

D

IESC Guidelines Table

GRASSTREE
EXTENSION PROJECT
EPBC Act Environmental Assessment Report

Appendix D IESC Guidelines Cross Reference Table

Table 1
Information Guidelines for Independent Expert Scientific Committee Advice on Coal Seam Gas and Large Coal Mining Development Proposals – Cross References to the Relevant Sections of the Grasstree Extension Project EPBC Act EAR

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Description of the proposal	
A regional overview of the proposed project area including a description of the geological basin, coal resource, surface water catchments, groundwater systems, water-dependent assets, and past, current and reasonably foreseeable coal mining and CSG developments.	<p>The project setting is described in Section 2.4 of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) Environmental Assessment Report (EAR).</p> <p>The geological setting is described in Section 2.4.8 of the EPBC Act EAR, and Sections 3.4 and 5 of the EPBC Act EAR Groundwater Report.</p> <p>The coal resource is described in Section 2.3.2 of the EPBC Act EAR.</p> <p>The surface water catchments are described in Section 6.2 of the EPBC Act EAR.</p> <p>The groundwater regime and systems are described in Section 5 of the EPBC Act EAR Groundwater Report.</p> <p>Water-dependent assets are described in Sections 5 and 6 of the EPBC Act EAR Groundwater Report, Sections 5.3, 5.4, 6.2, 6.3, 7.3 and 7.4 of the EPBC Act EAR.</p> <p>Relevant coal mining and coal seam gas activities are described in Section 2.4 of the EPBC Act EAR and Section 6.6 of the EPBC Act EAR Groundwater Report.</p>
A description of 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.	<p>Section 2 of the EPBC Act EAR describes the location, scale, duration, disturbance area of the project.</p> <p>Section 5.4 of the EPBC Act EAR and Section 6 of the EPBC Act EAR Groundwater Report describe the potential impacts on the groundwater regime and associated assets.</p> <p>Section 6.3 of the EPBC Act EAR describes the potential impacts on the surface water resources and surface water-dependent assets.</p>
A description of the statutory context, including information on the proposal's status within the regulatory assessment process and on any water management policies or regulations applicable to the proposal.	<p>Section 1 of the EPBC Act EAR provides a description of the approval status of the project.</p> <p>The take of and/or interference with groundwater (i.e. exercise underground water rights) for the project will be approved upon the grant of the Environmental Authority (EA) amendment under the Queensland <i>Environmental Protection Act 1994</i> (EP Act). The EA will include groundwater conditions which relate to the exercise of underground water rights.</p> <p>Relevant surface water policies and regulations are discussed within Section 6 of the EPBC Act EAR.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
<p>A description of how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.</p>	<p>Section 2 of the EPBC Act EAR Groundwater Report describes state and Commonwealth regulation of groundwater resources.</p> <p>Relevant regulation of surface water resources is discussed within Section 6 of the EPBC Act EAR.</p> <p>The amendment of existing EA conditions for the project will be based on the Queensland Department of Environment and Science (DES) Model Mine Conditions.</p>
Groundwater – Context and Conceptualisation	
<p>Descriptions and mapping of geology at an appropriate level of horizontal and vertical resolution including:</p> <ul style="list-style-type: none"> • definition of the geological sequence/s in the area, with names and descriptions of the formations with accompanying surface geology and cross-sections. • definitions of any significant geological structures (e.g. faults) in the area and their influence on groundwater, in particular, groundwater flow, discharge or recharge. 	<p>Sections 3.4 and 5 of the EPBC Act EAR Groundwater Report and Section 5 of the EPBC Act EAR describe the geology and hydrogeology of the project longwall mining area and its surrounds.</p>
<p>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, hydrographs and hydrochemical characteristics (e.g. acidity/alkalinity, electrical conductivity, metals, major ions). Time series data representative of seasonal and climatic cycles.</p>	<p>Sections 3.4 and 5 and Appendices I to III of the EPBC Act EAR Groundwater Report describe the depth and distribution of hydrogeological units, the groundwater levels and flow, and the groundwater quality.</p>
<p>Description of the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.</p>	<p>Groundwater recharge and flow are described in Section 5 of the EPBC Act EAR Groundwater Report.</p>
