Appendix 1 Scope of Work

PROPOSED BICKHAM COAL MINE

SCOPE OF WATER RESOURCE ASSESSMENT AND DRAFT WATER MANAGEMENT PLAN

1) General Scope of Work

The scope of work for studies leading to preparation of a Water Resource Assessment and Draft Water Management Plan for the proposed Bickham Coal Mine project includes sufficient work to meet the requirements for assessment under Part 3A of the *Environmental Planning & Assessment Act 1979*, including requirements arising as a result of the recommendations of the draft Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley.

It is proposed to confine the groundwater resource assessment studies to areas within 3 km of the proposed open cut mine outline, as any direct hydrogeological impacts of the proposed mining operation are expected to be contained well within this distance. The studies would also consider any potential indirect hydrogeological impacts downstream or downgradient from this study area. Surface water studies would include both the Pages River and Kingdon Ponds catchments.

It is proposed that the water resource assessment would make use of up to 5.5 years of baseline surface water and groundwater monitoring data, which has been collected from the project area since the commencement of monitoring in June 2002. This includes monitoring through a range of climatic conditions, as well as a period of intense monitoring of both surface water and groundwater during the extraction of a bulk coal sample from the project site during 2004, and the subsequent recovery of groundwater levels in 2005.

The scope of work outlined below addresses principally the requirements arising as a result of the recommendations of the draft *Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley*. It is proposed that the Water Resource Assessment and draft Water Management Plan would also address the typical matters relating to groundwater, surface water and related values, that are likely to be applied by the Director-General for the overall impact assessment for this project. These requirements are not detailed here. Further, the WRA and draft WMP would also address the requirements as they relate to water resources of all other relevant legislation and policy guidelines.

2) Proposed Project Management Team and Reporting Structure

The Proponent for the project is Bickham Coal Company Pty Ltd. The Water Resource Assessment and Water Management Plan will be completed under the overall direction of Peter Dundon of Peter Dundon and Associates Pty Ltd, with contributions from a number of specialist individuals and organisations. Key individuals are also nominated to provide internal Peer Review. The study team will also consult extensively with relevant government departments during the preparation of the Water Resource Assessment and Water Management Plan.

Key individuals in the Project Management Team are as follows:

Bickham Coal Management

Director David Foster
Director John Richards

Water Study Team

Name	Organisation	Project Role
Groundwater Project Team		
Peter Dundon	Aquaterra (formerly Peter Dundon & Associates)	Study leader & hydrogeology studies
Hugh Middlemis	Aquaterra	Groundwater modelling
Paul Lambert	Parsons Brinckerhoff	Geotechnical studies
Andrew Scott	Scott Consulting Services	Microfracturing
Graham Holt	GE Holt & Associates	Geotechnical stability assessment
Rod Davis	Mining & Exploration Geology	Geology
Noel Merrick	UTS (Centre Groundwater Studies)	Peer review: groundwater
Surface Water Project Team		
Steve Perrens	Evans and Peck	Surface water studies
Martin Predavec	Parsons Brinkerhoff	Terrestrial ecology
Paul Anink	Marine Pollution Research	Aquatic ecology
Christopher Gippel	Fluvial Systems Pty Ltd	Geomorphology
Drew Bewsher	Bewsher Consulting	Peer review: surface water
Community Consultation		
Mary Diab	Parsons Brinkerhoff	Community Consultation

***Note**: Due to the length of the study a number of support sub-consultants were changed. However, the key personnel have continued throughout the study*

Key Consultations with Government Departments

Fergus Hancock — Department of Water and Energy, Hunter Region (formerly the Department of Natural Resources)

Howard Reed — Department of Planning

Department of Environment and Climate Change (formerly the Department of Environment and Conservation)

Department of Primary Industries – Minerals

Department of Primary Industries – Agriculture

3) General requirements arising as a result of the recommendations of the draft Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley

a) The proponent will prepare a full groundwater and surface Water Resource Assessment and a draft life-of-mine Water Management Plan (including water management relating to mine closure and post-mining).

