

Appendix B

IESC guidelines checklist

Table B.1 IESC Guidelines checklist of specific information needs (IESC 2015) and section where addressed in this document

Specific information needs	Section where addressed in the document
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.	2, 5, 6
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.	2.3, 10, 11, Chapter 2 of Hume Coal Project EIS (EMM 2017a)
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.	3
A description of how impacted water resources are currently being regulated under state or Commonwealth law, including whether there are any applicable standard conditions.	3
Groundwater	
Context and conceptualisation	
Descriptions and mapping of geology at an appropriate level of horizontal and vertical resolution including:	6.2
definition of the geological sequence/s in the area, with names and descriptions of the formations with accompanying surface geology and cross-sections.	6.2
definitions of any significant geological structures (eg faults) in the area and their influence on groundwater, in particular, groundwater flow, discharge or recharge.	6.2
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 (eg acidity/alkalinity, electrical conductivity, metals, major ions). Time series data representative of seasonal and climatic cycles.	6
Description of the likely recharge, discharge and flow pathways for all hydrogeological units likely to be impacted by the proposed development.	6.5, 6.6
Values for hydraulic parameters (eg vertical and horizontal hydraulic conductivity and storage characteristics) for each hydrogeological unit.	Table 8.7, Appendices H, I
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.	6.7, 7.3, Appendix H
Analytical and numerical modelling	
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.	8.6, Appendices I
Identification of the volumes of water predicted to be taken annually with an indication of the proportion supplied from each hydrogeological unit.	12
Undertaken in accordance with the Australian Groundwater Modelling Guidelines ¹⁰ , including peer review.	8.6, Appendices I, and J
An explanation of the model conceptualisation of the hydrogeological system or systems, including key assumptions and model limitations, with any consequences described.	8.6, Appendix I,
Calibration with adequate monitoring data, ideally with calibration targets related to model prediction (eg use baseflow calibration targets where predicting changes to baseflow).	8.6, Appendix I,
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.	8.6, Appendix I,

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Representations of each hydrogeological unit, the thickness, storage and hydraulic characteristics of each unit, and linkages between units, if any.	6, 8.6, Appendix I
Sensitivity analysis of boundary conditions and hydraulic and storage parameters, and justification for the conditions applied in the final groundwater model.	Appendix I
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.	6.5, 8.6, 11.1
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.	8.6, Appendices H, I
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.	Appendix I
A programme for review and update of the models as more data and information become available, including reporting requirements.	13
Information on the time for maximum drawdown and post-development drawdown equilibrium to be reached.	11.1, Appendices I, M, N
Impacts to water resources and water-dependent assets	
An assessment of the potential impacts of the proposal, including how impacts are predicted to change over time and any residual long-term impacts:	11
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.	11, Appendix I
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.	11
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.	8.7.1, 11, Appendix I
Consideration of possible fracturing of and other damage to confining layers.	<i>Hume Coal Project Hazard and Risk Assessment Report (EMM 2017e)</i>
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.	3, 12
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.	6
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.	11, Appendix I
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.	3, 12

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Specific information needs	Section where addressed in the document
An assessment of the cumulative impact of the proposal on groundwater when all developments (past, present and/or reasonably foreseeable) are considered in combination.	11
Proposed mitigation and management actions for each significant impact identified, including any proposed mitigation or offset measures for long-term impacts post mining.	12, Appendix O
Description and assessment of the adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	12
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.	4
Long-term groundwater monitoring, including a comprehensive assessment of all relevant chemical parameters to inform changes in groundwater quality and detect potential contamination events.	4, Appendix K
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.	4, 12
Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines ¹¹ and relevant legislated state protocols ¹² .	4
Surface water	
Context and conceptualisation	
A description of the hydrological regime of all watercourses, standing waters and springs across the site including:	5
Geomorphology, including drainage patterns, sediment regime and floodplain features.	5, Appendix F
Spatial, temporal and seasonal trends in streamflow and/or standing water levels.	5, Appendix F
Spatial, temporal and seasonal trends in water quality data (such as turbidity, acidity, salinity, relevant organic chemicals, metals and metalloids and radionuclides).	5, Appendix E
Current stressors on watercourses, including impacts from any currently approved projects.	5, 12
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.	5, Appendix G
Assessments of the frequency, volume and direction of interactions between water resources, including surface water/ groundwater connectivity and connectivity with sea water.	5, 6, 7
Analytical and numerical modelling	
Conceptual models at an appropriate scale, including water quality, stores, flows and use of water by ecosystems.	7, 8
Methods in accordance with the most recent publication of Australian Rainfall and Runoff ¹³ .	8
Description and justification of model assumptions and limitations, and calibration with appropriate surface water monitoring data.	8
An assessment of the risks and uncertainty inherent in the data used in the modelling, particularly with respect to predicted scenarios.	Appendix D, E, G
A programme for review and update of the models as more data and information becomes available.	13
A detailed description of any methods and evidence (e.g. expert opinion, analogue sites) employed in addition to modelling.	Appendix D, E, F, G