<p>Values for hydraulic parameters (e.g. vertical and horizontal hydraulic conductivity and storage characteristics) for each hydrogeological unit.</p>	<p>Hydraulic parameters are described in Section 5 and Appendices I and II of the EPBC Act EAR Groundwater Report.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
<p>Assessment of the frequency, location, volume and direction of interactions between water resources, including surface water/groundwater connectivity, inter-aquifer connectivity and connectivity with sea water.</p>	<p>Sections 5 and 6 of the EPBC Act EAR Groundwater Report and Section 5 of the EPBC Act EAR describe inter-aquifer connectivity and the potential for interaction between the groundwater regime and surface water drainage features. The coastline is located more than 120 km by direct line to the east of the project longwall mining area. The project is not predicted to result in direct impacts on sea water due to this significant distance.</p>
Groundwater – Analytical and Numerical Modelling	
<p>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.</p>	<p>Section 6.3 and Appendix II of the EPBC Act EAR Groundwater Report.</p>
<p>Identification of the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.</p>	<p>Section 6.4 and Appendix II of the EPBC Act EAR Groundwater Report.</p>
<p>Undertaken in accordance with the Australian Groundwater Modelling Guidelines, including peer review.</p>	<p>The groundwater modelling was undertaken generally in accordance with the Australian Groundwater Modelling Guidelines.</p>
<p>An explanation of the model conceptualisation of the hydrogeological system or systems, including key assumptions and model limitations, with any consequences described.</p>	<p>Sections 5, 6.2 and 6.3, and Appendix II of the EPBC Act EAR Groundwater Report.</p>
<p>Calibration with adequate monitoring data, ideally with calibration targets related to model prediction (e.g. use baseflow calibration targets where predicting changes to baseflow).</p>	<p>Section 6.3 and Appendix II of the EPBC Act EAR Groundwater Report.</p>
<p>Consideration of 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.</p>	<p>Appendix II of the EPBC Act EAR Groundwater Report.</p>
<p>Representations of each hydrogeological unit, the thickness, storage and hydraulic characteristics</p>	<p>Appendix II of the EPBC Act EAR Groundwater Report.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
of each unit, and linkages between units, if any.	
Sensitivity analysis of boundary conditions and hydraulic and storage parameters, and justification for the conditions applied in the final groundwater model.	Boundary conditions are discussed in Appendix II of the EPBC Act EAR Groundwater Report. The boundary conditions were selected to ensure that they have no significant bearing on the model outcomes.
Representation of the existing recharge/discharge pathways of the units and the changes that are predicted to occur upon commencement, throughout, and after completion of the development activities.	Appendix II of the EPBC Act EAR Groundwater Report describes the modelled recharge and discharge pathways and parameters. Sections 6.2 and 6.3, and Appendix II of the EPBC Act EAR Groundwater Report describe the modelled representation of mining effects on groundwater.
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.	Sections 4 and 5, and Appendices I and III of the EPBC Act EAR Groundwater Report describe the hydrogeological data drawn from desk study and field investigations. Uncertainty is discussed in Section 6.3 and Appendix II of the EPBC Act EAR Groundwater Report. Sections 6.2 and 6.3, and Appendix II of the EPBC Act EAR Groundwater Report note the conservatism applied in the selection of modelling parameters and the representation of subsidence effects in the groundwater model.
Incorporation of the various stages of the proposed development (construction, operation and rehabilitation) with 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.	Predictive simulations are discussed in Section 6 of the EPBC Act EAR Groundwater Report. Modelling of groundwater recovery post mining is discussed in Section 6.4 of the EPBC Act EAR Groundwater Report.
A programme for review and update of the models as more data and information become available, including reporting requirements.	Section 7 of the EPBC Act EAR Groundwater Report describes the groundwater monitoring program that will be undertaken throughout mining operations. Monitoring will be used to identify any departures from the model predictions and any such departures will be investigated to determine the likelihood of significant adverse impacts. The merit of undertaking additional groundwater modelling would be considered as part of the investigation outcomes.