b) The Water Resource Assessment and draft life-of-mine Water Management Plan will:

i) examine contained and surrounding groundwater resources within 3 km of the proposed mine, to assess the distribution of groundwater and groundwater continuity, and to confirm the groundwater salinity within the region of potential impact of the proposed mine, identify all mapped high priority groundwater resources, along with embargoed aquifers, Water Sharing Plan areas (if applicable) and outline protective mechanisms in place for these aquifers;

ii) model and assess groundwater responses to ongoing open cut de-watering and associated aquifer de-pressurisation;

iii) examine connectivity between the Pages River and alluvial and hard rock aquifers in the vicinity of the proposed mine;

iv) examine appropriate means of avoiding any significant inflow to the mine from either the alluvium of the Pages River or any protected alluvial aquifer, if required, and identify potential risks to protected aquifers (defined as "high priority embargoed aquifers") and present a mechanism to monitor impacts, detect levels of impacts against accepted trigger levels, and options for remediation of impacts which exceed nominated trigger levels;

v) examine means of minimising generation of mine wastewater, maximising use or re-use of mine wastewater, and options for the mine to achieve a "nil discharge" status;

vi) demonstrate that mitigation measures and contingency plans are capable of adequately addressing any risks to flow or water quality in Pages River as a result of mining;

vii) discuss potential final void configurations, modelled groundwater inflow for up to 100 years post mining, and post-mining management options and outcomes for any residual water resources impacts; and

viii) Report and discuss water resource concerns identified by the local community

c) The Water Resource Assessment and draft Water Management Plan will demonstrate that the proposed coal mine can be managed so as to maintain the long-term integrity of the streams, alluvial aquifers and ecosystem values of the Pages River Catchment and the Kingdon Ponds Catchment. To this end, the Assessment and draft Management Plan will demonstrate that:

i) opportunities for alternative use of excess mine wastewater, either on-site or off-site, have been fully investigated prior to any mine wastewater discharge being proposed;

ii) mine wastewater discharges (if any) will have no significant impact on the water quality of the receiving waters, and that all major water quality parameters (eg salinity, acidity, turbidity, etc) in any discharge will be consistent with maintaining the water quality of the Catchments and their associated values;

iii) any discharge will not significantly alter natural flow regimes in Pages River or the Kingdon Ponds Catchment;

iv) buffer zones have been applied between the proposed coal mine and the Pages River (and any other streams) consistent with the DNR's 'Guidelines for Management of Stream/Aquifer Systems in Coal Mining Developments – Hunter Region, April 2005';

v) areas of riparian vegetation within land owned or controlled by the proponent are protected and/or rehabilitated, so as to provide improved riverine health and improved bank stability, and to assist maintenance of healthy aquatic ecosystems; and

vi) runoff of silt or sediment will be controlled using appropriate techniques set out in "Managing Urban Stormwater: Soils and Construction" (2004).

d) The local and regional community will be consulted during the preparation of the draft Assessment and Management Plan.

4) Other specific information requirements

The following information requirements relating to surface water, groundwater and related values are likely to be applied by the Director-General for the environmental assessment for the Bickham Coal Mine.

a) Land Status/Ownership

i) Land title description and if proposal includes Crown land (eg bed of waterway) or Crown roads

ii) Land tenure (eg freehold/lease/license)

iii) Details of the registered owner/s of the property and applicant/s

b) Site Information/Survey

i) Site location with north point and scale, presented at no less than 1:10000 scale for the mining project, the length of streams to be affected and the zone between the pit(s) and the Pages River.

ii) Layout plan, set out at a scale of not less than 1:10000

iii) Survey plan of the existing site, at a scale of not less than 1:10000 for native vegetation blocks and mine pit(s) for the project

iv) Survey plan to provide cross sectional details along the mine pit(s), at sections along the Pages River and for the barrier interval between the mine pit(s) and the bed of the Pages River

v) Topographic contours at not less than 5 metre intervals

vi) Site features - watercourses, lakes, wetlands, vegetation, buildings, tracks, infrastructure etc.

vii) Details on direction of flow of surface and groundwater, water levels, high bank, low bank, major aggradation / erosion for any watercourses, flood runners, terraces and other geomorphological features

viii) Plan to identify 1: 100 year flood level

ix) Plans showing surface, watercourse bed/bank long profile and piezometric gradients, with particular emphasis on the barrier between the pit(s) and the Pages River

x) Photographs (multiple frames) across the development site, with particular emphasis on any area for which a licence, permit or approval will apply. Note: If watercourses are impacted upon in the vicinity of the development, include photographs also looking upstream and downstream at points of geomorphic change or at distances of no greater than 500 metres

xi) Layout plan to indicate the location of photographic reference points

xii) Exploration borehole survey plan, geological structure interpretation, nomination and sampling of representative core sections, geochemical sampling testing and prediction

xiii) Land capability map, soil profiling and assessment.

