

Final Terms of Reference for the Bloodwood Creek Underground Coal Gasification Project Environmental Impact Statement (EIS)

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Background

Carbon Energy Limited (CEL) and its wholly owned subsidiary Carbon Energy (Operations) Pty Ltd (CEOps) is seeking approval to develop a large-scale syngas production facility and an associated electrical power generation station at the Bloodwood Creek project site located on mineral development licence (MDL) 374, which is approximately 40 kilometres west of Dalby. Syngas is a mixture of carbon monoxide (CO), hydrogen (H₂), methane (CH₄) and ethene (C₂H₄).

CEOps has lodged an application for a mining lease (MLA 50253) over part of MDL374 and an application for an environmental authority. The total area within ML50253 would be approximately 1,344 ha.

The project that is subject to this environmental impact statement (EIS) process would use proprietary underground coal gasification (UCG) technology owned by CEL to produce syngas with an energy content of approximately 40 petajoules (PJ). The production of approximately 40 PJ per year of syngas would consume approximately 2 million tonnes (Mt) of coal per year on ML50253, which has a suitable coal resource of at least 100 Mt.

A portion of the total syngas production would be used as fuel to generate up to 30MW of electricity by gas-powered engines and alternators located on the mining lease. The balance of the syngas may be used as feedstock for a number of potential industrial processes, which may include the production of ammonia, fertiliser, explosives or methanol, or the supply of methane to an LNG facility. The quantity of syngas that would be produced at the Bloodwood Creek site would depend on the demand for uses other than power generation, and the viability of those potential uses is dependent on various commercial and other considerations to be assessed at a later time. The production rate of approximately 40PJ of syngas to be assessed in this EIS would allow sufficient capacity for anticipated industrial uses. However, as the actual uses are not yet known, this EIS will only address the underground coal gasification process and the potential generation of 30MW of power on the mining lease. Any application to develop additional facilities that would use the syngas would require separate environmental assessment at that time.

CEOps is currently operating an initial UCG demonstration trial at Bloodwood Creek that is producing syngas. The trial has demonstrated that the technology allows control over the gasification process to vary the content of the gases within the syngas production stream, depending on the required end-use of the syngas. As part of the initial demonstration trial, a small 5 MW power station is currently producing power using syngas as the fuel.

The project to be assessed in the EIS would expand UCG to approximately 40 operational panels at any one time to produce syngas. Specific features of the proposed project are:

- multiple UCG panels joined in parallel feeding into a surface facility, which would clean and compress the gas before delivery to a pipeline for industrial users or directly to a power generation plant
- a nominal 30MW electrical power generation plant fuelled by syngas.
- carbon dioxide (CO₂) separation, which would upgrade the quality of the syngas. An assessment of the alternatives for CO₂ sequestration will be undertaken at this stage.

The Queensland Government has issued the Underground Coal Gasification Policy (Feb 2009). The policy allows certain pilot projects to proceed, including Carbon Energy's current trial on MDL374. However, the policy also states that an expert panel will review the outcomes of the pilot projects and advise the government before they decide on the future viability of the underground coal gasification industry in Queensland. Consequently, whatever the findings of the EIS for the project covered by these terms of reference, progression to a mining lease and subsequent implementation of the project will also be determined by the outcomes of the review process in the Underground Coal Gasification Policy.

CONTENT OF THE EIS

Executive summary

The function of the executive summary is to convey the most important aspects and options relating to the project to the reader in a concise and readable form. It should use plain English and avoid the use of jargon and esoteric terms. The structure of the executive summary should follow that of the EIS, and focus strongly on the key issues and conclusions.

Glossary of terms

A glossary of technical terms, acronyms and abbreviations shall be provided before the main text of the EIS.

1 Introduction

The function of the introduction is to explain why the EIS has been prepared and what it sets out to achieve. In particular, the introduction should address the level of detail of information required to meet the level of approval being sought. It should also define the audience to whom it is directed, and contain an overview of the structure of the document. Throughout the EIS, factual information contained in the document should be referenced.

1.1 Project proponent

Provide details of the project proponents, including details of any joint venture partners.

1.2 Project description

A brief description of the key elements of the project should be provided and illustrated. Any major associated infrastructure requirements should also be summarised. Detailed descriptions of the project should follow in section 3.

1.3 Project objectives and scope

A statement of the objectives leading to the development of the proposal and a brief outline of the events leading up to the proposal's formulation, including alternatives, envisaged time scale for implementation and project life, anticipated establishment costs and actions already undertaken within the project area.

Describe the current status of the project and outline the relationship of the project to other developments or actions that may relate whether or not they have been approved. The consequences of not proceeding with the project should also be discussed.

1.4 The environmental impact statement (EIS) process

The purpose of this section is to make clear the methodology and objectives of the environmental impact statement under the *Environmental Protection Act 1994*.

1.4.1 Methodology of the EIS

This section should provide a description of the EIS process steps, timing and decisions to be made for relevant stages of the project. A brief description should be provided of studies or surveys that have been undertaken for the purposes of developing the project and preparing the EIS. This should include reference to relevant baseline studies or investigations undertaken previously. This section should also indicate how the consultation process (which will be described in detail in section 1.5) would integrate with the other components of the impact assessment, including the stages, timing and mechanisms for public input and participation.

The information in this section is required to ensure:

- relevant legislation is addressed
- readers are informed of the process to be followed
- stakeholders are aware of any opportunities for input and participation.

1.4.2 Objectives of the EIS

Having described the methodology of the EIS, a succinct statement should be made of the EIS objectives. The structure of the EIS can then be outlined as an explanation of how the EIS will meet its objectives. The reader should be able to distinguish the EIS as the key environmental document providing advice to decision makers considering approvals for the project.

While the terms of reference provide guidance on the scope of the EIS studies, they should not be seen as exhaustive or limiting. It is important for proponents and their consultants to recognise that there cannot be perfect knowledge in advance of undertaking an EIS of what the EIS studies may find.

If it transpires during the preparation of the EIS that previously unforeseen matters not addressed in the terms of reference are found to be relevant to the assessment of impacts of the proposal, those matters should be included in the EIS.

In addition, it is essential that the main text of the EIS should address all relevant matters concerning environmental values, impacts on those values and proposed mitigation measures. No relevant matter should be raised for the first time in an appendix or the draft environmental management plan (EM plan).

The depth and scope of the assessment in the EIS will need to be commensurate with the values to be impacted and the scale of the impacts. When considering whether an impact is or is not significant, the proponent should take account of both the intensity of the impact and the context in which it would occur.

The EIS is a public document. Its purpose is to provide information to regulatory agencies as well as to inform the public of the scope, impacts and mitigation measures of the proposal. As such, the main text should be written in plain English avoiding jargon as much as possible. Additional technical detail may be provided in appendices. The main text should not assume that a reader would have prior knowledge of the project site. It should not be necessary for the reader to have visited the site to understand the issues involved in the proposal.

In brief, the EIS objectives should be to provide public information on the need for and likely effects of the project, to set out acceptable standards and levels of impacts (both beneficial and adverse) on environmental values, and demonstrate how environmental impacts can be managed through the protection and enhancement of the environmental values. Discussion of options and alternatives and their likely relative environmental management outcomes is a key aspect of the EIS.

The role of the EIS in providing the project's draft EM plan should also be discussed, with particular reference to the EM plan's role in providing management measures that can be carried over into conditions that would attach to any approval(s), environmental authorities and permits for the project.

1.4.3 Submissions

The reader should be informed as to how and when public submissions on the draft EIS can be made, and how they will be addressed and taken into account in the decision-making process.

1.5 Public consultation process

An appropriate public consultation program is essential to the impact assessment. This section should outline the methodology that will be adopted to identify and mitigate socio-economic impacts of the project. Information about the consultation that has already taken place and the results of such consultation should be provided.

The submission of a list of affected persons and interested persons as well as a statement of how the proponent proposes to consult with those persons is a statutory requirement of the EIS process in the *Environmental Protection Act 1994* (see section 41). Similar requirements, though non-statutory, are usually applied to EIS processes under other state legislation.

The public consultation program should provide opportunities for community involvement and education. It may include interviews with individuals, public meetings, interest group meetings, production of regular summary information and updates, and other consultation mechanisms to encourage and facilitate active public consultation.

The public consultation process should identify broad issues of concern to local community and interest groups and should continue from project planning through commissioning, project operations and final decommissioning. Refer to the DERM guideline: Issue Identification and Community Consultation.

1.6 Project approvals

1.6.1 Relevant legislation and policy requirements

This section should explain the legislation and policies controlling the approvals process. Reference should be made to the Queensland *Environmental Protection Act 1994*, *Sustainable Planning Act 2009* and other potentially relevant Queensland laws. Any requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* should also be included.

The EIS should identify all environmentally relevant activities that would be undertaken at the project site, including those that would otherwise require a development approval if the project were not covered by an environmental authority for a mining or petroleum activity.

If any potentially relevant legislation (such as the *Water Act 2000* for taking water, the *Nature Conservation Act 1992* for protected wildlife, or the *Vegetation Management Act 1999* for clearing) is not applicable, this section of the EIS should explain why.

Local government planning controls, local laws and policies applying to the development should be described, and a list provided of the approvals required for the project and the expected program for approval of applications.

This information is required to assess how the legislation applies to the proposal, which agencies have jurisdiction, and whether the proposed impact assessment process is appropriate.

Underground Coal Gasification Policy 18 February 2009

The Queensland Government's Underground Coal Gasification Policy is intended to provide the UCG pilot projects currently underway with the opportunity to assess the technical, environmental and commercial viability of the technology. Under this policy, the Carbon Energy pilot project at Bloodwood Creek is one of three underground coal gasification projects that are authorised to undertake trials.

The EIS can, and should, support the intent of the policy and provide relevant information to the expert panel that will evaluate the UCG industry. The EIS should not only address the requirements in this terms of reference, but also should address any relevant matters identified through the expert review of the three pilot studies undertaken under the policy.

It should be noted that regardless of the findings of the EIS for the project subject to these Terms of Reference (ToR), progression to a mining lease and subsequent implementation of the project will also be determined by the outcomes of the review process in the Underground Coal Gasification Policy.

1.6.2 Planning processes and standards

This section should discuss the project's consistency with existing land uses or long-term policy framework for the area (e.g. as reflected in local and regional plans), and with legislation, standards, codes or guidelines available to monitor and control operations on site. This section should refer to all relevant state and regional planning policies. This information is required to demonstrate how the proposal conforms to state, regional and local plans for the area.

1.7 Accredited process for controlled actions under Commonwealth legislation

As the proponent considers that the Bloodwood Creek UCG Project is unlikely to impact on matters of national environmental significance it has not been referred to the Commonwealth's Department of Environment and Heritage under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC). Consequently, these terms of reference do not address matters of national environmental significance.

2 Project need and alternatives

2.1 Project justification

The justification for the project should be described, with particular reference made to the economic and social benefits, including employment and spin-off business development, which the project may provide. The status of the project should be discussed in a regional, state and national context.

2.2 Alternatives to the project

This section should describe feasible alternatives, including conceptual, technological and locality alternatives to the project, and discuss the consequences of not proceeding with the project. Alternatives should be discussed in sufficient detail to enable an understanding of the reasons for preferring certain options and courses of action and rejecting others. Comparative environmental impacts of each alternative should be summarised.

The interdependencies of the proposal components should be explained, particularly in regard to how each of any industrial developments, or various combinations of industrial developments, and any infrastructure requirements relate to the viability of the proposal. Should water supply, power, transport and/or storage infrastructure be included as an element of the proposal, this section should include a description of, and rationale for, such infrastructure.

Reasons for selecting the preferred options should include technical, commercial, social and natural environment aspects. In particular, the principles of environmentally sustainable development (ESD) and sustainable development should be included. The relationship of options chosen for waste management and any emissions produced should be detailed.

This information is required to assess why the scope of the proposal is as it is and to ensure that the ESD principles and sustainable development aspects have been considered and incorporated during the scoping and planning of the proposal.