Information on the time for maximum drawdown and post-development drawdown equilibrium to be reached.	Maximum drawdown will occur at the end of mining and is addressed in Section 6.4.1 and Figure 16 of the EPBC Act EAR Groundwater Report. Groundwater recovery in the post mining phase is described in Section 6.4.3 of the EPBC Act EAR Groundwater Report.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Groundwater – Impacts to Water Resources and Water-dependent Assets	
<p>An assessment of the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts:</p> <ul style="list-style-type: none"> • Description of 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. • 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. • Description of 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. • Consideration of possible fracturing of and other damage to confining layers. • For each relevant hydrogeological unit, the proportional increase in groundwater use and impacts as a consequence of the development proposal, 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. 	<p>Groundwater impacts are discussed in Section 6 of the EPBC Act EAR Groundwater Report.</p> <p>Section 6.4 of the EPBC Act EAR Groundwater Report describes the impact of mining on groundwater levels.</p> <p>Sections 6.5 and 6.6 of the EPBC Act EAR Groundwater Report describe the impacts on water resources and water-dependent assets. Dewatering and depressurisation will not affect surface topography.</p> <p>Section 6.2 of the EPBC Act EAR Groundwater Report describes the potential impacts on properties of hydrogeological units. Section 6.5.4 of the EPBC Act EAR Groundwater Report discusses the potential for groundwater contamination.</p> <p>Section 6.2 of the EPBC Act EAR Groundwater Report discusses the impacts of subsidence cracking.</p> <p>Groundwater inflow to the mine and use as mine water supply are discussed in Sections 6.4.2 of the EPBC Act EAR Groundwater Report and Section 2.6 of the EPBC Act EAR, respectively.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Description of 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.	Section 6 of the EPBC Act EAR Groundwater Report.
For each potentially impacted water resource, 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.	Section 6 of the EPBC Act EAR Groundwater Report.
Description of existing water quality guidelines and targets, environmental flow objectives and other requirements (e.g. water planning rules) for the groundwater basin(s) within which the development proposal is based.	Section 2 of the EPBC Act EAR Groundwater Report describes the relevant water quality guidelines. The take and/or interference of groundwater (i.e. exercise underground water rights) for the project will be approved upon the grant of the EA amendment under the EP Act. The amended EA will include groundwater conditions which relate to the exercise of underground water rights. There are currently no groundwater flow objectives relevant to the project.
An assessment of the cumulative impact of the proposal on groundwater when all developments (past, present and/or reasonably foreseeable) are considered in combination.	Other mines in close proximity to the project with potential for cumulative impacts are discussed in Section 6.6 of the EPBC Act EAR Groundwater Report. The modelling indicates that the project is not predicted to contribute to cumulative impacts on any groundwater-dependent assets.
Proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	The project is not predicted to result in significant adverse impacts on groundwater or groundwater-dependent assets. Section 7 of the EPBC Act EAR Groundwater Report describes the proposed groundwater monitoring program that will be implemented to identify any unexpected departures from the groundwater modelling predictions. All unexpected departures will be investigated to allow the early identification of any significant departures that could potentially result in impacts to groundwater users or other sensitive environmental features.
Description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	Refer above.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Groundwater – Data and Monitoring	
Sufficient physical aquifer parameters and hydrogeochemical data to establish pre-development conditions, including fluctuations in groundwater levels at time intervals relevant to aquifer processes.	Sections 4 and 5 and Appendices I and III of the EPBC Act EAR Groundwater Report.
Long-term groundwater monitoring, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.	Sections 4 and 5 and Appendices I and III of the EPBC Act EAR Groundwater Report.
A robust groundwater monitoring programme, utilising dedicated groundwater monitoring wells and targeting specific aquifers, providing an understanding of the groundwater regime, recharge and discharge processes and identifying changes over time.	Sections 4, 5 and 7 and Appendices I and III of the EPBC Act EAR Groundwater Report.
Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines and relevant legislated state protocols.	Sections 4 and 7 of the EPBC Act EAR Groundwater Report.
Surface Water – Context and Conceptualisation	
<p>A description of the hydrological regime of all watercourses, standing waters and springs across the site including:</p> <ul style="list-style-type: none"> • Geomorphology, including drainage patterns, sediment regime and floodplain features. • Spatial, temporal and seasonal trends in streamflow and/or standing water levels. • Spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals and metalloids and radionuclides). • Current stressors on watercourses, including impacts from any currently approved projects. 	Section 6.2 of the EPBC Act EAR and Sections 2 and 3 of the EPBC Act EAR Flood Modelling Report describe the hydrology, morphology and quality of site drainage, where relevant to the project.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
A description of the existing flood regime, including flood volume, depth, duration, extent and velocity for a range of annual exceedance probabilities, and flood hydrographs and maps identifying peak flood extent, depth and velocity.	Sections 3 and 4 of the EPBC Act EAR Flood Modelling Report.