c) Project Description and Operational Information

i) Description of the proposed development, including all ancillary works (stormwater drainage, access crossings, roads or railway access, pipelines or other infrastructure)

ii) Operational plan detailing the ongoing operation including staging/ sequencing of the mine extraction plan, including cross sectional plans for each mine pit

iii) Geotechnical engineers report on the stability of the proposal and its influence on geological or soil terrain stability and geochemistry

iv) Erosion and Sediment Control Plan prepared in accordance the guideline manual 'Managing Urban Stormwater Soils and Construction'

v) Assessment of salinity hazards

vi) Rehabilitation plan that details the progressive and final restoration/ rehabilitation of landform, revegetation, surface water, groundwater and maintenance

vii) Monitoring program for assessment on fluvial geomorphology – with particular emphasis on the current status of the Pages River and any other affected watercourse

viii) Monitoring program for assessment of surface water

ix) Monitoring program for assessment of groundwater, with particular emphasis on volume/salinity relationships pre-mining, through mine life and to the establishment of stable trends across the site post-mine development – with verification of any groundwater modelling conducted on the site

x) Contingency plans, in the event that surface and/or ground water behaviour leads to adverse impacts not in accord with modelling predictions for the site

xi) Contingency plans linked to the monitoring program, with trigger levels nominated for assessment against current water availability and usage in the Pages River Catchment

d) Geomorphology/ Watercourses

i) Assessment of the impact of the proposal on the existing flow regime (ie flow quantity, velocity, frequency and duration) for all rainfall events up to a 100 year Average Recurrence Interval

ii) Assessment of impact on the fluvial geomorphology of the watercourse including any erosion and sedimentation likely to be caused by the development

iii) Measures to be implemented to guard against actual and potential environmental disturbances during the construction and operation of the proposal

iv) Draft water management plan, which is based on and includes appropriate engineering, geomorphic and ecosystem identification and protection principles

v) Rehabilitation principles and measures, landform reconstruction and revegetation strategies to minimise salinity recharge/discharge

e) Groundwater

i) Explain and justify the choice of groundwater model developed for the groundwater assessment including inputs, choices and ranges of parameters and strata, and sensitivity analyses of the model.

ii) Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes

iii) Details of any proposed works likely to intercept groundwater

iv) Description of different aquifer systems including their extent and inter-relationships (including inter-relationships with surface water bodies and dependent ecosystems)

v) Description of the flow directions and rates and the physical and chemical characteristics of the aquifers, including differentiation of different aquifers and aquifer characteristics (ionic speciation, hydraulic conductivities, migration rates, linkages between aquifers)

vi) Description of the potential interaction of hard rock aquifer systems on the site and alluvial groundwater connected to the Pages River, and the presence of any geological structures potentially acting as preferential pathways for groundwater transmission

vii) Details of the predicted impacts of any final landform on the groundwater regime

viii) Details of the existing groundwater users within the area of the proposal and any potential impacts on these users, including water/salt balance assessment to determine if interception of groundwater by the project will have environmental, economic and/or social benefits/disbenefits to water users, the community and the local environment

ix) Details of the predicted highest groundwater table at the development site, and the level of natural variability across the site, and anticipated changes in groundwater conditions across the project site to the limit of depressurisation as the project proceeds

x) An assessment of the quality of the groundwater for the development site

xi) Identify water application areas and method of application, and measures to address unacceptable salt accumulations across the site

xii) Details of proposed method of disposal of tailings or waste water

xiii) Details of the results of any models or predictive tools used, including inputs, sensitivity analyses, justification for any assumptions used in the development of the model(s), and general conformance with the MDBC groundwater flow modelling guidelines[1]

xiv) Specification for groundwater model performance measures

xv) Assessment of alternative configurations and engineering of final void based on 100 year model impact predictions