3 Description of the project

The objective of this section is to describe the project through its lifetime of construction and operation and decommissioning. This information is required to allow assessment of all aspects of a proposal including all phases of the proposal from planning, construction and operation through to decommissioning. It also allows further assessment of which approvals may be required and how they may be managed through the life of the proposal. Maps or figures showing the position of features or boundaries should use latitudes and longitudes on the GDA94 datum. Latitudes and longitudes on the GDA94 datum should also be used in the text to describe the locations of any features (such as discharge points) or boundaries that may be relevant to subsequent approvals.

3.1 Location

3.1.1 Regional context

The regional context of the proposal should be described and illustrated on maps at suitable scales.

3.1.2 Local context

The local context of the proposal should be described and include real property descriptions of the project site and adjacent properties. Maps at suitable scales should be provided showing the precise location of the project area, and in particular:

- the location and boundaries of land tenures, in place or proposed, to which the project area is or will be subject
- the location and boundaries of the project footprint showing all key aspects including excavations, stockpiles, areas of fill, watercourses, plant locations, water storages, buildings, bridges, culverts, hardstands, car parks, etc
- the location of any proposed buffers surrounding the working areas.

This section should include a rectified air photo enlargement (preferably A3 size) to illustrate components of the project in relation to the land and mining tenures and natural and built features of the area.

3.2 Construction

The extent and nature of the project's construction phase should be described. The description should include the type and methods of construction, the construction equipment to be used and the items of plant to be transported onto the construction site. Any staging of the proposal should be described and illustrated showing site boundaries, development sequencing and timeframes. The estimated numbers of people to be employed in the project construction phase should also be provided with a description of where those people may be accommodated and/or how they will be transported to the site.

3.3 Operations

The location and nature of the processes to be used should be described in the text and illustrated with maps, diagrams and artist's impressions as required. Operational issues to be addressed should include, but may not be limited to:

- a description of plant and equipment to be employed
- the capacity of plant and equipment
- chemicals to be used.

Concept and layout plans should be provided highlighting proposed buildings, structures, plant and equipment associated with the processing operation. The nature, sources, location and quantities of all materials to be handled, including the storage and stockpiling of raw materials, should be described.

Indicative process flow-sheets should be provided showing material balances for the processing plant, and the anticipated rates of inputs, along with similar data on products, wastes and recycle streams.

3.3.1 Tenements and tenures

Describe and illustrate any existing mining tenements and petroleum tenures overlying and adjacent to the project site, and any to be applied for this project.

3.3.2 Resource base and mine life

Summarise the results of studies and surveys undertaken to identify the mineral and natural resources required to implement the proposal (further detail should be provided in section 4.2.1.2, Geology). The location, volume, tonnage and quality of natural resources required should be described (e.g. land, water, timber, energy, etc). Specific details should be provided of the following:

- the proposed mine life and an outline of the coal/mineral resource base including the total thickness, extent and competency of seams
- the planned recovery of resources
- locations of any resources that would be sterilised by the planned activities
- the quantity of coal to be mined annually including any proposed ramping of production or staging of development.

3.3.3 Mining methods and equipment

Specific details should be provided of the following:

- the mining type and methods to be used including the major equipment to be used in the various components of the operation
- the use of different techniques in areas of different topographic or geo-technical character
- chemicals to be used including hydraulic fluids.

The description should refer to, and be complemented by, the figures previously presented in section 3.3.1 showing the locations of key aspects of the project. Additional figures should be provided if required.

3.3.4 Mine sequencing

Specific details should be provided of the following:

- the proposed sequence and timing of mining of each seam within the mining lease
- the area disturbed at each major stage of the project.

3.3.5 Workforce

Information should be provided on the workforce numbers to be employed in the facility's operations during its various phases (construction, commissioning, operation and decommissioning) and stages. The EIS should also provide a description of where those people may be accommodated and/or how they will be transported to the site. Comment should be made on the anticipated basis of employment (permanent, contract, etc).

3.3.6 Processing and products

This section should describe the quantities and characteristics of the products produced on an annual basis. Indicative process flow-sheets should be provided showing material balances for the processing plant, and the anticipated rates of inputs, along with similar data on products, wastes and recycle streams.

3.3.7 Ongoing evaluation and exploration activities

This section should describe the extent and nature of any proposed ongoing exploration or geological/geo-technical evaluation within the project area that may be required over the life of the project.

3.4 Product handling

Describe and show on plans at an appropriate scale the proposed methods and facilities to be used for product storage and for transferring product from the processing plant to the storage facilities and from the storage

facilities to the transport facilities. Include discussion of any environmental design features of these facilities including bunding of storage facilities.

3.5 Infrastructure requirements

This section should provide descriptions, with concept and layout plans, of requirements for constructing, upgrading or relocating all infrastructure with the project. The locations of any necessary infrastructure easements should be shown on the plan. The matters to be considered include such infrastructure as roads, rail, bridges, tracks and pathways, dams and weirs, bore fields, power lines and other cables, wireless technology (e.g. microwave telecommunications), and pipelines for any services (whether underground or above).

3.5.1 Transport—road/rail/air/ship

Provide an overview of the arrangements for the transport of plant, equipment, products, wastes and personnel during both the construction phase and operational phases of the project. The description should cover the use of existing facilities and all requirements for the construction, upgrading or relocation of any transport related infrastructure.

3.5.2 Energy

The EIS should describe all energy requirements including electricity, natural gas, and/or solid and liquid fuel requirements for the construction and operation of the proposal. The locations of any easements should be shown on the infrastructure plan. Energy conservation should be briefly described in the context of any Commonwealth, State and local government policies.

3.5.3 Water supply and storage

The EIS should provide information on water usage and storage by the project, including the quality and quantity of all water supplied to, or captured at, the site. In particular, the proposed and optional sources of water supply should be described (e.g. bores, process water, any surface storages such as dams and weirs, municipal water supply pipelines). The quantity of water, by source, should be specified for both the construction and operational phases of the project.

Estimated rates of supply from each source (average and maximum rates) should be given. Any proposed water conservation and management measures should be described.

Determination of potable water demand should be made for the project, including the temporary demands during the construction period. Details should be provided of any existing town water supply to meet such requirements. If water storage and treatment is proposed on site, for use by the site workforce, then this should be described.

3.5.4 Stormwater drainage

A description should be provided of the proposed stormwater drainage system and the proposed disposal arrangements, including any off-site services. The description should be illustrated using figures with contours at suitable intervals (1 m contours in areas of low relief) showing drainage pathways and the locations and discharge points of sediment detention basins and any other stormwater quality improvement devices.

3.5.5 Sewerage

This section should describe, in general terms, the sewerage infrastructure required by the project. If it is intended that industrial effluent or relatively large amounts of domestic effluent are to be discharged into an existing sewerage system, an assessment of the capacity of the existing system to accept the effluent should be provided in section 4.4 Waste. For industrial effluent, this should include detail of the physical and chemical characteristics of the effluent(s).

3.5.6 Telecommunications

The EIS should describe any impacts on existing telecommunications infrastructure (such as optical cables, microwave towers, etc) and identify the owners of that infrastructure.

3.5.7 Accommodation and other infrastructure

A description should be provided of any other developments directly related to the project not described in other sections, such as:

- camps, townships or residential developments
- fuel storage areas
- equipment hardstand and maintenance areas
- technical workshops and laboratories.

3.6 Waste management

Provide an inventory of all wastes to be generated by the proposal during the construction, operational and decommissioning phases of the project. In addition to the expected total volumes of each waste produced, include an inventory of the following per unit volume of product produced:

- the tonnage of raw materials processed
- the amount of resulting process wastes
- the volume and tonnage of any reusable by-products.

Schematic diagrams, which for the operational phase may be simplified versions of those provided in section 3.3, should be provided for each distinct stage of the project (e.g. construction/site preparation, commissioning, operation and decommissioning). These should indicate the processes to be used and highlight their associated waste streams (i.e. all waste outputs: solid, liquid and gaseous) including recycling efforts, such as stockpiling and reusing topsoil. The schematic diagrams, or an associated table, should cross-reference the relevant sections of the EIS where the potential impacts and mitigation measures associated with each waste stream are described. The physical and chemical characteristics of waste material from the process plant should be provided.

Having regard for best practice waste management strategies and the Environmental Protection (Waste Management) Policy 2000 (EPP(Waste)), the proposals for waste avoidance, reuse, recycling, treatment and disposal should be described in the appropriate subsection below. Information should also be provided on the variability, composition and generation rates of all waste produced at the site and processing plant.

Cleaner production waste management planning should be detailed especially as to how these concepts have been applied to preventing or minimising environmental impacts at each stage of the proposal. Details on natural resource use efficiency (e.g. energy and water), integrated processing design, co-generation of power and by-product reuse as shown in a material/energy flow analysis should be presented.

This information is required to enable the resource management agencies and other stakeholders to assess the efficiency of resource use, and allocation issues.

3.6.1 Air emissions

Describe in detail the quantity and quality of all air emissions (including particulates, fumes and odours) from the project during construction and operation. Particulate emissions include those that would be produced by any industrial process, or disturbed by wind action on stockpiles and conveyors, or by transportation equipment (e.g. trucks, either by entrainment from the load or by passage on unsealed roads).

The methods to be employed in the mitigation of impacts from air emissions should be described in section 4.6 Air.

3.6.2 Production waste

Describe the waste materials left underground by the coal gasification process. This should include the types and quantities of products that would remain when the gasification process is completed, including any materials that are pumped down to the coal seam to assist in the process.

The physical and chemical characteristics of the waste products as well as whether there will be any further reaction and change in these products after the gas production is complete should be described. Details of the

fate of this waste material should be described particularly in terms of movement and contamination of groundwater, emissions to air or seepage into adjoining strata.

Any issues associated with the long term underground storage (e.g. changes due to oxidation, etc) of this material should also be identified.

3.6.3 Solid waste disposal

Describe the quantity and quality of solid wastes (other than waste rock and subsoil addressed in other sections) and the proposed methods of their disposal. The proposed location, site suitability, dimensions and volume of any landfill, including its method of construction, should be shown.

3.6.4 Liquid waste

A description should be presented of the origin, quality and quantity of wastewater and any immiscible liquid waste originating from the project other than that addressed in previous sections. Particular attention should be given to the capacity of wastes to generate acid, and saline or sodic wastewater. A water balance for the proposal and processing plant is required to account for the estimated usage of water.

The EIS may need to consider the following effects:

- water separated from generated syngas
- rainfall directly onto disturbed surface areas
- run-off from roads, plant and industrial areas, chemical storage areas
- drainage (i.e. run-off plus any seepage or leakage)
- seepage from other waste storages
- water usage for:
 - process use
 - dust suppression
 - domestic purposes
- evaporation
- domestic sewage treatment – disposal of liquid effluent and sludge
- water supply treatment plant – disposal of wastes.

3.7 Rehabilitation and decommissioning

This section should describe the options, strategies and methods for progressive and final rehabilitation of the environment disturbed by the proposal. The strategic approach to progressive and final rehabilitation should be described. A preferred rehabilitation strategy should be developed with a view to minimising the amount of land disturbed at any one time. The final topography of any excavations, waste areas and dam sites should be shown on maps at a suitable scale.

The strategies and methods presented for progressive and final rehabilitation of disturbed areas should demonstrate compliance with the objectives of the DERM guideline 18, Rehabilitation Requirements for Mining Projects and the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (1995) except where superseded by guideline 18. In particular, the strategies and methods should have the following objectives:

- Mining and rehabilitation should aim to create a landform with land use capability and/or suitability similar to that prior to disturbance unless other beneficial land uses are pre-determined and agreed.
- Disturbed land should be rehabilitated to a condition that is self-sustaining or to a condition where the maintenance requirements are consistent with an agreed post-mining land use.