Assessments of the frequency, volume and direction of interactions between water resources, including surface water/ groundwater connectivity and connectivity with sea water.	<p>Sections 5 and 6 of the EPBC Act EAR Groundwater Report discuss surface water-groundwater connectivity, where relevant.</p> <p>The coastline is located more than 120 km by direct line to the east of the project longwall mining area and approximately 600 km downstream of the project longwall mining area, following the line of downstream waterways. The project is not predicted to result in direct impacts on sea water due to this significant distance. The project is not predicted to give rise to significant impacts on the downstream drainage and therefore will not give rise to significant impacts on sea water 600 km downstream of the project longwall mining area.</p>
Surface Water – Analytical and Numerical Modelling	
Conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.	<p>Section 2 of the Flood Modelling Report and Section 6.2 of the EPBC Act EAR describe the conceptual surface water setting and baseline characteristics.</p> <p>Section 2.6 of the EPBC Act EAR describes the mine water management system.</p> <p>Section 7 of the EPBC Act EAR describes the conceptual interactions between ecology and surface water.</p>
Description and justification of model assumptions and limitations, and calibration with appropriate surface water monitoring data.	<p>Sections 3 and 4 of the EPBC Act EAR Flood Modelling Report describe the hydrology and hydraulic modelling.</p> <p>Section 2.6 of the EPBC Act EAR describes the mine water management system.</p>
Methods in accordance with the most recent publication of Australian Rainfall and Runoff.	Sections 2 and 3 of the EPBC Act EAR Flood Modelling Report.
An assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios.	<p>All relevant site-specific and regional information has been incorporated into the flood modelling study and used to develop conceptual and numerical models that reflect the range of hydrological characteristics exhibited within the vicinity of the project longwall mining area. On this basis, the flood model is suitable for the purposes of impact assessment and the data and assumptions do not contribute to any material level of uncertainty in the modelling predictions.</p>
A programme for review and update of the models as more data and information becomes available.	A subsidence monitoring program will be undertaken throughout longwall mining operations in accordance with the Grasstree Subsidence Management Plan (SMP), required by

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
	<p>the German Creek mining complex EA. Monitoring will be used to identify any departures from the subsidence predictions and any such departures will be investigated to determine the likelihood of significant adverse impacts on surface waters. The merit of undertaking additional flood modelling would be considered as part of the investigation outcomes.</p> <p>As discussed in Section 2.6 of the EPBC Act EAR, water balance monitoring will be conducted in accordance with the Capcoal Water Management Plan (WMP) required by the EA. In the event that monitoring results indicate a significant departure from the predicted water balance an investigation would be conducted. The merit of undertaking additional water balance modelling would be considered as part of the investigation outcomes.</p>
<p>A detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.</p>	<p>Sections 3 and 4 of the EPBC Act EAR Flood Modelling Report provide a description of the flood modelling method. Section 2.6 of the EPBC Act EAR describes the mine water management system.</p>
Surface Water – Impacts to Water Resources and Water-dependent Assets	
<p>Description of all potential impacts of the proposed project on surface waters, including 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, including:</p> <ul style="list-style-type: none"> • Impacts on streamflow under different flow conditions. • Impacts associated with surface water diversions. • Impacts to water quality, including consideration of mixing zones. • Estimates of 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. • Identification and consideration of landscape modifications, for example, subsidence, voids, onsite earthworks including disturbance of acid-forming or sodic soils, roadway and pipeline networks through effects on 	<p>Section 5 of the EPBC Act EAR Flood Modelling Report and Section 6.3 of the EPBC Act EAR describe the impacts of the project on surface drainage.</p> <p>The project will not increase the annual volume of mine water transferred to the existing German Creek water management system or require any modifications to the existing Grasstree Mine water management system. The management of mine affected water generated by the project is not anticipated to result in any significant adverse surface water impacts.</p> <p>No watercourse diversions are proposed as part of the project. The management of on-site earthworks including erosion and sediment control and the management of soils is discussed in Section 4 of the EPBC Act EAR.</p> <p>Section 7 of the EPBC Act EAR describes the impacts of the project on MNES Ecology.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
<p>surface water flow, surface water quality, erosion and habitat fragmentation of water-dependent species and communities.</p>	
<p>Existing water quality guidelines and targets, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.</p>	<p>As discussed in Section 2.6 of the EPBC Act EAR, the water management system is operated in accordance with the EA mine water discharge conditions. These EA conditions have been established in consultation with DES and include surface water quality limits and triggers, and flow limits for receiving waters applicable to the project.</p>