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Specific information needs	Section where addressed in the document
Impacts to water resources and water-dependent assets	
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:	10
Impacts on streamflow under different flow conditions.	10
Impacts associated with surface water diversions.	10
Impacts to water quality, including consideration of mixing zones.	10
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	10, Appendix D, E, F, G, and <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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 surface water flow, surface water quality, erosion and habitat fragmentation of water-dependent species and communities.	10, Appendix F, <i>Hume Coal Project Land and Soil Assessment Report</i> (EMM 2017f)
Existing water quality guidelines and targets, environmental flow objectives and requirements for the surface water catchment(s) within which the development proposal is based.	2, 5, Appendix E
Identified processes to determine surface water quality and quantity triggers which incorporate seasonal variation but provide early indication of potential impacts to assets.	8.4, 10, 13, Appendix E
Proposed mitigation actions for each trigger and identified significant impact.	13
Description and adequacy of proposed measures to prevent/minimise impacts on water resources and water-dependent assets.	13
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.	9.4, 10.4
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.	10, Appendix G
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.	4, 13
Water quality monitoring complying with relevant National Water Quality Management Strategy (NWQMS) guidelines ⁵ and relevant legislated state protocols ⁸ .	4, 13, Appendix E
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.	2, 4, Appendix D, E, F, G
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.	4, 13
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.	4, Appendix E, F
Ongoing ecotoxicological monitoring, including direct toxicity assessment of discharges to surface waters where appropriate.	-

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Identification of dedicated sites to monitor hydrology, water quality, and channel and floodplain geomorphology throughout the life of the development proposal and beyond.	4
Water-dependent assets	
Context and conceptualisation	
Identification of water-dependent assets, including:	
Water-dependent fauna and flora supported by habitat, flora and fauna (including stygofauna) surveys.	4.2.6, 5.5.2, 6.10.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Public health, recreation, amenity, Indigenous, tourism or agricultural values for each water resource.	5.4, 6.9
An estimation of the ecological water requirements of identified GDEs and other water-dependent assets.	5.5.2, 6.10.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Identification of GDEs in accordance with the method outlined by Eamus et al. (2006) ¹⁴ . Information from the GDE Toolbox ¹⁵ and GDE Atlas ¹⁶ may assist in identification of GDEs.	6.10.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Identification of the hydrogeological units on which any identified GDEs are dependent.	4.2, 6
An outline of the water-dependent assets and associated environmental objectives and the modelling approach to assess impacts to the assets.	4.2, 5.4, 5.5, 6.10, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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) ² .	4.2, 5.4, 6.10, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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 significant impact on an asset may occur).	4.2, 5.4, 6.10, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	10, 11, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	10, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	11, Appendix M, N
An assessment of the overall level of risk to water-dependent assets that combines probability of occurrence with severity of impact.	10, 11
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.	10, 11, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	9
Identification and consideration of landscape modifications (for 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.	10

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Proposed mitigation actions for each identified impact, including a description of the adequacy of the proposed measures and how these will be assessed.	13, Appendix O
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.	4.1, 4.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	4.1, 4.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Regular reporting, review and revisions to the monitoring programme.	13
Concurrent baseline monitoring from unimpacted control and reference sites to distinguish impacts from background variation in the region (e.g. BACI design).	4.1, 4.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Ecological monitoring complying with relevant state or national monitoring guidelines.	4.2, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
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.	2.3, 7, 8.2, Appendix D
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.	2.3, 7, 8.2, Appendix D
Description of water requirements and onsite water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	2.3, 7, 8.2, Appendix D
Salt balance modelling, including stores and the movement of salt between stores taking into account seasonal and long-term variation.	8.7, 11.2.1
Cumulative Impacts	
Context and conceptualisation	
Cumulative impact analysis with sufficient geographic and time boundaries to include all potentially significant water-related impacts.	10, 11, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Cumulative impact analysis identifies all past, present, and reasonably foreseeable actions, including development proposals, programs and policies that are likely to impact on the water resources of concern.	10, 11
Impacts	
An assessment of the condition of affected water resources which includes:	
Identification of all water resources likely to be cumulatively impacted by the proposed development.	5, 6
A description of the current condition and quality of water resources and information on condition trends.	5, 6
Identification of ecological characteristics, processes, conditions, trends and values of water resources.	5, 6, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
Adequate water and salt balances.	8.2, 8.7, 11.2.1