- Surface and ground waters that leave the lease should not result in the contamination and degradation of water quality. Current and future water quality affected by the project should be at levels that maintain environmental values.
- Proposals for the long-term monitoring of groundwater quality after decommissioning should be included in the EIS.

The means of decommissioning the proposal, in terms of the removal of plant, equipment, structures and buildings should be described, and the methods proposed for the stabilisation of the affected areas should be given. Information should be provided regarding decommissioning and rehabilitation of the plant site, removal of processing plant, rehabilitation of concrete footings and foundations, hardstand areas and storage tanks (including any potential for reuse of these facilities). Options and methods for the disposal of wastes from the demolition of plant and buildings should be discussed in sufficient detail for their feasibility and suitability to be established.

Describe any proposals to divert creeks during operations and, if applicable, the reinstatement of the creeks after operations have ceased. Where dams are to be constructed, proposals for the management of these structures after the completion of the project should be given. Also, the final drainage and seepage control systems and long-term monitoring plans should be described.

A description of topsoil management should consider transport, storage and replacement of topsoil to disturbed areas. The minimisation of topsoil storage times (to reduce fertility degradation) should also be addressed.

Detail of the impacts of the preferred rehabilitation strategy should be discussed in the appropriate subsections of section 4 (Environmental values and management of impacts) particularly with regard to such issues as final landform stability (section 4.2.2) and rehabilitation of flora (section 4.8.2). Implications for the long-term sustainable use and fate of the site should also be addressed, particularly with regard to the on-site disposal of waste and the site's inclusion on the environmental management register or contaminated land register.

4 Environmental values and management of impacts

The functions of this section are to:

- Describe the existing environmental values of the area that may be affected by the proposal. Environmental values are defined in section 9 of the *Environmental Protection Act 1994*, environmental protection policies and other documents such as the Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 guidelines and South East Queensland Regional Water Quality Management Strategy. Environmental values may also be derived following recognised procedures, such as described in the ANZECC 2000 guidelines. Environmental values should be described by reference to background information and studies, which should be included as appendices to the EIS.
- Describe the potential adverse and beneficial impacts of the proposal on the identified environmental values. Any likely environmental harm on the environmental values should be described.
- Describe any cumulative impacts on environmental values caused by the proposal, in combination with other existing and planned development or sources of contamination within 200 km of the project site, or that may materially contribute to the cumulative impacts of this project. The location and impacts of other existing relevant activities, and proposed activities, should be identified on maps at a suitable scale. Diagrams and other visual aids should be used, where possible, to describe the impacts.
- Propose environmental protection objectives and commitments. All environmental protection commitments must be measurable and auditable.
- Examine viable alternative strategies for managing impacts. These alternatives should be presented and compared in view of the stated objectives and standards to be achieved. Available techniques, including best practice, to control and manage impacts to the nominated objectives should be discussed. This section should detail the environmental protection measures to be used in the planning, construction, operations, rehabilitation and decommissioning stages of the project and any associated works. Measures should prevent, or where prevention is not possible, minimise environmental harm and maximise socio-economic and environmental benefits of the proposal. Preferred measures should be identified and described in more detail than other alternatives.
- Describe any computational model used to make predictions of impacts and/or outcomes of mitigation measures. The description should address the inputs, assumptions, limitations, sensitivities, accuracy and precision of the model.

Any maps or figures showing the position of features or boundaries should use latitudes and longitudes on the GDA94 datum. Latitudes and longitudes on the GDA94 datum should also be used in the text to describe the locations of any features (such as discharge points) or boundaries that may be relevant to subsequent approvals.

Environmental protection objectives may be derived from legislative and planning requirements that apply to the proposal including Commonwealth strategies, state planning policies, local authority strategic plans, environmental protection policies under the *Environmental Protection Act 1994*, and any catchment management plans prepared by local water boards or land care groups. Special attention should be given to those mitigation strategies designed to protect the values of any sensitive areas and any identified ecosystems of high conservation value within the area of possible proposal impact.

This section should address all elements of the environment (such as land, water, air, waste, noise, nature conservation, cultural heritage, social and community, health and safety, economy, hazards and risk) in a way that is comprehensive and clear. To achieve this, the following issues should be considered for each environmental value relevant to the project:

- Environmental values affected: describe the existing environmental values of the area to be affected including values and areas that may be affected by any cumulative impacts (refer to any background studies in appendices – note such studies may be required over several seasons). It should be explained how the environmental values were derived (e.g. by citing published documents or by following a recognised procedure to derive the values).
- Impact on environmental values: describe quantitatively the likely impact of the proposal on the identified environmental values of the area. The cumulative impacts of the proposal must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the

impacts. In particular relevant state planning policies, environmental protection policies, national environmental protection measures and integrated catchment management plans should be addressed.

- Cumulative impacts on the environmental values of land, air and water and cumulative impacts on public health and the health of terrestrial and aquatic ecosystems must be discussed in the relevant sections. This assessment may include air and water sheds affected by the proposal and other proposals competing for use of the local air and water sheds.
- Where impacts from the proposal will not be felt in isolation to other sources of impact, it is recommended that the proponent develop consultative arrangements with other industries in the proposal's area to undertake cooperative monitoring and/or management of environmental parameters. Such arrangements should be described in the EIS.
- Environmental protection objectives: describe qualitatively and quantitatively the proposed objectives for enhancing or protecting each environmental value. Include proposed indicators to be monitored to demonstrate the extent of achievement of the objective as well as the numerical standard that defines the achievement of the objective (this standard must be auditable). The measurable indicators and standards can be determined from legislation, support policies and government policies as well as the expected performance of control strategies. Objectives for progressive and final rehabilitation and management of contaminated land should be included.
- Control strategies to achieve the objectives: describe the control principals, proposed actions and technologies to be implemented that are likely to achieve the environmental protection objectives; include designs, relevant performance specifications of plant. Details are required to show that the expected performance is achievable and realistic.
- Environmental offsets: information is required to show that measures have been taken to avoid and minimise potential adverse impacts of the proposal. Environmental offsets may be proposed to counterbalance any remaining loss of environmental values, consistent with the specific-issue offset policies under the framework of the Queensland Government Environmental Offset Policy 2008.
- Monitoring programs: describe the monitoring parameters, monitoring points, frequency, data interpretation and reporting proposals.
- Auditing programs: describe how progress towards achievement of the objectives will be measured, reported and whether external auditors will be employed. Include scope, methods and frequency of auditing proposed.
- Management strategies: describe the strategies to be used to ensure the environmental protection objectives are achieved and control strategies implemented, such as by a continuous improvement framework, including details of corrective action options, reporting (including any public reporting), monitoring, staff training, management responsibility pathway, and any environmental management systems and how they are relevant to each element of the environment.
- Information quality: information given under each element should also state the sources of the information, how recent the information is, how any background studies were undertaken (e.g. intensity of field work sampling), how the reliability of the information was tested, and what uncertainties (if any) are in the information.

It is recommended that the final ToR and the EIS follow the heading structure shown below. The mitigation measures, monitoring programs, etc identified in this section of the EIS should be used to develop the environmental monitoring program for the project (see section 5).

4.1 Climate

This section should describe the rainfall patterns (including magnitude and seasonal variability of rainfall), air temperatures, humidity, wind (direction and speed) and any other special factors (e.g. temperature inversions) that may affect management of the proposal including air quality within the region of the proposal. Extremes of climate (droughts, floods, cyclones, etc) should also be discussed with particular reference to water management at the proposal site. The vulnerability of the area to natural or induced hazards, such as floods and bushfires, should also be addressed. The relative frequency and magnitude of these events should be considered together with the risk they pose to management of the project.

The potential impacts due to climatic factors should be addressed in the relevant sections of the EIS. The impacts of rainfall on soil erosion should be addressed in section 4.2. The impacts of storm events on the capacity of waste containment systems (e.g. site bonding and stormwater management) should be addressed in section 4.5 with regard to contamination of waterways and in section 4.4 with regard to the design of the waste containment systems. The impacts of winds, rain, humidity, and temperature inversions on air quality should be addressed in section 4.6.

4.2 Land

4.2.1 Description of environmental values

This section describes the existing environment values of the land area that may be affected by the proposal. It should also define and describe the objectives and practical measures for protecting or enhancing land-based environmental values, describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.2.1.1 Topography/geomorphology

The topography of the proposal site and any other potentially impacted area should be detailed with contours at suitable increments, shown with respect to Australian Height Datum (AHD) and drafted to the GDA 94 datum. Significant features of the locality should be included on the maps. Such features would include any locations subsequently referred to in the EIS (e.g. the nearest noise sensitive locations) that are not included on other maps in section 4.2. Commentary on the maps should be provided highlighting the significant topographical features.

4.2.1.2 Geology

The EIS should provide a description, map and a series of cross-sections of the geology of the proposal area, with particular reference to the physical and chemical properties of surface and sub-surface materials and geological structures within the proposed areas of disturbance. This should include areas outside the project site that could be influenced by the project's activities. Geological properties that may influence ground stability (including seismic activity, if relevant), occupational health and safety, rehabilitation programs, or the quality of wastewater leaving any area disturbed by the proposal should be described. In locations where the age and type of geology is such that significant fossil specimens (such as dinosaurs or their tracks) may be uncovered during construction/operations, the EIS should address the potential for significant finds.

4.2.1.3 Mineral resources and ore reserves

The EIS should provide a summary of the results of studies and surveys undertaken to identify and delineate the mineral resources and ore reserves within the project area (including any areas underlying related infrastructure).

The location, tonnage and quality of the mineral resources and ore reserves within the project area should be described in detail as indicated below and, for coal projects, where possible it should be presented on a 'seam by seam' basis and include the modifying factors and assumptions made in arriving at the estimates. The mineral resources and ore reserves should be estimated and reported in accordance with the Australasian Code for Reporting of Mineral Resources and Ore Reserves (the Joint Ore Reserves Committee (JORC) Code - available at www.jorc.org) and the principles outlined in the Australian Guidelines for the Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves (available at www.jorc.org/pdf/coalguidelines.pdf) as appropriate.

In addition, appropriately scaled maps should be provided showing the general location of the project area, and in particular:

- the location and a real extent of the mineral resources to be developed or mined
- the location and boundaries of mining tenures, granted or proposed, to which the project area is, or will be subject
- the location of the proposed mine excavation(s)
- the location and boundaries of any project sites
- the location and boundaries of any other features that will result from the proposed mining including waste/spoil dumps, water storage facilities and other infrastructure

- the location of any proposed buffers, surrounding the working areas
- Any part of the resource not intended to be mined and any part of the resource that may be sterilised by the proposed mining operations or infrastructure.

4.2.1.4 Soils

A soil survey of the sites affected by the proposal should be conducted at a scale of 1:25000 (or more detailed), with particular reference to the physical and chemical properties of the materials that will influence erosion potential, storm water run-off quality, rehabilitation and agricultural productivity of the land. Information should also be provided on soil stability and suitability for construction of proposal facilities.

Soil investigations should include a broad scale, desktop assessment followed by a detailed site-specific program of soil sampling and analysis. Soil profiles should be mapped and described according to the Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain), Guidelines for Surveying Soil and Land Resources (McKenzie et al. 2nd Ed., 2008) and Australian Soil Classification (Isbell, 2002). Soils should be described and matched to soils identified in the technical report Understanding and Managing Soils in the Murilla, Tara and Chinchilla Shires, Land Management Manual QE96001 (1996), Queensland Government.

Detailed on-ground surveys and laboratory analyses should be conducted to provide physical and chemical analysis of soil types. Areas to be disturbed should be investigated and mapped more intensively than other areas within the project site.

4.2.1.5 Land use

The EIS should provide a description of current land tenures and land uses, including native title issues, in the proposal area, with particular mention of land with special purposes. The location and owner/custodians of native title in the area and details of native title claims should be shown.

Maps at suitable scales showing existing land uses and tenures, and the proposal location, should be provided for the entire proposal area and surrounding land that could be affected by the development. The maps should identify areas of conservation value in any locality that may be impacted by the proposal. The location of existing dwellings and the zoning of all affected lands according to any existing town or strategic plan should be included.