<p>Identified processes to determine surface water quality and quantity triggers which incorporate seasonal variation but provide early indication of potential impacts to assets.</p>	<p>Refer above.</p>
<p>Proposed mitigation actions for each trigger and identified significant impact.</p>	<p>Refer above.</p>
<p>Description and adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.</p>	<p>The site water management system is operated in accordance with the Capcoal WMP developed in accordance with the EA conditions. The plan includes a requirement for the annual review the adequacy of water management measures and amendment of any measures that are not effective in preventing or minimising impacts. Similarly, the potential impacts of subsidence on surface water will be managed in accordance with the Grasstree SMP, developed in accordance with the EA conditions. The Grasstree SMP also requires annual review the adequacy of subsidence management measures and amendment of any measures that are not effective in preventing or minimising impacts.</p>
<p>Description of the cumulative impact of the proposal on surface water resources and water-dependent assets when all developments (past, present and/or reasonably foreseeable) are considered in combination.</p>	<p>The EPBC Act EAR did not identify any potential significant cumulative impacts on water resources.</p>
<p>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.</p>	<p>Impacts on surface drainage are described in Section 5 of the EPBC Act EAR Flood Modelling Report and Section 6.3 of the EPBC Act EAR. Impacts on MNES ecology are discussed in Section 7 of the EPBC Act EAR.</p>

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Surface Water – Data and Monitoring	
Monitoring sites representative of the diversity of potentially affected water-dependent assets and the nature and scale of potential impacts, and matched with suitable replicated control and reference sites (BACI design) to enable detection and monitoring of potential impacts.	The potential impacts of subsidence on surface water will be monitored in accordance with the Grasstree SMP, developed in accordance with the EA conditions.
A surface water monitoring programme collecting sufficient data to detect and identify the cause of any changes from established baseline conditions, and assessing the effectiveness of mitigation and management measures.	A surface water monitoring program is undertaken in accordance with the Capcoal WMP developed in accordance with the EA conditions. The plan includes a requirement for the annual review the adequacy of the surface water monitoring program and amendment of the program if it is not effective in preventing or minimising impacts.
Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines and relevant legislated state protocols.	It is a standard requirement of the EHP model mine conditions that water quality monitoring is conducted in accordance with relevant standards.
The rationale for selected monitoring variables, duration, frequency and methods, including the use of satellite or aerial imagery to identify and monitor large-scale impacts.	Refer above. The project is not likely to result in any large-scale impacts on water resources.
Specified data sources, including streamflow data, proximity to rainfall stations, data record duration and a description of data methods, including whether missing data has been patched.	Section 3 of the EPBC Act EAR Flood Modelling Report.
Ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	As discussed in Section 2.6 of the EPBC Act EAR, the project will not increase the volume of mine water transferred to the existing German Creek water management system or require any modifications to the existing Grasstree Mine water management system. The mine water management system will continue to be operated in accordance with EA conditions and will not impact downstream water quality. Ecotoxicological monitoring is therefore not necessary.
Identification of dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of	A surface water monitoring program is undertaken in accordance with the Capcoal WMP developed in accordance with the EA conditions. The plan includes a requirement for the annual review the adequacy of the surface water

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
the development proposal and beyond.	monitoring program and amendment of the program if it is not effective in preventing or minimising impacts. The potential impacts of subsidence on surface water will be monitored in accordance with the Grasstree SMP, developed in accordance with the EA conditions.
Water-dependent Assets – Context and Conceptualisation	
Identification of water-dependent assets, including: <ul style="list-style-type: none"> • Water-dependent fauna and flora supported by habitat, flora and fauna (including stygofauna) surveys. • Public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource. 	The relevant environmental values of surface water are discussed in Section 6.2 of the EPBC Act EAR. Aquatic biology is addressed in Section 7.3 of the EPBC Act EAR.
An estimation of the ecological water requirements of identified GDEs and other water-dependent assets.	As discussed in Section 7.4.4 of the EPBC Act EAR, there are no groundwater dependent ecosystems (GDEs) within the project longwall mining area or its surrounds.
Identification of the hydrogeological units on which any identified GDEs are dependent.	Refer above.
