (section 6.3.3). Appendix AA (section 3.3.3).
<p>Provide an assessment of the long-term impacts to water resources and water-dependent assets posed by various options for the final landform design, including complete or partial backfilling of mining voids. Assessment of the final landform for which approval is being sought should consider:</p> <ul style="list-style-type: none"> <li>(a) groundwater behaviour;</li> <li>(a) sink or lateral flow from void;</li> <li>(b) water level recovery;</li> <li>(c) rate, depth, and stabilisation point (e.g. timeframe and level in relation to existing groundwater level, surface elevation);</li> <li>(d) seepage;</li> <li>(e) geochemistry and potential impacts;</li> <li>(f) long-term water quality, including salinity, pH, metals and toxicity; and</li> <li>(g) measures to prevent migration of void water off-site.</li> </ul> <p>For other final landform options considered sufficient detail of potential impacts should be provided to clearly justify the proposed option.</p>	Section 9.10.4. Appendix A (section 6.3.4). Appendix B (section 7.0).
Assess the probability of overtopping of final voids with variable climate extremes, and management mitigations.	Section 9.10.4. Appendix A (section 6.3.4).
<b>Acid-forming materials and other contaminants of concern</b>	

Information requirements	Section referenced
Identify the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).	Section 9.8.4. Appendix E (section 3.0).
Identify the presence and volume of potentially acid-forming waste rock, fine-grained amorphous sulphide minerals and coal reject/tailings material and exposure pathways.	Section 9.8.4. Appendix E (section 3.0).
Identify other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.	Sections 9.10.2. Appendix A (section 4.0). Appendix E (section 3.0).
Describe handling and storage plans for acid-forming material (co-disposal, tailings dam, and encapsulation)	Appendix E (section 5.0).
Assess the potential impact to water-dependent assets, taking into account dilution factors, and including solute transport modelling where relevant, representative and statistically valid sampling, and appropriate analytical techniques	Sections 9.8.4 and 9.10.4. Appendix A (section 8.0).
Describe proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.	Sections 9.8.5, 9.10.5, 9.13.6 and 9.14.4. Appendix A (section 10.0). Appendix B (section 9.1). Appendix H (section 6.4).
<b>CSG well construction and operations</b>	
Describe the scale of fracturing (number of wells, number of fracturing events per well), types of wells to be stimulated (vertical versus horizontal), and other forms of well stimulation (cavitation, acid flushing)	Not applicable
Describe proposed measuring and monitoring of fracture propagation.	Not applicable
Identify water source for drilling and hydraulic stimulation and outline the volume of fluid and mass balance (quantities/volumes).	Not applicable
Describe the rules (e.g. water sharing plans) covering access to each water source used for drilling and hydraulic stimulation and how the project proposes to comply with them.	Not applicable
Quantify and describe the quality and toxicity of flowback and produced water and how it will be treated and managed.	Not applicable
Assess the potential for inter-aquifer leakage or contamination.	Not applicable
The use of drilling and hydraulic fracturing chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent with Australian Government testing guidelines (see CoA 2012; MRMMC-EPHC-NHMRC 2009)	Not applicable
Propose waste management measures (including salt and brines) during both operations and legacy after closure.	Not applicable
List the chemicals proposed for use in drilling and hydraulic stimulation including: (a) names of the companies producing fracturing fluids and associated products (b) proprietary names (trade names) of compounds (fracturing fluid additives) being produced chemical names of each additive used in each of the fluids (c) Chemical Abstract Service (CAS) numbers of each of the chemical components used in each of the fluids (d) general purpose and function of each of the chemicals used	Not applicable

Information requirements	Section referenced
(e) mass or volume proposed for use (f) maximum concentration (mg/L or g/kg) of the chemicals used (g) chemical half-life data, partitioning data, and volatilisation data (h) ecotoxicology, and (i) any material safety data sheets for the chemicals or chemical products used.	
Chemicals for use in drilling and hydraulic fracturing must be identified as being approved for import, manufacture or use in Australia (that is, confirmed by NICNAS as being listed in the Australian Inventory of Chemical Substances (see CoA 2017b).	Not applicable