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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).	5, 6
An assessment of cumulative impacts to water resources which considers:	
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.	10, 11, <i>Hume Coal Project Biodiversity Assessment</i> (EMM 2017c)
An assessment of impacts considered at all stages of the development, including exploration, operations and post closure / decommissioning.	10, 11, Appendices D, E, F, G, I
An assessment of impacts, utilising appropriately robust, repeatable and transparent methods.	8, 10, 11,
Identification of the likely spatial magnitude and timeframe over which impacts will occur, and significance of cumulative impacts.	10, 11, Appendices D, E, F, G, I
Identification of opportunities to work with others to avoid, minimise or mitigate potential cumulative impacts.	13, Appendix O
Mitigation, monitoring and management	
Identification of modifications or alternatives to avoid, minimise or mitigate potential cumulative impacts	13, Appendix O
Identification of cumulative impact environmental objectives	9
Appropriate reporting mechanisms	13
Identification of measures to detect and monitor cumulative impacts, pre and post development, and assess the success of mitigation strategies	13
Proposed adaptive management measures and management responses	13, Appendix O
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 ^{17, 18}	8.5, 10.1.2, <i>Hume Coal Project Subsidence Assessment (Mine Advice 2016)</i>
Description of subsidence monitoring methods, including use of remote or on-ground techniques and explanation of predicted accuracy of such techniques.	<i>Hume Coal Project Subsidence Assessment (Mine Advice 2016)</i>
Consideration of geological layers and their properties (strength/hardness/fracture propagation) in subsidence modelling.	<i>Hume Coal Project Subsidence Assessment (Mine Advice 2016)</i>
Final landform and voids – coal mines	
Identification and consideration of landscape modifications (for 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.	10, Chapter 17 of <i>Hume Coal Project EIS</i> (EMM 2017a)
An assessment of the adequacy of modelling, including surface water and groundwater quantity and quality, lake behaviour, timeframes and calibration.	Appendices D, E, F, G, I, J
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:	
Groundwater behaviour – sink or lateral flow from void.	11, Appendices H, I, J
Water level recovery – rate, depth, and stabilisation point (e.g. timeframe and level in relation to existing groundwater level, surface elevation).	11, Appendices H, I, J

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Specific information needs	Section where addressed in the document
Seepage – geochemistry and potential impacts.	11, Appendix K
Long-term water quality, including salinity, pH, metals and toxicity.	10, 11, Appendices E, K
Measures to prevent migration of void water off-site.	2.3, 10, 11, 13
Acid-forming materials and other contaminants of concern	
Identification of the presence and potential exposure of acid-sulphate soils (including oxidation from groundwater drawdown).	<i>Hume Coal Project Land and Soil Assessment Report (EMM 2017f)</i>
Handling and storage plans for acid-forming material (co-disposal, tailings dam, encapsulation).	2.3, 8, 10, 11, Appendix K
Identification of the presence and volume of potentially acid-forming waste rock and coal reject/tailings material and exposure pathways.	11, Appendix K, <i>Hume Coal Project Land and Soil Assessment Report (EMM 2017f)</i>
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.	11, Appendix K
Identification of other sources of contaminants, such as high metal concentrations in groundwater, leachate generation potential and seepage paths.	6, Appendix K
Description of proposed measures to prevent/minimise impacts on water resources, water users and water-dependent ecosystems and species.	13
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).	N/A
Measuring and monitoring of fracture propagation.	N/A
A description of the water source for hydraulic stimulation, volume of fluid and mass balance (quantities/volumes).	N/A
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.	N/A
Quantification of flowback water and a description of how it will be managed.	N/A
Potential for inter-aquifer leakage or contamination.	N/A
A list of chemicals proposed for use in hydraulic fracturing including:	N/A
names of the companies producing fracturing fluids and associated products	N/A
proprietary names (trade names) of compounds (fracturing fluid additives) being produced	N/A
chemical names of each additive used in each of the fluids	N/A
Chemical Abstract Service (CAS) numbers of each of the chemical components used in each of the fluids	N/A
general purpose and function of each of the chemicals used	N/A
mass or volume proposed for use	N/A
maximum concentration (mg / L or g / kg) of the chemicals used	N/A
chemical half-life data, partitioning data, and volatilisation data	N/A
ecotoxicology	N/A
any material safety data sheets for the chemicals or chemical products used.	N/A