[1] "*Murray-Darling Basin Commission Groundwater Flow Modelling Guide", by H Middlemis, N Merrick and J Ross, October 2000.*

f) Surface Water

i) Details of any proposed surface water extraction, including purpose, location of any existing pumps, dams, diversions, cuttings and levees on the site, and expected annual extraction volumes, from both on-site interception and external sources

ii) Identify sources of surface water, proportions of flow resulting from groundwater accessions, and measures to protect and enhance ecosystem integrity, and the geomorphic integrity of affected streams above, within and below the project site

iii) Location and design specifications for all clean water diversions including channels, detention basins and outlet fixtures

iv) Location and design specifications for dirty water or contaminated water circuit including channels, detention basins and outlet fixtures

v) Provide details regarding any dirty water or contaminated discharge resulting from the proposed development

vi) Provide information on detailed water balance including inflows and imports and/or exports to and from the proposed development

vii) Details of the integrated water management system, including an assessment of changes to the water balance under a range of conditions (including 10%, 50% and 90% wet years and severe storm events)

viii) Specification for hydrological model performance measures

g) Water Storage Structures

i) Details of proposed water storage structures, including purpose, location, design specifications (crest, bywash, discharge, low flow bypass provisions)

ii) Calculation of the catchment area, water storage structure capacity (ML) and water storage surface area.

iii) Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC)

iv) Estimate the MHRDC as it changes over the life of the operations

v) Details of stream order (using the Strahler System)

vi) Estimate of evaporation rates and annual evaporation losses

vii) Details of pumps and intended extraction volumes from the water storage structure/s

viii) Details of any other persons/party to be supplied (eg. volume, rate, purpose)

ix) Identify impacts on other licence users or 'basic rights' as defined in *Water Management Act 2000*

x) Identification of potential construction / surveillance requirements of the Dam Safety Act

h) Monitoring and Management Programs

i) Details of monitoring programs, including:
- distribution of monitoring network
- frequency of monitoring
- parameters to be monitored

ii) Details of mitigation and contingency plans with respect to groundwater contamination and identification of triggers for implementation of these plans.

iii) Detail the presence of groundwater dependent ecosystems in the surrounding areas, including the identification of flora and fauna and their likely dependence on groundwater.

iv) Identification of required buffer zones for any likely groundwater dependent ecosystems.

v) Identification of auditing and reporting schedule.

5) General legislative and policy framework

The Water Resource Assessment and draft Water Management Plan will aim to demonstrate that (in respect of water resources) the proposed mine will operate in accordance with applicable legislation and natural resource management policies. It is expected that the Bickham Coal Mine proposal will be subject to environmental assessment under Part 3A of the *Environmental Planning & Assessment Act 1979.*

A list of the principal legislation administered by the Department of Planning (DoP), the Department of Water and Energy (DWE) and the Department of Environment and Climate Change (DECC), together with relevant Government natural resource management policies and gazetted Hunter Valley Water Sharing Plans appears below. The natural resource legislation listed below will be applied within the context of Part 3A of the *Environmental Planning & Assessment Act 1979.*

a) Statutory Framework

The following legislation is administered by the Department of Planning (DoP):

- *Environmental Planning & Assessment Act 1979*
- *Environmental Planning & Assessment Regulation 2000*

The following legislation is administered by the Department of Water and Energy (DWE):

- *Rivers and Foreshores Improvement Act 1948*
- *Water Act 1912*
- *Water Management Act 2000*
- *Hunter Water (Special Areas) Regulation 2003*
- *Dam Safety Act 1978*

The following legislation is administered by the Department of Environment and Climate Change (DECC):

- *Native Vegetation Conservation Act 1997*
- *Native Vegetation Act 2003*
- *Native Vegetation (Savings and Transitional) Amendment (Minimal Clearing Exemption) Regulation 2004*
- *Plantations and Reafforestation Act 1999*
- *Coastal Protection Act 1979*

Where relevant, the new roles and responsibilities of the Hunter-Central Rivers Catchment Management Authority will be considered under vegetation management legislation.

b) Water Sharing Plans

At the time of commencement of this study, there were no Water Sharing Plans gazetted or in published draft which were directly relevant to development within the Pages River Catchment.