An assessment should be made of the agricultural land suitability for each identified soil type in accordance with the Guidelines for Agricultural Land Evaluation in Queensland (Dept of Primary Industries. 1990), Planning Guidelines: The Identification of Good Quality Agricultural Land (DPI, DHLGP, 1993) and the State Planning Policy 1/92: Development and the Conservation of Agricultural Land. Reference should also be made to land management studies carried out on the Western Downs.

Provide a land suitability map of the proposed and adjacent area, and setting out land suitability and current land uses, e.g. for grazing of native and improved pastures and horticulture. Land classified as good quality agricultural land in DERM's land classification system is to be shown in accordance with the planning guideline, The Identification of Good Quality Agricultural Land, which supports State Planning Policy 1/92.

4.2.1.6 Infrastructure

The location and owner/custodians of all tenures, reserves, roads and road reserves, railways and rail reserves, stock routes and the like, covering the affected land should be shown on maps of a suitable scale. Indicate locations of gas and water pipelines, power lines and any other easements. Describe the environmental values affected by this infrastructure.

4.2.1.7 Sensitive environmental areas

The proximity of the proposal to any environmentally sensitive areas should be shown on a map of suitable scale. This section of the EIS should then identify whether any of those environmentally sensitive areas could be affected, directly and indirectly, by the proposal.

In particular, the EIS should indicate if the land affected by the proposal is, or is likely, to become part of the protected area estate, or is subject to any treaty. Consideration should be given to national parks, conservation parks, declared fish habitat areas, wilderness areas, aquatic reserves, heritage/historic areas or items, national estates, world heritage listings and sites covered by international treaties or agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA), areas of cultural significance and scientific reserves (see section 4.9 for further guidance on sensitive areas).

In addition, the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* should be addressed and a determination should be made whether there are national environmentally significant matters relevant to this section that should be described.

4.2.1.8 Landscape character

This section should describe in general terms the existing character of the landscape that will be affected by the proposal. It should comment on any changes that have already been made to the natural landscape since European settlement. It should 'set the scene' for the description of particular scenic values in the following section on visual amenity. The difference being that this section describes the general impression of the landscape that would be obtained while travelling through and around it, while the visual amenity section addresses particular panoramas and views (e.g. from constructed lookouts, designated scenic routes, etc) that have amenity value.

4.2.1.9 Visual amenity

This section should describe existing landscape features, panoramas and views that have, or could be expected to have, value to the community whether of local, regional, statewide, national or international significance. Information in the form of maps, sections, elevations and photographs is to be used, particularly where addressing the following issues:

- identification of elements within the proposal and surrounding area that contribute to their image of the town/city as discussed in the any local government strategic plan - city image and townscape objectives and associated maps
- major views, view sheds, existing viewing outlooks, ridgelines and other features contributing to the amenity of the area, including assessment from private residences in the affected area along the route
- focal points, landmarks (built form or topography), gateways associated with project site and immediate surrounding areas, waterways, and other features contributing to the visual quality of the area and the project site
- character of the local and surrounding areas including character of built form (scale, form, materials and colours) and vegetation (natural and cultural vegetation) directional signage and land use
- identification of the areas of the proposal that have the capacity to absorb land use changes without detriment to the existing visual quality and landscape character
- the value of existing vegetation as a visual screen.

4.2.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing the land-based environmental values identified through the studies outlined in the previous section. It should describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.2.2.1 Resource utilisation

With regard to resource stewardship, the EIS should analyse the effectiveness of the mining proposal in achieving the optimum utilisation of the mineral resources within the project area and consider its impacts on other resources. It should demonstrate that the mining proposal will 'best develop' the mineral resources within the project area, minimise resource wastage and avoid any unnecessary sterilisation of these or any other of the state's coal, mineral, and petroleum (including gas and coal seam methane) resources that may be impacted upon or sterilised by the mining activities or related infrastructure.

The EIS should provide detail on how the company plans to manage low grade or currently uneconomic material to ensure that non-sterilisation of this significant potential future resource is considered. The EIS should detail the basis for any non-stockpiling or sterilisation of currently uneconomic material. This section should also provide maps of expected residual or remnant resources within the project area.

4.2.2.2 Land use suitability

The potential for the construction and operation of the proposal to change existing and potential land uses of the proposal site and adjacent areas should be detailed. Post operations land use options should be detailed including suitability of the area to be used for primary production, industry or nature conservation. The factors

favouring or limiting the establishment of those options should be given in the context of land use suitability prior to the proposal and minimising potential liabilities for long-term management.

The potential environmental harm caused by the proposal on the adjacent areas currently used for agriculture, urban development, recreation, tourism, other business and the implications of the proposal for future developments in the impact area including constraints on surrounding land uses should be described. If the development adjoins or potentially impacts on good quality agricultural land, then an assessment of the potential for land use conflict is required. Investigations should follow the procedures set out in the planning guideline, The Identification of Good Quality Agricultural Land, which supports State Planning Policy 1/92.

Outline incompatible land uses, whether existing or potential, adjacent to all aspects of the project. This should include essential and proposed ancillary developments or activities, and areas directly or indirectly affected by the construction and operation of these activities should be identified and measures to avoid unacceptable impacts defined.

4.2.2.3 Subsidence

The EIS should provide:

- a comprehensive discussion of surface subsidence predictions due to the project. The discussion should include a full description of the methodology and include an assessment of the reliability of the predictions
- maps with 0.5 m contour increments or less and at a scale appropriate for assessment of surface subsidence changes and their impacts
- a description of mitigation measures proposed to deal with any significant impacts that would result from subsidence..

4.2.2.4 Land disturbance

A strategy should be developed that will minimise the amount of land disturbed at any one time. The strategic approach to progressive rehabilitation of landforms and final decommissioning should be described with particular regard to the impacts in the short, medium and long timeframes. The methods to be used for the proposal, including backfilling, covering, re-contouring, topsoil handling and revegetation, should be described. However, a description of erosion and sediment control could be deferred to section 4.2.2.6. Any proposals to disturb land that would impede or divert overland flow or waterways, and any subsequent reinstatement, during construction or operations should be first described in this section. However, the potential impacts of interfering with flow on the quantity and quality of water resources should be assessed in section 4.5. Also, the final drainage and seepage control systems and any long-term monitoring plans should be described.

In addition to assessing the operational phase of land disturbance, the EIS should address the ultimate changes following implementation of the decommissioning and rehabilitation plan described in section 3.7. The EIS should detail the proposed long-term changes that will occur to the land after mining ceases compared to the situation before mining commences. Those changes should be illustrated on maps at a suitable scale and with contours at intervals sufficient to assess the likely drainage pattern for ground and surface waters (though the assessment of the impacts on drainage and water quality should be provided in the water resources section of the EIS). The mitigation measures for land disturbance to be used on decommissioning the site should be assessed in sufficient detail to decide their feasibility.

Rehabilitation success criteria for land disturbance should be proposed in this section while rehabilitation success criteria for revegetation should be proposed in the section on nature conservation.

4.2.2.5 Land contamination

The EIS should describe the possible contamination of land from aspects of the proposals including waste, reject product, the storage and use of process water e.g. dust suppression and in process plants, and spills at chemical and fuel storage areas.

The means of preventing land contamination should be addressed. Methods proposed for preventing, recording, containing and remediating any contaminated land should be outlined. Intentions should be stated concerning the classification (in terms of the Queensland contaminated land register) of land contamination on the land, processing plant site and product storage areas after proposal completion.

A preliminary site investigation (PSI) of the site consistent with DERM's Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland should be undertaken to determine background contamination levels. The results of the PSI should be summarised in the EIS and provided in detail in an appendix.

If the results of the preliminary site investigation indicate potential or actual contamination, a detailed site investigation progressively managed in accordance with the stages outlined in Appendix 5 of the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland should be undertaken.

In short, the following information may be required in the EIS:

- mapping of any areas listed on the environmental management register or contaminated land register under the *Environmental Protection Act 1994*
- identification of any potentially contaminated sites not on the registers which may need remediation
- a description of the nature and extent of contamination at each site and a remediation plan and validation sampling.

The EIS should address management of any existing or potentially contaminated land in addition to preventing and managing land contamination resulting from project activities. The Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland can be downloaded from the DERM website at: www.derm.qld.gov.au/ecoaccess/contaminated_land/guidelines_and_information_sheets/. Proponents should refer study proposals to DERM for review prior to commencement.

4.2.2.6 Erosion and stability

For all permanent and temporary landforms, possible erosion rates and management techniques should be described. For each waste rock and soil type identified, erosion potential (wind and water) and erosion management techniques should be outlined. An erosion-monitoring program, including rehabilitation measures for erosion problems identified during monitoring, should also be outlined. Mitigation strategies should be developed to achieve acceptable soil loss rates, levels of sediment in rainfall runoff and wind-generated dust concentrations.

The report should include an assessment of likely erosion and stability effects for all disturbed areas such as:

- areas cleared of vegetation
- waste dumps
- stockpiles
- dams, banks and creek crossings
- the plant site, including buildings
- access roads or other transport corridors
- drill core holes
- pipelines.

Methods proposed to prevent or control erosion should be specified and should be developed with regard to (a) preventing soil loss in order to maintain land capability/suitability, and (b) preventing significant degradation of local waterways by suspended solids. Erosion control measures should be developed into an erosion and sediment control plan for inclusion in the EM plan.

4.2.2.7 Landscape character

Describe the potential impacts of the project landscape character of the site and the surrounding area. Particular mention should be made of any changes to the broad-scale topography and vegetation character of the area.

Details should be provided of measures to be undertaken to mitigate or avoid the identified impacts.

4.2.2.8 Visual amenity

This section should analyse and discuss the visual impact of the proposal on particular panoramas and outlooks. It should be written in terms of the extent and significance of the changed skyline as viewed from places of residence, work and recreation, from road, cycle and walkways, from the air and other known vantage points day and night, during all stages of the project as it relates to the surrounding landscape. The assessment is to address the visual impacts of the project structures and associated infrastructure, using appropriate simulation. Sketches, diagrams, computer imaging and photos are to be used where possible to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations.

Special consideration is to be given to public roads, public thoroughfares and places of residence or work, which are within the line-of-sight of the project.

Detail should be provided of all management options to be implemented and how these will mitigate or avoid the identified impacts.

4.2.2.9 Lighting

Management of the lighting of the project, during all stages, is to be provided, with particular reference to objectives to be achieved and management methods to be implemented to mitigate or avoid:

- the visual impact at night
- night operations/maintenance and effects of lighting on fauna and residents
- the potential impact of increased vehicular traffic
- changed habitat conditions for nocturnal fauna and associated impacts.

4.3 Transport

The transport section of the EIS should have separate subsections describing infrastructure associated with the various modes of transport, such as road, rail, pipeline, conveyor, air and sea.

4.3.1 Description of existing infrastructure and values

Provide details of existing infrastructure that is proposed to be used for the transport of materials, products or wastes to and from the project site. The EIS should provide details of any assets within the jurisdiction of any transport authority that could be impacted by the project. Also provide details, either in the transport section of the EIS or by cross reference to other sections, of the environmental values that would be affected by the altered use of existing transport infrastructure or the construction of new or altered infrastructure.

For road, rail or conveyor transport, describe separately and in detail the existing networks that would be used by the project. The description should cover any local roads and stock routes potentially affected by the project. Provide illustrations of the networks at suitable scales.

In relation to air transport, describe the existing air fields and associated infrastructure that would be used by the project.

In relation to the importation or export of materials and products, the EIS should identify any port that would be used by the project. Details should be provided of those ports, including: the berths to be used; the size and types of vessels that the berths can accommodate; the typical turnaround time for vessels; and the associated infrastructure that moves and stores materials between the ships and the rail and/or road networks.