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The use of 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 ^{5, 19, 20}	N/A
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 ²¹).	N/A
Supporting documents:	
1. Commonwealth of Australia 2015, Bioregional Assessments, http://www.bioregionalassessments.gov.au/	
2. Commonwealth of Australia 2015, Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development, http://iesc.environment.gov.au/	
3. Commonwealth of Australia 2015, Modelling water-related ecological responses to coal seam gas extraction and coal mining, prepared by Auricht Projects and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for the Department of the Environment, Commonwealth of Australia, http://www.environment.gov.au/system/files/resources/83770681-a40b-4fa2-bf6e-8d41022873bd/files/modelling-water-related-ecological-responses-csq-extraction.pdf	
4. Commonwealth Scientific and Industrial Research Organisation 2015, Australian Climate Futures, Climate Change in Australia Projections for Australia's NRM Regions, http://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures-tool/introduction-climate-futures/	
5. Minerals Council of Australia 2012, Water Accounting Framework for the Minerals Industry User Guide, http://www.minerals.org.au/file_upload/files/resources/water_accounting/WAF_UserGuide_v1.2.pdf	
6. Environmental Protection Authority Western Australia 2013, Environmental Assessment Guideline for Environmental principles, factors and objectives, http://edit.epa.wa.gov.au/EPADocLib/EAG8-Principles-factors-objectives-RevJan2015.pdf	
7. Environmental Protection Authority Western Australia 2013, Environmental Assessment Guideline for Recommending environmental conditions, http://edit.epa.wa.gov.au/EPADocLib/EAG%2011%20Recommending%20environmental%20conditions%20130913.pdf	
8. Commonwealth of Australia 2013, Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments - impacts on water resources, http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf	
9. Barrett DJ, Couch CA, Metcalfe DJ, Lytton L, Adhikary DP and Schmidt RK 2013, Methodology for bioregional assessments of the impacts of coal seam gas and coal mining development on water resources. A report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment, Commonwealth of Australia, http://www.iesc.environment.gov.au/system/files/resources/139a0230-d4ed-43f1-b919-8c2f5f5da3d2/files/methodology-bioregional-assessments.pdf	
10. Barnett et al, 2012, Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra, http://www.groundwater.com.au/media/W1siZiIsIjIwMTIvMTAvMTcvMjFfNDZfMzZfOTYwX0F1c3RyYWxpYW5fZ3JvdW5kd2F0ZXJfbW9kZWxsaW5nX2d1aWRlbGluZXMuMucGRmIl1d/Australian-groundwater-modelling-guidelines.pdf	
11. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, 2000. Australian and New Zealand guidelines for fresh and marine water quality volume 1, http://www.environment.gov.au/system/files/resources/53cda9ea-7ec2-49d4-af29-d1dde09e96ef/files/nwqms-guidelines-4-vol1.pdf	
12. Department of Environment and Heritage Protection 2009, Monitoring and Sampling Manual 2009, Version 2, July 2013 format edits, https://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf	
13. Pilgrim, DH, (ed), Australian Rainfall & Runoff – A Guide to Flood Estimation, Institution of Engineers, Australia, Barton, ACT, 1987. Most recent version available from: http://www.arr.org.au/	
14. Eamus et al, 2006, A functional methodology for determining the groundwater regime needed to maintain the health of groundwater-dependent vegetation, Australian Journal of Botany, 2006, 54: 97–114.	
15. Richardson S, et al. 2011, Australian groundwater-dependent ecosystem toolbox part 1: assessment framework, Waterlines report, National Water Commission, Canberra, http://archive.nwc.gov.au/_data/assets/pdf_file/0006/19905/GDE-toolbox-part-1.pdf	
16. Bureau of Meteorology, 2015, Atlas of Groundwater Dependent Ecosystems, http://www.bom.gov.au/water/groundwater/gde/map.shtml	
17. Commonwealth of Australia, 2014, Subsidence from coal seam gas in Australia, Background review, http://www.environment.gov.au/water/publications/background-review-subsidence-coal-seam-gas-extraction-australia	

18. Commonwealth of Australia, 2014, *Subsidence from coal mining activities, Background review*, <http://www.environment.gov.au/water/publications/background-review-subsidence-from-coal-mining-activities>
19. Priestly B, et al. 2012, *Environmental health risk assessment: guidelines for assessing human health risks from environmental hazards*, enHealth, Canberra, [http://www.health.gov.au/internet/main/publishing.nsf/Content/A12B57E41EC9F326CA257BF0001F9E7D/\\$File/DoHA-EHRA-120910.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/A12B57E41EC9F326CA257BF0001F9E7D/$File/DoHA-EHRA-120910.pdf)
20. NRMCC-EPHC-NHMRC 2009a, *Australian Guidelines for Water Recycling (Phase 2): Managed aquifer recharge*, Natural Resource Ministerial Management Council, Environmental Protection and Heritage Council and National Health and Medical Research Council, Canberra, <http://www.environment.gov.au/system/files/resources/d464c044-4c3b-48fa-ab8b-108d56e3ea20/files/water-recycling-guidelines-mar-24.pdf>
21. Department of Health, *Australian Inventory of Chemical Substances (ACIS)*, <http://www.nicnas.gov.au/regulation-and-compliance/aics>