However, if any Water Sharing Plans relevant to the Project area are drafted or gazetted prior to completion of the Water Resources Assessment and Water Management Plan, they will be considered. Two recently drafted plans / policies considered in this study include:

- Draft Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources;
- Embargo on any further Applications for Sub Surface Water Licences: Coastal Floodplain Alluvial Groundwater Sources and Highly Connected Alluvial Groundwater Sources of Coastal Catchments – Regional NSW (11 April 2008).

c) Policy Guidelines

- NSW State Rivers and Estuaries Policy
- NSW Sand and Gravel Extraction Policy for Non-Tidal Rivers
- NSW Coastal Policy
- NSW Wetlands Management Policy
- NSW Groundwater Policy Framework Document - General
- NSW Groundwater Quantity Management Policy
- NSW Groundwater Quality Protection Policy
- NSW Groundwater Dependent Ecosystem Policy
- NSW Weirs Policy
- Farm Dams Policy

The following table itemises the Department of Planning's requirements for the WRA and draft WMP, and assigns responsibilities and references to the section in this report in which each task is addressed.

Responsibilities and Section References for Tasks in DoP's Scope

Scope Section	Item	Task Description	Section Reference
3		General requirements arising as a result of the recommendations of the draft Strategic Assessment of Coal Mining Potential in the Upper Hunter Valley	
3	*a)*	*The proponent will prepare a full groundwater and surface Water Resource Assessment and a draft life-of-mine Water Management Plan (including water management relating to mine closure and post-mining).*	Part A, Part B, Part C
3	*b)*	*The Water Resource Assessment and draft life-of-mine Water Management Plan will:*	
	i)	examine contained and surrounding groundwater resources within 3 km of the proposed mine;	A3.2, B4, App 5, App6
	ii)	model and assess groundwater responses to ongoing open cut de-watering and associated aquifer de-pressurisation;	A3.4, B5, App 13
	iii)	examine connectivity between the Pages River and alluvial and hard rock aquifers in the vicinity of the proposed mine;	A3.3, B4, B6, App 4
	iv)	examine appropriate means of avoiding any significant inflow to the mine from either Pages River or any protected alluvial aquifer	A3.3, B6, C4.3
	v)	examine means of minimising generation of mine wastewater, maximising use or re-use of mine wastewater and options for the mine to achieve a "nil discharge" status;	A3.8, B8.3, C5, App 19
	vi)	demonstrate that mitigation measures and contingency plans are capable of adequately addressing any risks to flow or water quality in Pages River as a result of mining;	A3.15, B6, C4, App3
	vii)	discuss potential final void configurations, modelled groundwater inflow for up to 100 years post mining, and post-mining management options and outcomes for any residual water resources impacts;	A3.14, B5, B6.8
	viii)	report and discuss water resources concerns identified by the local community.	A2.16, B1.4
3	*c)*	*The Water Resource Assessment and draft Water Management Plan will demonstrate that the proposed coal mine can be managed so as to maintain the long-term integrity of the streams, alluvial aquifers and ecosystem values of the Pages River Catchment and the Kingdon Ponds Catchment. To this end, the Assessment and draft Management Plan will demonstrate that:*	
	i)	opportunities for alternative use of excess mine wastewater, either on-site or off-site, have been fully investigated prior to any mine wastewater discharge being proposed;	A3.8, A3.13, B8.3, C2, App 19
	ii)	mine wastewater discharges will have no significant impact on the water quality of the receiving waters and major water quality parameters in any discharge will be consistent with maintaining water quality of the Catchments;	A3.6, A3.12, B8.3, B8.6
	iii)	any discharge will not significantly alter natural flow regimes in Pages River or Kingdon Ponds;	A3.9, B8.6, C2
	iv)	buffer zones have been applied between the proposed coal mine and the Pages River consistent with the DNR's "*Guidelines for Management of Stream/Aquifer Systems in Coal Mining Developments – Hunter Region, April 2005*";	A3.5, B8.7, B8.8, App 23, App 24
	v)	areas of riparian vegetation within land owned or controlled by the proponent are protected and/or rehabilitated, so as to provide improved riverine health and improved bank stability, and to assist maintenance of healthy aquatic ecosystems; and	A3.5, C2.5, C6, C7
	vi)	runoff of silt or sediment will be controlled using appropriate techniques set out in "*Managing Urban Stormwater: Soils and Construction" (2004).*	A3.7, C5, App 25