4.3.2 Potential impacts and mitigation measures

For each mode of transport and each phase of the project, the EIS should describe the:

- proposed construction, realignment, structural alteration or changed use of any access and haul roads, conveyor easements, rail loops and load-out facilities, and rail crossings (over or under the track) used by any transport associated with the project
- expected volumes and weights of materials, products, hazardous goods or wastes
- types and size of vehicles, rolling stock, vessels and craft to be used
- likely number and timing of trips.

The EIS must address the impacts of any new, single-user transport infrastructure that would transport materials to, or product from, the project, even if that infrastructure would be built and operated by a third party. Such infrastructure would include any rail or conveyor system used to transport materials or product to and from the mine site. The EIS must also address any impacts on common user transport infrastructure and its surrounding environment that may be due to increased traffic from the project.

The EIS should provide sufficient information to make an independent assessment of how transport infrastructure will be affected by each phase of the project at a local and regional level. Similarly, sufficient information should be provided to make an independent assessment of how transport used by the project will

impact on environmental values. In both cases, the impacts along the whole length of each affected route should be discussed and measures proposed to avoid or mitigate the impacts. The assessment should address access to and use of the state road network.

Details should be provided of the:

- results of any modelling of transport impacts
- assessment methodology used, including a summary of consultation undertaken with transport authorities regarding the scope of the impact assessment and methodology to be used
- base data assumptions, including an assessment of the current condition of the affected network and its performance
- adequacy of access to the state road network to accommodate project related traffic
- possible interruptions to transport operations
- likelihood and nature of spills of products or hazardous materials during transport, prevention measures to be used, and the requirements for dealing with any spills.

The EIS should assess any impacts on stock routes due to the projects activities. Mitigation measures should be proposed for any disruptions to movement of travelling stock on stock routes. This section of the EIS should also outline, and cross-reference to more detailed descriptions with the EIS, the impacts of transport associated with the project on amenity, human health and ecological values as a result of dust, noise, vibration and any other environmental effects.

The assessment of road impacts should be in accordance with the latest version of the Department of Transport and Main Road's Guidelines for Assessment of Road Impacts of Development, available from the website: www.mainroads.qld.gov.au. Provide details of any heavy or oversized loads, including the number and type of vehicles, with a description of the likely timing and routes of those loads highlighting any vulnerable bridges or other structures along the proposed routes. Also provide details of the likely traffic to be generated by workforce personnel and service providers.

In relation to road impacts, the EIS should include an assessment of impacts on:

- the safety, efficiency and condition of road operations and assets, including driver fatigue
- existing or proposed road networks, for example, road closures, and construction or upgrading of alternative routes
- any existing or proposed pedestrian cycle networks
- any existing public transport networks (assets and services)
- watercourses and overland flows, and their interaction with the current and future road network (note: impacts on water values due to transport infrastructure should be outlined in the transport section of the EIS and cross-referenced to a detailed assessment in the water resources section).

The assessment of impacts on the rail network itself, or on environmental values affected by changes in rail traffic (e.g. due to dust, noise and vibration) should also consider the following matters:

- the likely size of trains and the number of train paths needed to move materials, products or wastes to or from the project site
- new or altered rail transport infrastructure to meet demand from the project
- impacts on rail freight and other transport services (e.g. variability on existing train path availability)
- impacts on passenger transport and services
- impacts at interface points with other private and public transport pathways such as roadway level crossings or occupational crossings (i.e. those crossings which form part of private access pathways to and from residential or business sites)
- the requirements for any approvals needed for rail crossings by roads or other infrastructure.

In relation to the importation or export of materials and products, the EIS should identify any aspects of the project that will increase the shipment of materials through any port. Details should be provided of the likely size and number of additional vessels that would use the port.

In relation to air transport, describe the new, and/or altered air fields and associated infrastructure that would be needed for the project. Describe the likely additional number of flights, frequency, timing (particularly any increase in night arrivals or take-offs), and size of aircraft. Describe any features of the project that could impact on air transport (e.g. the placement of waste dumps, stacks or flares beneath flight paths).

The EIS should assess any impacts on environmental values due to the need to redevelop or construct new airfields; and any impacts on amenity due to increased air traffic. The proposal and assessment should have regard to State Planning Policy 1/02: Development in the Vicinity of Certain Airports and Aviation Facilities. With regard to air safety, matters to be assessed include the raising of landforms or the construction of stacks, flares or lighting within flight paths.

If the works that could result in impacts, or the associated mitigation works for identified impacts, are the responsibility of the proponent then the EIS should fully assess those impacts, detail the mitigation works and carry the environmental protection commitments forward into the project's EM plan.

If the proponent will not be responsible for the works associated with the impacts, the EIS should clearly identify the entity that will be responsible and what approvals would be needed. Nevertheless, in this case, the EIS should provide enough assessment of the likely impacts of all associated activities for the regulatory authorities to have confidence that approval of the project, subject to this EIS process, would not have unacceptable flow-on impacts due to necessary works farther down the transport chain.

The proponent should detail measures to avoid or mitigate impacts on each transport mode. The mitigation measures should ensure the safety, efficiency and condition of each mode is maintained. These mitigation measures are to be prepared by the proponent in close consultation with the relevant transport authorities. Any residual impacts that cannot be avoided should be identified and quantified.

Mitigation strategies must include:

- consideration of any transport authority's works program and forward planning
- proposed construction plans of all required transport infrastructure works in accordance with relevant and accepted authority standards and practices
- the responsible parties for any works
- estimates of costs
- details on the timing of the works
- a summary of relevant approvals and legislative requirements needed to implement mitigation strategies and transport infrastructure works required by the project.

4.4 Waste

This section should complement other sections of part 4 of the EIS by providing technical details of waste treatment and minimisation, with proposed emission, discharge and disposal criteria, while other sections describe how those emissions, discharges and disposals would impact on the relevant environmental values. The purpose of this format is to concentrate the technical information on waste management into one section in order to facilitate its transfer into the EM plan.

4.4.1 Description of environmental values

This section should introduce and briefly describe the existing environment values that may be affected by the project's wastes. Refer to each of the waste streams described in section 3.6 and provide references to more detailed descriptions of the relevant environmental values in other sections of part 4 of the EIS.

4.4.2 Potential impacts and mitigation measures

The purpose of this section is to bring together a description of the preferred methods (and discuss any alternatives) to be used to deal with waste streams and outline their impacts. The full description of the magnitude and nature of impacts on particular environmental values due to the management of waste should be provided in the relevant sections of part 4 of the EIS.

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values from impacts by wastes, describes how nominated quantitative standards and indicators may be achieved for waste management, and how the achievement of the objectives will be monitored, audited and managed.

As part of the description, and unless issues related to excavated waste have been addressed in section 4.2 (in which case reference should be made to the appropriate subsection), this section should provide details of each waste in terms of:

- operational handling and fate of all wastes including storage
- on-site treatment methods proposed for the wastes
- methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes
- hazards associated with the handling and storage of wastes
- the potential level of impact on environmental values
- proposed discharge/disposal criteria for liquid and solid wastes
- measures to ensure stability of the dumps and impoundments should be described
- methods to prevent, seepage and contamination of groundwater from stockpiles and/or dumps should be given
- design criteria to be used to ensure that waste containment and/or storage facilities perform satisfactorily
- market demand for recyclable waste (where appropriate) should be addressed
- waste minimisation techniques processes proposed
- decommissioning of the site.

Having regard to the EPP(Waste), the EIS should indicate the results of investigation into the feasibility of using waste minimisation and cleaner technology options during all phases of the proposal. Waste minimisation and treatment, and the application of cleaner production techniques, should also be applied to gaseous wastes, particularly methane, nitrogen oxides, sulfur oxides, particulates and carbon dioxide. Particular attention should be paid to measures, which will maximise energy efficiency and minimise internal energy consumption in the proposal.

Cleaner production waste management planning should be detailed especially as to how these concepts have been applied to preventing or minimising environmental impacts at each stage of the proposal. Details on natural resource use efficiency (e.g. energy and water), integrated processing design, and any co-generation of power and by-product reuse as shown in a material/energy flow analysis are required.

4.5 Water resources

4.5.1 Description of environmental values

This section describes the existing environment for water resources that may be affected by the proposal in the context of environmental values as defined or considered in such documents as the *Environmental Protection Act 1994*, Environmental Protection (Water) Policy 2009 (EPP(Water)), ANZECC 2000 Water Quality Guidelines, the National Water Quality Management Strategy (NWQMS), the DERM Guideline: Establishing Draft Environmental Values and Water Quality Objectives and the Queensland Water Quality Guidelines 2006. The definition of waters in the EPP(Water) includes the bed and banks of waters, so this section should address benthic sediments as well as the water column.

Additional legislation to be considered includes:

- the *Water Act 2000*
- Water Resource (Condamine-Balonne) Plan 2004 and associated Resource Operations Plan
- the Water Resource (Great Artesian Basin) Plan 2006 and associated Resource Operations Plan.

4.5.1.1 Surface waterways

A description should be given of the surface watercourses and their quality and quantity in the area affected by the proposal with an outline of the significance of these waters to the river catchment system in which they occur. Details provided should include a description of existing surface drainage patterns, and flows in major streams and wetlands. Also provide details of the likelihood of flooding, history of flooding including extent, levels and frequency, and a description of present and potential water uses downstream of the areas affected by the proposal. Flood studies should include a range of annual exceedance probabilities for affected waterways, based on observed data if available or use appropriate modelling techniques and conservative assumptions if there are no suitable observations. The flood modelling assessment should include local flooding due to short duration events from contributing catchments on site, as well as larger scale regional flooding including waterways downstream.

The EIS should provide a description, with photographic evidence, of the geomorphic condition of any watercourses likely to be affected by disturbance or stream diversion. The results of this description should form the basis for the planning and subsequent monitoring of rehabilitation of the watercourses during or after the operation of the proposal.

A description is required of existing water quality in surface waters and wetlands likely to be affected by the proposal. The basis for this assessment should be a monitoring program, with sampling stations located upstream and downstream of the proposal. Complementary stream-flow data should also be obtained from historical records (if available) to aid in interpretation.

The water quality should be described, including seasonal variations or variations with flow where applicable. A relevant range of physical, chemical and biological parameters should be measured to gauge the environmental harm on any affected creek or wetland system.

Describe the environmental values of the surface waterways of the affected area in terms of:

- values identified in the EPP(Water)
- sustainability, including both quality and quantity
- physical integrity, fluvial processes and morphology of watercourses, including riparian zone vegetation and form
- any water resource plans, land and water management plans relevant to the affected catchment.

4.5.1.2 Groundwater

The EIS should review the quality, quantity and significance of groundwater in the proposal area, together with groundwater use in neighbouring areas.

The review should include a survey of existing groundwater supply facilities (bores, wells or excavations) to the extent of any environmental harm. The information to be gathered for analysis is to include:

- location
- pumping parameters
- draw down and recharge at normal pumping rates
- seasonal variations (if records exist) of groundwater levels
- depth of supply aquifers.

A network of observation points which would satisfactorily monitor groundwater resources both before and after commencement of operations should be developed and described in the EIS. The EIS should detail the design of the monitoring network and the frequency (schedule) of monitoring groundwater bores and the groundwater parameters which will be measured.

This section of the EIS should address the nature and hydrology of the aquifers and provide a description of the:

- geology/stratigraphy, such as alluvium, volcanic, metamorphic sedimentary and also include faulting, dip and strike
- aquifer type, such as confined, unconfined
- depth to and thickness of the aquifers

- water quality in the aquifers
- the significance of the resource at a local and regional scale
- depth to water level and seasonal changes in levels
- groundwater flow directions (defined from water level contours)
- interaction with surface water and with other aquifers
- interaction with sea/salt water
- possible sources of recharge
- vulnerability to pollution
- potential for aquifer interconnectivity.

The data obtained from the groundwater survey should be sufficient to enable specification of the major ionic species, pH, electrical conductivity, total dissolved solids and any potentially toxic or harmful substances.