Identification of GDEs in accordance with the method outlined by Eamus et al. (2006). Information from the GDE Toolbox and GDE Atlas may assist in identification of GDEs.	Refer above.
An outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.	The relevant environmental values of surface water are discussed in Section 6.2 of the EPBC Act EAR. Aquatic biology is addressed in Section 7.3 of the EPBC Act EAR. Sections 3 and 4 of the Flood Modelling Report provide a description of the flood modelling method. The mine water management system is discussed in Section 2.6 of the EPBC Act EAR.
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).	Refer above.
A description of the process employed to determine water quality and quantity triggers and impact thresholds for water-dependent assets (e.g. threshold at which a	As discussed in Section 2.6 of the EPBC Act EAR, the project will not increase the volume of mine water transferred to the existing German Creek water management system or require any modifications to the existing Grasstree Mine water management system. The mine water management system

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
significant impact on an asset may occur).	will continue to be operated in accordance with EA conditions and will not result in additional impacts on downstream water quality.
Water-dependent Assets – Impacts, Risk Assessment and Management of Risks	
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.	As discussed in Section 7.4.4 of the EPBC Act EAR, there are no GDEs within the project longwall mining area or its surrounds. Impacts on aquatic ecology are discussed in Section 7.3 of the EPBC Act EAR.
Estimates of the impact of operational discharges of water (particularly saline water), including potential emergency discharges due to unusual events, on water-dependent assets and ecological processes.	As discussed in Section 2.6 of the EPBC Act EAR, the project will not increase the volume of mine water transferred to the existing German Creek water management system or require any modifications to the existing Grasstree Mine water management system. The mine water management system will continue to be operated in accordance with EA conditions and will not result in additional impacts on downstream water quality.
A description of the potential range of drawdown at each affected bore, and a clear articulation of the scale of impacts to other water users.	As discussed in Section 6.5.2 of the EPBC Act EAR Groundwater Report, no water supply bores will be affected by the project. The project will not impact any other water users.
An assessment of the overall level of risk to water-dependent assets that combines probability of occurrence with severity of impact.	As discussed in Section 7.4.4 of the EPBC Act EAR, there are no GDEs within the project longwall mining area or its surrounds. Impacts on aquatic ecology are discussed in Section 7.3 of the EPBC Act EAR.
Indication of the vulnerability to contamination (for example, from salt production and salinity) and the likely impacts of contamination on the identified water-dependent assets and ecological processes.	The potential for groundwater contamination is discussed in Section 6.5.4 of the EPBC Act EAR Groundwater Report. As discussed in Section 2.6 of the EPBC Act EAR, the project will not increase the volume of mine water transferred to the existing German Creek water management system or require any modifications to the existing Grasstree Mine water management system. The mine water management system will continue to be operated in accordance with EA conditions and will not result in additional impacts on downstream water quality.
The proposed acceptable level of impact for each water-dependent asset based on the best available science and site-specific data, and ideally developed in conjunction with stakeholders.	Refer above.
Identification and consideration of landscape modifications (for	The effects on surface water flow and erosion are assessed in Section 6.3 of the EPBC Act EAR.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
example, voids, onsite earthworks, roadway and pipeline networks) and their potential effects on surface water flow, erosion and habitat fragmentation of water-dependent species and communities.	The impacts on MNES ecology are addressed in Section 7.3 and 7.4 of the EPBC Act EAR.
Proposed mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	As discussed in Section 6.3 of the EPBC Act EAR, there are no significant creeks or waterways traversing the project longwall mining area and drainage is limited to minor drainage lines. Subsidence of minor drainage lines will be monitored for instability in accordance with the Grasstree SMP and remedial stabilisation works will be undertaken, where necessary. Subsidence from the project mining activities is therefore not expected to have a significant impact on surface waterways.
Water-dependent Assets – Data and Monitoring	
Sampling sites at an appropriate frequency and spatial coverage to establish pre-development (baseline) conditions, and test hypothesised responses to impacts of the proposal.	Baseline and operational groundwater monitoring is discussed Sections 4, 5 and 7 of the EPBC Act EAR Groundwater Report. The Capcoal WMP includes a surface water quality monitoring program and baseline data in accordance with the EA requirements. The proposed monitoring of subsided minor drainage lines is discussed in Section 6.3 of the EPBC Act EAR. Specific monitoring locations will be determined periodically over the life of the project as part of the regular review of the Grasstree SMP.
Monitoring 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.	Refer above.