Scope Section	Item	Task Description	Section Reference
3	*d)*	*The local and regional community will be consulted during the preparation of the draft Assessment and Management Plan.*	A3.16, B1.4
4		Other specific information requirements The following information requirements relating to surface water, groundwater and related values are likely to be applied by the Director-General for the environmental assessment for the Bickham Coal Mine.	
4	*a)*	*Land Status/Ownership*	B2.1
	i)	Land title description and if proposal includes Crown land (eg bed of waterway) or Crown roads	B2.1
	ii)	Land tenure (eg freehold/lease/license)	B2.1
	iii)	Details of the registered owner/s of the property and applicant/s	B2.1
4	*b)*	*Site Information/Survey*	
	i)	Site location with north point and scale, presented at no less than 1:10000 scale for the mining project, the length of streams to be affected and the zone between the pit(s) and the Pages River.	App 27
	ii)	Layout plan, set out at a scale of not less than 1:10000	App 27
	iii)	Survey plan of the existing site, at a scale of not less than 1:10000 for native vegetation blocks and mine pit(s) for the project	App 27
	iv)	Survey plan to provide cross sectional details along the mine pit(s), at sections along the Pages River and for the barrier interval between the mine pit(s) and the bed of the Pages River	App 27
	v)	Topographic contours at not less than 5 metre intervals	App 27
	vi)	Site features – watercourses, lakes, wetlands, vegetation, buildings, tracks, infrastructure etc.	App 27
	vii)	Details on direction of flow of surface and groundwater, water levels, high bank, low bank, major aggradation / erosion for any watercourses, flood runners, terraces and other geomorphological features	B4
	viii)	Plan to identify 1: 100 year flood level	App 27
	ix)	Plans showing surface, watercourse bed/bank long profile and piezometric gradients, with particular emphasis on the barrier between the pit(s) and the Pages River	App 20
	x)	Photographs (multiple frames) across the development site	App 2
	xi)	Layout plan to indicate the location of photographic reference points	App 2
	xii)	Exploration borehole survey plan, geological structure interpretation, nomination and sampling of representative core sections, geochemical sampling testing and prediction	App 27
	xiii)	Land capability map, soil profiling and assessment.	App 22, App 27
4	*c)*	*Project Description and Operational Information*	
	i)	Description of the proposed development, including all ancillary works	B3
	ii)	Operational plan detailing the ongoing operation including staging/ sequencing of the mine extraction plan	B3
	iii)	Geotechnical engineers report on the stability of the proposal and its influence on geological or soil terrain stability and geochemistry	App 15
	iv)	Erosion and Sediment Control Plan prepared in accordance the guideline manual *"Managing Urban Stormwater Soils & Construction"*	C5
	v)	Assessment of salinity hazards	B6.7
	vi)	Rehabilitation plan that details the progressive and final restoration/ rehabilitation of landform, revegetation, surface water, groundwater and maintenance	C7
	vii)	Monitoring program for assessment on fluvial geomorphology - with particular emphasis on the current status of the Pages River and any other affected watercourse	C3.4
	viii)	Monitoring program for assessment of surface water	C3.3
	ix)	Monitoring program for assessment of groundwater	C3.1