Describe the environmental values of the underground waters of the affected area in terms of:

- values identified in the EPP(Water)
- sustainability, including both quality and quantity
- physical integrity, fluvial processes and morphology of groundwater resources.

4.5.2 Potential impacts and mitigation measures

This section is to assess potential impacts on water resource environmental values identified in the previous section. It should also define and describe the objectives and practical measures for protecting or enhancing water resource environmental values, to describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed. An assessment should be undertaken of the impact of the project on the local groundwater regime including the potential for impacts on groundwater interconnectivity and groundwater flows.

The EIS should describe the possible environmental harm caused by the proposal to environmental values for water as expressed in the EPP(Water). The DERM Operational Policy Waste Water Discharge to Queensland Waters may be consulted for guidance on how discharge proposals will be assessed.

Where a licence or permit will be required under the *Water Act 2000* to take or interfere with the flow of water, this section of the EIS should provide sufficient information for a decision to be made on the application. Similarly, waterway barrier works may need approval under the *Fisheries Act 1994*, and if so should be addressed in the EIS.

Water management controls should be described, addressing surface and groundwater quality, quantity, drainage patterns and sediment movements. The beneficial (environmental, production and recreational) use of surface and groundwater should be discussed, along with the proposal for the diversion of affected creeks during mining, and the stabilisation of those works. Monitoring and reporting programs should be described which will assess the effectiveness of management strategies for protecting water quality during the construction, operation and decommissioning of the proposal.

Key water management strategy objectives include:

- protection of important local aquifers and protection of their waters
- maintenance of sufficient quantity and quality of surface waters to protect existing beneficial downstream uses of those waters (including maintenance of in-stream biota)
- minimisation of impacts on flooding levels and frequencies both upstream and downstream of the project.

Conduct a risk assessment for uncontrolled emissions to water due to system or catastrophic failure, implications of such emissions for human health and natural ecosystems, and list strategies to prevent, minimise and contain impacts.

4.5.2.1 Surface water and water courses

The potential environmental harm to the flow and the quality of surface waters from all phases of the proposal should be discussed, with particular reference to their suitability for the current and potential downstream uses, including the requirements of any affected riparian area, wetland and in-stream biological uses. The impacts of surface water flow on existing infrastructure should be considered with reference to the EPP(Water) and *Water Act 2000*.

The hydrological impacts of the proposal should be assessed, particularly with regard to: stream diversions (whether temporary or permanent); scouring and erosion; the consequent impacts of subsidence; and changes to flooding levels and frequencies both upstream and downstream of the project. When flooding levels will be affected, modelling of afflux should be provided and illustrated with maps.

Quality characteristics discussed should be those appropriate to the downstream and upstream water uses that may be affected. Chemical and physical properties of any waste water (including concentrations of constituents) at the point of entering natural surface waters should be discussed, along with toxicity of effluent constituents to flora and fauna.

Reference should be made to the properties of the land disturbed and processing plant wastes, the technology for settling suspended clays from contaminated water, and the techniques to be employed to ensure that contaminated water is contained and successfully treated on the site.

In relation to water supply and usage, and wastewater disposal, the EIS should discuss anticipated flows of water to and from the proposal area. Where dams, weirs or ponds are proposed, the EIS should investigate the effects of predictable climatic extremes (storm events, floods and droughts) on: the capacity of the dams to retain contaminants; the structural integrity of the containing walls; and the quality of water contained, and flows and quality of water discharged. The design of all water storage facilities should follow the current technical guidelines on site water management.

The need or otherwise for licensing of any dams (including referable dams) or creek diversions, under the *Water Act 2000* should be discussed. Water allocation and water sources should be established in consultation with DERM. Where there is a potential for infrastructure, water storages and subsidence, to capture or interfere with overland flows the EIS should indicate how the project will meet the overland flow provisions of the Water Resource (Condamine-Balonne) Plan 2004 and associated resource operations plan.

Assess the impacts on water resources of any dams and roads and other infrastructure related to the project and propose management measures for identified impacts.

Having regard for the requirements of the EPP(Water), the EIS should present the methods to avoid stormwater contamination by raw materials, wastes or products and present the means of containing, recycling, reusing, treating and disposing of stormwater. Where no-release water systems are to be used, the fate of salts and particulates derived from intake water should be discussed.

The ANZECC 2000 National Water Quality Management Strategy, Australian Water Quality Guidelines for Fresh and Marine Waters and the EPP(Water) should be used as a reference for evaluating the effects of various levels of contamination.

Options for mitigation and the effectiveness of mitigation measures should be discussed with particular reference to sediment, acidity, salinity and other emissions of a hazardous or toxic nature to human health, flora or fauna.

Where it is proposed that creeks will be diverted, the EIS should detail how rehabilitation will affect both the physical and ecological condition of the creek's bed and banks and the quality of water in it. Furthermore, the EIS should describe the monitoring that will be undertaken after decommissioning, and who will have responsibility for management measures and corrective action, to ensure that rehabilitated creeks do not degrade.

4.5.2.2 Groundwater

The EIS should include an assessment of the potential environmental harm caused by the proposal to local groundwater resources.

The impact assessment should define the extent of the area within which groundwater resources are likely to be affected by the proposed operations and the significance of the proposal to groundwater depletion or recharge, and propose management options available to monitor and mitigate these effects. This could include

consideration of the need for a 'buffer' zone around UCG activities. The response of the groundwater resource to the progression and finally cessation of the UCG activities should be described.

An assessment should be undertaken of the impact of the proposal on the local ground water regime caused by the altered porosity and permeability of any land disturbance.

An assessment of the potential to contaminate groundwater resources (including through drilling, underground gasification, and surface activities) and the time frames associated with possible contamination. Measures to prevent, mitigate and remediate such contamination should be described.

4.6 Air

4.6.1 Description of environmental values

This section describes the existing air environment that may be affected by the proposal. The following topics may be addressed (note – the topics are not an exhaustive treatment of all possible air or impacts).

A description of the existing air shed environment should be provided having regard for particulates and gaseous and odorous compounds. The EIS should discuss the background levels and sources of suspended particulates, SO_x, NO_x, and any other relevant constituent, whether major or minor, of the air environment that may be affected by the proposal.

Sufficient data on local meteorology and ambient levels of contaminants should be gathered to provide a baseline for later studies or for the modelling of air quality environmental impacts within the air shed. Parameters should include air temperature, wind speed and direction, atmospheric stability, mixing depth and other parameters necessary for input to the models.

4.6.1.1 Greenhouse gas emissions

This section of the EIS should:

- provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO₂ equivalent' terms
- estimate emissions from upstream activities associated with the proposed project, including fossil fuel based electricity consumed
- briefly describe method(s) by which estimates were made.

The Australian Department of Climate Change's National Greenhouse Accounts (NGA) Factors (available via the internet) can be used as a reference source for emission estimates and supplemented by other sources where practicable and appropriate. Coal mining projects should include estimates of coal seam methane to be released as well as emissions resulting from such activities as transportation of products and consumables, and energy use by the project.

4.6.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values for air, to describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed. Information should be submitted on the use of new technologies to reduce air emissions from the stack(s) or other emission sources.

The emissions should be modelled using a recognised atmospheric dispersion model. The objectives for air emissions should be stated, and compared to the modelling results, in accordance with relevant standards (e.g. for stack or ground level concentrations), relevant emission guidelines, and any relevant legislation. The potential for interaction between the emissions from the processing plant, and emissions in the air shed, and the likely environmental harm from any such interaction, should also be detailed.

Where appropriate, the predicted ground level concentrations in nearby areas should be provided. These predictions should be made for both normal and expected maximum emission conditions and the worst case meteorological conditions should be identified and modelled where necessary. Ground level predictions should be made at any residential, industrial and agricultural developments believed to be sensitive to the effects of predicted emissions. The techniques used to obtain the predictions should be referenced, and key assumptions and data sets explained. The assessment of the proposal's impact on air quality should address at least the following matters:

- A description of the pollution control equipment and pollution control techniques to be employed on the premises and the features of the proposal designed to suppress or minimise emissions, including dusts and odours.
- A description of the back up measures to be incorporated that will act in the event of failure of primary measures to minimise the likelihood of plant upsets and adverse air impacts.
- Provide an air emission inventory of the proposed site for all potential point, line, area and volume sources.
- Provide a separate air emission inventory of any offsite activities directly associated with the project, including fugitive emissions such as from rail or road transport of product or wastes.
- Provide a complete list of emissions to the atmosphere. The list should address SO_x, NO_x, VOC, CO, CO₂, particulates (including dust), PM₁₀, PM_{2.5}, trace metals, odours and any toxic, persistent and/or hazardous substances that would be emitted by the project. Present the concentrations of all components of emissions at standard temperature and pressure, and provide the mass emission rate, exit velocity, volume flow rate and temperature at exit. Also, specify the oxygen content of the flue gases.
- Where possible, estimates of emission rates should be based on actual measurements from samples taken from similar facilities, preferably full-scale facilities operating elsewhere or otherwise from experimental or demonstration-scale facilities. Where this is not possible, use published emission factors and/or data supplied by manufacturers of process and control equipment.
- The proposed level of emissions must be compared with the best practice national and international source emission standards.
- For other than insignificant emissions, undertake an impact assessment with relevant inputs of emissions and local meteorology using an air dispersion model to provide estimates of the likely impacts on the surrounding environment. The model inputs should be as detailed as possible, reflecting any variation of emissions with time and including at least a full year of representative hourly meteorological data. The model input parameters must be based on the actual stack conditions for the licence conditions. Provide stack parameters such as stack height, diameter, temperature, and exit velocity and volume flow rate. Estimate ground level concentration (GLC) at the nearest sensitive receptor(s) based on 1-hour average for maximum (99.9 percentile) and 99.5 percentile values. Results of the dispersion modelling must be presented as concentration contour plots and frequency contour plots. The predicted average ground level concentration should be made for both normal and expected maximum emission conditions and the worst case meteorological conditions should be identified and modelled where necessary. Ground level predictions should be made at any residential, industrial and agricultural developments believed to be sensitive to the effects of predicted emissions. The techniques used to obtain the predictions should be referenced, and key assumptions and data sets explained.
- Evaluate the cumulative impacts of the proposed emissions on the receiving environment by considering the project in conjunction with existing and known likely future emission sources within the region. Describe air shed management and the contribution of the proposal to air shed capacity in view of existing and future users of the air shed for assimilation and dispersion of emissions.
- Identify 'worst case' emissions that may occur at start-up, shut-down or during 'upset' operating conditions. If these emissions are significantly higher than those for normal operations, it will be necessary to evaluate the worst-case impact, as a separate exercise to determine whether any planned buffer distance(s) between the facility and neighbouring sensitive receptors will be adequate.
- If odour could be an issue, conduct odour impact assessment using the criteria described in the DERM guideline Odour Impact Assessment from Developments. The guideline sets out various approaches to assess potential impacts from developments proposals. Guidance provides the use of air dispersion modelling as a tool to predict ground level odour concentrations and comparison must be made with guideline values to determine the likelihood of adverse odour impacts.
- The averaging period for ground level concentrations of contaminants that are modelled should be consistent with the relevant averaging periods for air quality indicators and goals in the Environmental Protection (Air) Policy 2008 (EPP(Air)) and the National Environmental Protection Measure Ambient Air Quality (NEPM (Air)). For example, the modelling of sulfur dioxide must be conducted for 1-hour, 24-hours and annual averaging periods.