Concurrent baseline monitoring from unimpacted control and reference sites to distinguish impacts from background variation in the region (e.g. BACI design).	Refer above.
Regular reporting, review and revisions to the monitoring programme.	Groundwater, surface water and subsidence monitoring programs will be reported, reviewed and revised on a regular basis in accordance with the requirements of the EA and the associated Capcoal WMP and Grasstree SMP.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Ecological monitoring complying with relevant state or national monitoring guidelines.	Management and monitoring of potential impacts on MNES ecology will be conducted in accordance with Section 7 of the EPBC Act EAR.
Water and Salt Balance and Water Management Strategy	
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.	The site water balance is described in Section 2.6 of the EPBC Act EAR.
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.	Note that the project does not involve any additional contained catchment areas that will collect significant mine affected drainage water volumes during high rainfall conditions. As discussed in Section 2.6 of the EPBC Act EAR, the mine water management system will continue to operate as a nil discharge system, with excess mine affected water transferred to the German Creek WMS for storage in dedicated open cut pit voids, reuse as water supply in the German Creek mining complex or discharge in accordance with the German Creek mining complex EA mine water discharge conditions.
Description of water requirements and onsite water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	Refer above.
Salt balance modelling, including stores and the movement of salt between stores taking into account seasonal and long-term variation.	As discussed in Section 2.6 of the EPBC Act EAR, the quality of stored and released mine water is undertaken in accordance with the Capcoal WMP and is a requirement of the EA. This is sufficient to identify and manage the accumulation of salts within the water management system. Salt balance modelling is therefore not necessary.
Cumulative Impacts – Context and Conceptualisation	
Cumulative impact analysis with sufficient geographic and time boundaries to include all potentially significant water-related impacts.	Section 6.6 of the EPBC Act EAR Groundwater Report addresses the potential impacts of surrounding operations on the groundwater environment in the region in relation to potential cumulative impacts they may have with the project. The modelling did not predict any significant cumulative impacts on groundwater users, resources or other sensitive environmental features. The EPBC Act EAR did not identify any potential significant cumulative impacts on surface water resources.
Cumulative impact analysis identifies all past, present, and reasonably foreseeable actions, including	Refer above.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
development proposals, programs and policies that are likely to impact on the water resources of concern.	
Cumulative Impacts – Impacts	
<p>An assessment of the condition of affected water resources which includes:</p> <ul style="list-style-type: none"> • Identification of all water resources likely to be cumulatively impacted by the proposed development. • A description of the current condition and quality of water resources and information on condition trends. • Identification of ecological characteristics, processes, conditions, trends and values of water resources. • Adequate water and salt balances. • 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). 	Not applicable.
<p>An assessment of cumulative impacts to water resources which considers:</p> <ul style="list-style-type: none"> • The full extent of potential impacts from the proposed development, including alternatives, and encompassing all linkages, including both direct and indirect links, operating upstream, downstream, vertically and laterally. • An assessment of impacts considered at all stages of the development, including exploration, operations and post closure / decommissioning. • An assessment of impacts, utilising appropriately robust, repeatable and transparent methods. • Identification of the likely spatial magnitude and timeframe over which impacts will occur, and 	Refer above.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
significance of cumulative impacts. Identification of opportunities to work with others to avoid, minimise or mitigate potential cumulative impacts.	
Cumulative Impacts – Mitigation, Monitoring and Management	
Identification of modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts.	The EPBC Act EAR did not identify any potential significant cumulative impacts on water resources.
Identification of cumulative impact environmental objectives.	Refer above.
Identification of measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies.	The proposed groundwater and surface water monitoring programs would detect any significant impacts from the project including any unexpected cumulative impacts.
Appropriate reporting mechanisms.	Refer above.
Proposed adaptive management measures and management responses.	The proposed groundwater and surface water monitoring programs would identify any unexpected impacts. Any unexpected monitoring results would be investigated in accordance with the EA conditions. Where necessary, such investigations would include the identification of adaptive management measures.
Subsidence – Underground coal mines and coal seam gas	
Predictions of subsidence impact on surface topography, water-dependent assets, groundwater (including enhanced connectivity between aquifers) and movement of water across the landscape.	Section 5 of the EPBC Act EAR Subsidence Report describes the predicted subsidence effects on surface topography. Section 6.2 of the EPBC Act EAR Groundwater Report describes the impact of subsidence cracking on groundwater. Section 5 of the EPBC Act EAR Flood Modelling Report and Section 6.3 of the EPBC Act EAR describe the impacts of subsidence on surface drainage.