Scope Section	Item	Task Description	Section Reference
	x)	Contingency plans, in the event that surface and/or ground water behaviour leads to adverse impacts not in accord with modelling predictions for the site	C4
	xi)	Contingency plans linked to the monitoring program, with trigger levels nominated for assessment against current water availability and usage in the Pages River Catchment	C4
4	*d)*	*Geomorphology/ Watercourses*	
	i)	Assessment of the impact of the proposal on the existing flow regime (ie flow quantity, velocity, frequency and duration) for all rainfall events up to a 100 year Average Recurrence Interval	App 21
	ii)	Assessment of impact on the fluvial geomorphology of the watercourse including any erosion and sedimentation likely to be caused by the development	App 21
	iii)	Measures to be implemented to guard against actual and potential environmental disturbances during the construction and operation of the proposal	App 21, C3.4
	iv)	Draft water management plan, which is based on and includes appropriate engineering, geomorphic and ecosystem identification and protection principles	C2
	v)	Rehabilitation principles and measures, landform reconstruction and revegetation strategies to minimise salinity recharge/discharge	C7
4	*e)*	*Groundwater*	
	i)	Explain and justify choice of groundwater model	App 13
	ii)	Details of any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes	B5.4, B7, B8.3
	iii)	Details of any proposed works likely to intercept groundwater	C2.4
	iv)	Description of different aquifer systems including their extent and inter-relationships (including inter-relationships with surface water bodies and dependent ecosystems)	B4
	v)	Description of the flow directions and rates and the physical and chemical characteristics of the aquifers	B4
	vi)	Description of the potential interaction of hard rock aquifer systems on the site and alluvial groundwater connected to the Pages River	B4
	vii)	Details of the predicted impacts of any final landform on the groundwater regime	B6.8
	viii)	Details of the existing groundwater users within the area of the proposal and any potential impacts on these users, including water/salt balance assessment to determine if interception of groundwater by the project will have environmental, economic and/or social benefits/disbenefits to water users, the community and the local environment	B4.4, B6, App 5, App 6
	ix)	Details of the predicted highest groundwater table at the development site, and the level of natural variability across the site, and anticipated changes in groundwater conditions across the project site to the limit of depressurisation as the project proceeds	B4.6, B6.2
	x)	An assessment of the quality of the groundwater for the development site	B4.7, B4.11, B6.3
	xi)	Identify water application areas and method of application, and measures to address unacceptable salt accumulations across the site	B6.7, C4.3
	xii)	Details of proposed method of disposal of tailings or waste water	C2
	xiii)	Details of the results of any models or predictive tools used, including inputs, sensitivity analyses, justification for any assumptions used in the development of the model(s), and general conformance with the MDBC groundwater flow modelling guidelines	B5, App 13
	xiv)	Specification for groundwater model performance measures	App 13
	xv)	Assessment of alternative configurations and engineering of final void based on 100 year model impact predictions	B6.8, App 13
4	*f)*	*Surface Water*	
	i)	Details of any proposed surface water extraction, including purpose, location of any existing pumps, dams, diversions, cuttings and levees on the site, and expected annual extraction volumes, from both on-site interception and external sources	B8.3, App 19
	ii)	Identify sources of surface water, proportions of flow resulting from groundwater accessions, and measures to protect and enhance ecosystem integrity, and the geomorphic integrity of affected streams above, within and below the project site	C2, App 19, App 21

Scope Section	Item	Task Description	Section Reference
	iii)	Location and design specifications for all clean water diversions including channels, detention basins and outlet fixtures	App 19, App 25
	iv)	Location and design specifications for dirty water or contaminated water circuit including channels, detention basins and outlet fixtures	App 19, App 25
	v)	Provide details regarding any dirty water or contaminated discharge resulting from the proposed development	C2.4, App 19, App 25
	vi)	Provide information on detailed water balance including inflows and imports and/or exports to and from the proposed development	App 19
	vii)	Details of the integrated water management system, including an assessment of changes to the water balance under a range of conditions (including 10%, 50% and 90% wet years and severe storm events)	B8.3, C2, App 19
	viii)	Specification for hydrological model performance measures	App 19, App 20
4	*g)*	*Water Storage Structures*	
	i)	Details of proposed water storage structures, including purpose, location, design specifications (crest, bywash, discharge, low flow bypass provisions)	App 25
	ii)	Calculation of the catchment area, water storage structure capacity (ML) and water storage surface area.	App 25
	iii)	Calculation of the Maximum Harvestable Right Dam Capacity (MHRDC)	App 25
	iv)	Estimate the MHRDC as it changes over the life of the operations	App 25
	v)	Details of stream order (using the Strahler System)	App 25
	vi)	Estimate of evaporation rates and annual evaporation losses	App 19, App 25
	vii)	Details of pumps and intended extraction volumes from the water storage structure/s	App 19, App 25
	viii)	Details of any other persons/party to be supplied (eg. volume, rate, purpose)	C2.4, App 19,
	ix)	Identify impacts on other licence users or 'basic rights' as defined in Water Management Act 2000	App 6
	x)	Identification of potential construction / surveillance requirements of the Dam Safety Act	App 25
4	*h)*	*Monitoring and Management Programs*	
	i)	Details of monitoring programs, including frequency of monitoring, distribution of monitoring network, -parameters to be monitored	C3
	ii)	Details of mitigation and contingency plans with respect to groundwater contamination and identification of triggers for implementation of these plans.	C4
	iii)	Detail the presence of groundwater dependent ecosystems in the surrounding areas.	B4.12, B6.5, B8.9, B8.10, App 23, App 24
	iv)	Identification of required buffer zones for any likely groundwater dependent ecosystems.	C2.5
	v)	Identification of auditing and reporting schedule.	C8