- Modelled air quality concentrations at the most exposed existing or likely future off-site sensitive receptors must be compared with the appropriate national and international ambient air quality standards including the EPP(Air) and the NEPM (Air).
- For the assessment of chemical species not listed in the EPP(Air), risk factors and best practice design criteria published by other jurisdictions could be used.
- The human health risk associated with emissions from the facility of all hazardous or toxic contaminants should be assessed whether they are or are not covered by the NEPM (Air) or the EPP(Air). The health risk assessment procedure for carcinogens and non-carcinogens must be based on the method recommended by the Australian Health Protection Committee - Environmental Health Committee (enHealth), Australian National Health and Medical Research Council guidelines.
- Where there is no single atmospheric dispersion model that is able to handle the different atmospheric dispersion characteristics exhibited in the proposal area (e.g. sea breezes, strong convection, terrain features, temperature inversions and contaminant re-circulation), a combination of acceptable models will need to be applied.
- The air quality modelling results should be discussed in light of the limitations and accuracy of the applied models.
- Evaluate the extent to which any significant sulfur dioxide emissions from the proposal and existing emission sources within the region will contribute to the generation of acid rain or acidification of other atmospheric condensation, such as dew.
- For any proposal that does not meet the EPP(Air) air quality objectives, the proponent should undertake a risk assessment of the potential for adverse impact off-site. Risk management strategies should be developed that identify options that will reduce exposure of local communities to levels of indicators that may be of concern and enable the proponent to meet the objectives of EPP(Air).

4.6.2.1 Greenhouse gas abatement

This section of the EIS should propose and assess greenhouse gas abatement measures. It should include:

- a description of the proposed measures (alternatives and preferred) to avoid and/or minimise greenhouse gas emissions directly resulting from activities of the project, including such activities as transportation of products and consumables, and energy use by the project
- an assessment of how the preferred measures minimise emissions and achieve energy efficiency
- a comparison of the preferred measures for emission controls and energy consumption with best practice environmental management in the relevant sector of industry
- a description of any opportunities for further offsetting greenhouse gas emissions through indirect means.

Direct means of reducing greenhouse gas emissions could include such measures as:

- minimising clearing at the site (which also has imperatives besides reducing greenhouse gas emissions)
- integrating transport for the project with other local industries such that greenhouse gas emissions from the construction and running of transport infrastructure are minimised
- maximising the use of renewable energy sources

Indirect means of reducing greenhouse gas emissions could include such measures as:

- carbon sequestration at nearby or remote locations, either:
 - above ground by such means as planting trees and other vegetation to achieve greater biomass than that cleared for the project; or
 - below ground by geosequestration.
- carbon trading through recognised markets.

The environmental management plan in the EIS should include a specific module to address greenhouse abatement. That module should include:

- commitments to the abatement of greenhouse gas emissions from the project with details of the intended objectives, measures and performance standards to avoid, minimise and control emissions

- commitments to energy management, including undertaking periodic energy audits with a view to progressively improving energy efficiency
- a process for regular review of new technologies to identify opportunities to reduce emissions and use energy efficiently, consistent with best practice environmental management
- any voluntary initiatives such as projects undertaken as a component of the national Greenhouse Challenge Plus program, or research into reducing the lifecycle and embodied energy carbon intensity of the project's processes or products
- opportunities for offsetting greenhouse emissions, including, if appropriate, carbon sequestration and renewable energy uses
- commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures.

4.6.2.2 Climate change adaptation

Climate change, through alterations to weather patterns and rising sea level, has the potential to impact in the future on developments designed now. Most developments involve the transfer to, or use by, a proponent of a community resource in one form or another, such as the granting of a non-renewable resource or the approval to discharge contaminants to air, water or land. Therefore, it is important that the project design be adaptive to climate change so that community resources are not depreciated by projects that would be abandoned or require costly modification before their potential to provide a full return to the community is realised. Consequently, the EIS should provide an assessment of the project's vulnerabilities to climate change and describe possible adaptation strategies for the activity including:

- a risk assessment of how changing patterns of rainfall and hydrology, temperature and extreme weather may affect the viability and environmental management of the project
- the preferred and alternative adaptation strategies to be implemented
- commitments to undertaking, where practicable, a cooperative approach with government, other industry and other sectors to address adaptation to climate change.

DERM recognises that predictions of climate change and its effects have inherent uncertainties, and that a balance must be found between the costs of preparing for climate change and the uncertainty of outcomes. Nevertheless, proponents should use their best efforts to incorporate adaptation to climate change in their EIS and project design.

4.7 Noise and vibration

4.7.1 Description of environmental values

This section describes the existing environment values that may be affected by noise and vibration from the proposal.

If the proposed activity could adversely impact on the noise environment, baseline monitoring should be undertaken at a selection of sensitive receptors affected by the proposal. Noise sensitive places are defined in the Environmental Protection (Noise) Policy 2008 (EPP(Noise)). Long-term measured background noise levels that take into account seasonal variations are required. The locations of sensitive receptors should be identified on a map at a suitable scale. The results of any baseline monitoring of noise and vibration in the proposed vicinity of the proposal should be described.

Sufficient data should be gathered to provide a baseline for later studies. The daily variation of background noise levels at nearby sensitive receptors should be monitored and reported in the EIS, with particular regard given to detailing variations at different periods of the night. Monitoring methods should adhere to accepted best practice methodologies, relevant DERM guidelines and Australian Standards, and any relevant requirements of the Environmental Protection Regulation 2008 and the EPP(Noise).

Comment should be provided on any current activities near the proposal area that may cause a background level of ground vibration (for example: major roads, quarrying activities, etc).

4.7.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values from impacts by noise and vibration, describes how nominated quantitative standards and indicators may be achieved for noise and vibration management, and how the achievement of the objectives will be monitored, audited and managed. The assessment of noise impacts should include matters raised in the document *The Health Effects of Environmental Noise – Other Than Hearing Loss* published by the Health Council, 2004 (or later editions), ISBN 0 642 82304 9.

Information, including mapped noise contours from a suitable acoustic model, should be submitted based on the proposed generation of noise. The potential environmental harm of noise and vibration at all potentially sensitive receptors should be quantified in terms of objectives, standards and indicators to be achieved. Particular consideration should be given to emissions of low-frequency noise, that is, noise with components below 200 Hz. The assessment should also include environmental impacts on terrestrial animals and avifauna, particularly migratory species. Proposed measures for the minimisation or elimination of impacts should be provided, including details and illustrations of any screening, lining, enclosing or bunding. A discussion should be provided of timing schedules for construction and operations with respect to minimising environmental nuisance and harm from noise.

The assessment should also address off-site noise and vibration impacts that could arise due to increased road or rail transportation directly resulting from the project.

4.8 Nature conservation

4.8.1 Description of environmental values

This section describes the existing environment values for nature conservation that may be affected by the proposal.

Describe the environmental values of nature conservation for the affected area in terms of:

- integrity of ecological processes including habitats of rare and threatened species
- conservation of resources
- biological diversity including habitats of rare and threatened species
- integrity of landscapes and places including wilderness and similar natural places
- aquatic and terrestrial ecosystems.

A discussion should be presented on the nature conservation values of the areas likely to be affected by the proposal. The flora and fauna communities which are rare or threatened, environmentally sensitive localities including waterways, riparian zones, rainforest remnants, old growth indigenous forests, wilderness and habitat corridors should be described. The description should include a plant species list, a vegetation map at appropriate scale and an assessment of the significance of native vegetation, from a local and regional and state perspective. The description should indicate any areas of state or regional significance identified in an approved biodiversity planning assessment (BPA) produced by DERM (e.g. see the Draft Regional Nature Conservation Strategy for South-east Queensland 2001–2006).

Survey effort should be sufficient to identify, or adequately extrapolate, the floral and faunal values over the range of seasons, particularly during and following a wet season. The survey should account for the ephemeral nature of watercourses traversing the proposal area, and seasonal variation in fauna populations.

The EIS should identify sensitive areas, or areas that may have low resilience to environmental change, in proximity to the project or its associated activities. Areas of special sensitivity include wildlife breeding or roosting areas, any significant habitat or relevant bird flight paths for migratory species, bat roosting and breeding caves including existing structures such as adits and shafts, and habitat of threatened plants, animals and communities.

Areas regarded as sensitive with respect to flora and fauna have one or more of the following features (and which should be identified, mapped, avoided or effects minimised):

- protected areas, including nature refuges, which have been proclaimed under the *Nature Conservation Act 1992*

- critical habitat identified under the *Nature Conservation Act 1992*
- vegetation mapped as essential habitat
- sites listed under international treaties such as Ramsar wetlands and World Heritage areas
- important habitats of species listed under the *Nature Conservation Act 1992* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as presumed extinct, endangered, critically endangered, vulnerable or rare
- regional ecosystems listed as 'endangered' or 'of concern' under state legislation, and/or ecosystems listed as presumed extinct, endangered, critically endangered or vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- good representative examples of remnant regional ecosystems or regional ecosystems which are described as having 'medium' or 'low' representation in the protected area estate as defined in the Regional Ecosystem Description Database (REDD) available at DERM's website
- high value regrowth vegetation
- sites containing near threatened or bio-regionally significant species or essential, viable habitat for near threatened or bio-regionally significant species
- sites in, or adjacent to, areas containing important resting, feeding or breeding sites for migratory species of conservation concern listed under the Convention of Migratory Species of Wild Animals, and/or bilateral agreements between Australia and Japan (JAMBA), Australia and China (CAMBA), or Australia and the Republic of Korea (ROKAMBA)
- sites containing common species that represent a distributional limit and are of scientific value or that contains feeding, breeding, resting areas for populations of echidna, koala, platypus and other species of special cultural significance
- sites containing high biodiversity that are of a suitable size or with connectivity to corridors/protected areas to ensure survival in the longer term, such land may contain:
 - natural vegetation in good condition or other habitat in good condition (e.g. wetlands)
 - degraded vegetation or other habitats that still supports high levels of biodiversity or acts as an important corridor for maintaining high levels of biodiversity in the area
- a site containing other special ecological values, for example, high habitat diversity and areas of high endemism
- ecosystems which provide important ecological functions such as: wetlands of national, state and regional significance; riparian vegetation; important buffer to a protected area or important habitat corridor between areas
- sites of palaeontologic significance such as fossil sites
- sites of geomorphological significance, such as lava tubes or karst.

The Queensland *Vegetation Management Act 1999* and the findings of any regional vegetation management plan should also be referenced.

The occurrence of pest plants and animals in the project area should be described.

4.8.1.1 Terrestrial flora

Provide a map of terrestrial vegetation at a suitable scale with descriptions of the units mapped. Sensitive or important vegetation types should be highlighted, including any marine littoral and subtidal zone and riparian vegetation, and their value as habitat for fauna and conservation of specific rare floral and faunal assemblages or community types. The existence of rare or threatened species should be specifically addressed. The surveys should include species structure, assemblage, diversity and abundance. The description should contain a review of published information regarding the assessment of the significance of the vegetation to conservation, recreation, scientific, educational and historical interests.

The location of any horticultural crops in the vicinity of the site should be shown. The existence of important local and regional weed species should also be discussed.

Vegetation should be mapped for all relevant project sites including new transport infrastructure, port facilities and irrigation land if relevant. Adjacent areas should also be mapped to illustrate interconnectivity. Mapping should also illustrate any larger scale interconnections between areas of remnant or regrowth vegetation where the project site includes a corridor connecting those other areas.

The terrestrial vegetation communities within the affected areas should be described at an appropriate scale (maximum 1:10,000) with mapping produced from aerial photographs and ground truthing, showing the following:

- location and extent of vegetation types using DERM's regional ecosystem type descriptions in accordance with the REDD
- location of vegetation types of conservation significance based on DERM's regional ecosystem types and occurrence of species listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006 and any subsequent amendments, as well as areas subject to the *Vegetation Management Act 1999*
- the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected area estate (national parks, conservation parks, resource reserves, nature refuges)
- any plant communities of cultural, commercial or recreational significance should be identified
- location and abundance of any exotic or weed species.

Within each defined (standard system) vegetation community, a minimum of three sites (numbers should be discussed with DERM) should be surveyed for plant species, preferably in both summer and winter, as follows:

- site data shall be recorded using the Queensland Herbarium methodology and proformas in the latest version of the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, (EPA, 2005)
- the minimum site size should be 10 by 50 metres
- a complete list of species present at each site should be recorded
- the relative abundance of plant species present should be recorded
- any plant species of conservation, cultural, commercial or recreational significance should be identified
- specimens of species listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006, other than common species, are to be submitted to the Queensland Herbarium for identification and entry into the HERBRECS database.