Description of subsidence monitoring methods, including use of remote or on-ground techniques and explanation of predicted accuracy of such techniques.	Subsidence will be monitored by high accuracy ground survey in accordance with the Grasstree SMP that is required by the EA to be prepared prior to the commencement of longwall mining in the project longwall mining area.
Consideration of geological layers and their properties (strength/hardness/fracture propagation) in subsidence modelling.	The subsidence prediction methodology is discussed in Section 4 of the EPBC Act EAR Subsidence Report.
Final Landform and Voids – Coal Mines	
Identification and consideration of landscape modifications (for example, voids, onsite earthworks,	The effects on surface water flow and erosion are assessed in the Flood Modelling Report and Section 6.3 of the EPBC Act EAR.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
roadway and pipeline networks) and their potential effects on surface water flow, erosion and habitat fragmentation of water-dependent species and communities.	The impacts on MNES ecology are addressed in Section 7 of the EPBC Act EAR.
An assessment of the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.	Section 4 of the EPBC Act EAR Subsidence Report describes the modelling of subsidence effects on the final landform. This modelling is based upon an extensive dataset and is suitable for the purposes of impact assessment. Appendix II of the EPBC Act EAR Groundwater Report confirms the adequacy of the groundwater modelling and its suitability for impact assessment. The flood modelling presented in the EPBC Act EAR Flood Modelling Report is suitable for the purposes of impact assessment.
<p>An assessment of the long-term impacts to water resources posed by various options for the final landform design, including complete or partial backfilling of mining voids, which considers:</p> <ul style="list-style-type: none"> • Groundwater behaviour – sink or lateral flow from void. • Water level recovery – rate, depth, and stabilisation point (e.g. timeframe and level in relation to existing groundwater level, surface elevation). • Seepage – geochemistry and potential impacts. • Long-term water quality, including salinity, pH, metals and toxicity. • Measures to prevent migration of void water off-site. 	The project does not involve open cut mining or the creation of a final void.
Acid Forming Materials and Other Contaminants of Concern	
Identification of the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).	Section 4.3 of the EPBC Act EAR describes the soils in the project longwall mining area. Acid sulphate soils do not occur in the project longwall mining area.
Handling and storage plans for acid-forming material (co-disposal, tailings dam, encapsulation).	The project does not involve handling of any potentially acid forming materials.
Identification of the presence and volume of potentially acid-forming waste rock and coal reject/tailings material and exposure pathways.	Refer above.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
Assessment of 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.	Refer above.
Identification of other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.	Groundwater contamination is addressed in Section 6.5.4 of the EPBC Act EAR Groundwater Report.
Description of proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.	The project does not involve any potentially acid forming materials.
Hydraulic Stimulation – Coal Seam Gas	
A description of 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 – the project does not involve hydraulic stimulation for coal seam gas extraction.
Measuring and monitoring of fracture propagation.	Refer above.
A description of the water source for hydraulic stimulation, volume of fluid and mass balance (quantities/volumes).	Refer above.
A description of the rules (e.g. water sharing plans) covering access to each water source for hydraulic stimulation and how the project proposes to comply with them.	Refer above.
Quantification of flowback water and a description of how it will be managed.	Refer above.
Potential for inter-aquifer leakage or contamination.	Refer above.
The use of chemicals should be informed by appropriately tiered deterministic and/or probabilistic hazard and risk assessments, based on ecotoxicological testing consistent	Refer above.

IESC Requirement	Cross Reference to EPBC Act EAR Documentation
with Australian Government testing guidelines.	
<p>A list of chemicals proposed for use in hydraulic fracturing including:</p> <ul style="list-style-type: none"> • names of the companies producing fracturing fluids and associated products • proprietary names (trade names) of compounds (fracturing fluid additives) being produced • chemical names of each additive used in each of the fluids • Chemical Abstract Service (CAS) numbers of each of the chemical components used in each of the fluids • general purpose and function of each of the chemicals used • mass or volume proposed for use • maximum concentration (mg / L or g / kg) of the chemicals used • chemical half-life data, partitioning data, and volatilisation data • ecotoxicology • any material safety data sheets for the chemicals or chemical products used. 	Refer above.
Chemicals for use in 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)	Refer above.