Existing information on plant species may be used instead of new survey work provided that the data is derived from previous surveys at the site consistent with the above methodology. Methodology used for flora surveys should be specified in the appendices to the report.

4.8.1.2 Terrestrial fauna

The terrestrial and riparian fauna occurring in the areas affected by the proposal should be described, noting the broad distribution patterns in relation to vegetation, topography and substrate. The description of the fauna present or likely to be present in the area should include:

- species diversity (i.e. a species list) and abundance of animals, including amphibians, birds, reptiles and mammals
- any species that are poorly known but suspected of being rare or threatened
- habitat requirements and sensitivity to changes; including movement corridors and barriers to movement
- the existence of feral or exotic animals
- existence of any rare, threatened or otherwise noteworthy species/communities in the study area, including discussion of range, habitat, breeding, recruitment, feeding and movement requirements, and current level of protection (e.g. any requirements of protected area management plans)
- use of the area by migratory birds, nomadic birds, bats, and arboreal and ground-dwelling fauna.

A comprehensive vertebrate fauna survey should be undertaken of the project area at a sampling intensity that supports the scale of vegetation mapping (i.e. 1:10,000 or better). Apart from the species recorded in the

survey, an indicative list of all known and potential species and threatened species in the project area should be provided, by reference to the regional ecosystems within the project area and a 100 km buffer, and knowledge of species present in the local bioregion. The occurrence of fauna of conservation significance should be geocoded to mapped vegetation units or habitats, which can then be used in section 4.8.2 to propose areas to be protected.

The EIS should indicate how well any affected communities are represented and protected elsewhere in the province where the site of the proposal occurs.

4.8.1.3 Aquatic biology

The aquatic flora and fauna occurring in the areas affected by the proposal should be described, noting the patterns and distribution in the waterways and any associated wetlands. The description of the fauna and flora present or likely to be present in the area should include:

- fish species, mammals, reptiles, amphibians, crustaceans and aquatic invertebrates occurring in the waterways within the affected area
- aquatic plants
- aquatic and benthic substrate
- habitat downstream of the project.

4.8.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing nature conservation values, describes how nominated quantitative standards and indicators may be achieved for nature conservation management, and how the achievement of the objectives will be monitored, audited and managed.

The EIS should address any actions of the project or likely impacts that require an authority under the *Nature Conservation Act 1992*, and/or would be assessable development for the purposes of the *Vegetation Management Act 1999*.

The discussion should cover all likely direct and indirect environmental harm due to the project on flora and fauna particularly sensitive areas. Terrestrial and aquatic (marine and freshwater) environments should also be covered. Also include human impacts and the control of any domestic animals introduced to the area.

Strategies for protecting any rare or threatened species should be described, and any obligations imposed by state or Commonwealth legislation or policy or international treaty obligations (e.g. JAMBA, CAMBA or ROKAMBA) should be discussed.

Strategies for collecting and preserving any significant fossils should be described.

The potential environmental harm to the ecological values of the area arising from the construction, operation and decommissioning of the project including clearing, salvaging or removal of vegetation should be described, and the indirect effects on remaining vegetation should be discussed. Short-term and long-term effects should be considered with comment on whether the impacts are reversible or irreversible. The capacity of the environment to assimilate discharges/emissions should be assessed.

Key flora and fauna indicators should be identified for future ongoing monitoring.

The EIS should propose and describe in detail measures to be taken to avoid and minimise potential adverse impacts of the proposal on nature conservation and biodiversity values. Any potential net loss of environmental values should be identified and quantified. Environmental offsets should be described that would counterbalance the remaining loss of environmental values. Proposed environmental offsets should be consistent with the requirements set out in the specific-issue offset policies under the framework of the Queensland Government's Environmental Offset Policy (2008).

The potential environmental harm on flora and fauna due to any alterations to the local surface and ground water environment should be discussed with specific reference to environmental impacts on riparian vegetation or other sensitive vegetation communities. Measures to mitigate the environmental harm to habitat or the inhibition of normal movement, propagation or feeding patterns, and change to food chains should be described.

The provision of buffer zones and movement corridors, and strategies to minimise environmental harm on migratory, nomadic and aquatic animals should be discussed.

Weed management strategies are required for containing existing weed species (e.g. parthenium and other declared plants) and ensuring no new declared plants are introduced to the area. Feral animal management strategies and practices should also be addressed. The study should develop strategies to ensure that the project does not contribute to increased encroachment of a feral animal species. Reference should be made to the local government authority's pest management plan when determining control strategies. The strategies for both flora and fauna should be discussed in the main body of the EIS and provided in a working form in a pest management plan as part of the overall EM plan for the project.

Rehabilitation of disturbed areas should incorporate, where appropriate, provision of nest hollows and ground litter.

Relevant specific-issue policies that should be addressed are:

- Vegetation management – Policy for Vegetation Management Offsets, 21 October 2009, Department of Environment and Resource Management.
- Koala habitat – Offsets for Net Benefit to Koalas and Koala Habitat, 2006, Environmental Protection Agency
- Offsets framework – Queensland Government's Environmental Offset Policy (2008).

4.9 Cultural heritage

4.9.1 Description of environmental values

This section of the EIS should describe the existing cultural heritage values that may be affected by the proposal, and include a description of the environmental values of the cultural landscapes of the affected area in terms of the physical and cultural integrity of the landforms.

Unless an exemption applies under s86 of the *Aboriginal Cultural Heritage Act 2003*, an indigenous cultural heritage study must be undertaken in accordance with the requirements of part 7 of that Act.

An historical cultural heritage study should also be undertaken of the known and potential historical cultural heritage values of the affected area. The study will, as a minimum, include a desktop analysis and an archaeological investigation (i.e. a physical investigation) of the area potentially affected by the project.

The desktop component of the study should, as a minimum, review the following sources for information on historical cultural heritage values within the region of the project site:

- The Queensland heritage register, for places already protected under the *Queensland Heritage Act 1992*.
- Local government heritage registers, lists or inventories.
- The results of previous cultural heritage studies conducted within the region of the project..

The scope of the archaeological investigation should be based upon the results of the desktop analysis. The archaeological investigation is to be conducted by an appropriately qualified person, as required by the *Queensland Heritage Act 1992*, and should address all types of historical cultural heritage places located within the project area (i.e. built, archaeological and cultural landscape values).

The discovery and protection of any previously unidentified archaeological artefacts or archaeological places during the course of the historical cultural heritage study must comply with part 9 of the *Queensland Heritage Act 1992*.

4.9.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for managing, protecting or enhancing cultural heritage values that may be affected by the proposal. It describes how practices may be implemented for the appropriate management of those values, and how the achievement of the objectives will be monitored, audited and managed.

4.9.2.1 Indigenous cultural heritage

Unless an exemption applies under s86 of the *Aboriginal Cultural Heritage Act 2003*, the potential impacts on indigenous cultural heritage values in the vicinity of the project must be managed under a cultural heritage management plan (CHMP) developed and approved under part 7 of that Act. Development of the CHMP should follow the guidelines gazetted under section 85 of the *Aboriginal Cultural Heritage Act 2003*. DERM's EIS

Coordinator must be made aware of the progress of the CHMP approval process and of any related issues that should be addressed in the EIS assessment report.

4.9.2.2 Non-indigenous historical cultural heritage

The potential impacts on non-indigenous historical cultural heritage values and their avoidance or mitigation should also be addressed in a management plan. The historical heritage management plan will specifically address identified values and provide a process for managing yet undiscovered values should they become apparent during development of the project.

The development of a historical heritage management plan should be negotiated with DERM and any other relevant stakeholders.

The historical heritage management plan should as a minimum address the following issues:

- Processes for the mitigation, management and protection of identified historical cultural heritage values during excavations of the construction, operational, rehabilitation and decommissioning phases of the project.
- Processes for reporting, as required by section 89 of the *Queensland Heritage Act 1992*, the discovery of any archaeological artefact not previously identified in the historical cultural heritage study.
- Procedures for the collection of any artefact material, including appropriate storage and conservation.
- Historical cultural heritage awareness training or programs for project staff.

The historical heritage management plan should be incorporated into the project's draft EM plan.

4.10 Social

The description of the social and cultural values potentially impacted by the project, and the assessment of the impacts on those values, should be conducted in consultation with the social impact unit of the Department of Infrastructure and Planning, and all affected local, state and federal government bodies.

4.10.1 Description of social and cultural values

This section of the EIS should define and describe the social and cultural area of influence of the project and any associated activities. It should identify key social and cultural organisations, including relevant government, quasi-non-government and non-government organisations, and other community groups. This section of the EIS should also describe the community engagement process and present its findings to date.

The EIS should describe the current population and demographics of the potentially affected communities within the project's social and cultural area of influence. Such communities include all communities likely to be impacted directly and indirectly by the project, such as the potential host communities and the source communities for the project workforce and their families. Separate population figures and demographics should be provided for affected indigenous and non-indigenous populations and communities. Characteristics to be described include:

- the community size, history, age structure, ethnic characteristics, and gender composition
- average income profiles including the number and proportion of low income households
- education and skill level by age and gender
- prevalence of disability
- health and wellbeing indicators
- major trends and changes in the population make-up that may be occurring irrespective of the project
- any additional information identified as relevant through engagement with the communities.

Describe and analyse the current employment patterns, rates and trends within the social and cultural area of influence, for the indigenous and non-indigenous populations, including:

- the locations and types of other significant places of employment
- numbers employed in relevant industry sectors and demographic cohorts (including disadvantaged groups)

- shift patterns and hours of work
- type and level of qualifications and skills
- unemployment rates or shortage levels within relevant skill levels and sectors
- any other relevant historical or anticipated changes or shifts in these employment patterns, rates and trends.

The EIS should describe the settlement patterns and residential profile of communities within the social and cultural area of influence including:

- household size
- type of occupancy (e.g. families versus singles house sharing)
- length of occupancy, including generational continuity (e.g. of farming properties)
- current property values and trends
- home ownership rates
- the size of the private rental market
- typical rents for the area, including trends
- the vacancy rate of rental accommodation with an assessment of seasonal fluctuations
- rates of housing stress, e.g. availability, affordability, and adequacy
- comparative affordability for ownership and renting relative to other towns and centres
- constraints and opportunities for new housing construction in the local communities, including the capacity of the local land development and housing construction industries to provide new housing and accommodation.

The EIS should provide a profile of the current social and cultural values and the characteristics of communities, groups and individuals likely to be impacted by the proposal. The social and cultural values for the affected communities and populations should be described in terms of:

- the use of the area on and around the project site for business (including industry, agriculture, forestry, fishing, aquaculture, and education), cultural purposes (including the gathering of natural products for food, medicine or ceremonial purposes), or residential purposes
- the historical, aesthetic, social and cultural significance of places to people who use, or have used, potentially affected places in the area
- the sense of community
- the integrity of social conditions, including perceptions of community cohesion and personal safety
- amenity, liveability, harmony and well being.

Describe the current availability of community access to recreational facilities and sites, and to social and community services and infrastructure.

Outline the current rates of crime against persons and property, and the likely rate of substance abuse as far as it is known.

Social, economic and cultural values are not as easily separated as physical and ecological values. Therefore, it may be necessary for some material in this section to be cross-referenced with section 4.9 Cultural Heritage and section 4.12 Economy.

4.10.2 Potential impacts and mitigation measures

The assessment of impacts (both beneficial and adverse) must be supported by evidence-based discussions, and be developed in consultation with all relevant government agencies and community groups. It should include information obtained so far through the project's community engagement process, and provide a description of how consultation feedback has identified and informed the assessment of impacts and the development of mitigation measures. The assessment should not consider the impacts of the project in

isolation, rather it should discuss the likely direct, indirect and cumulative impacts of the project in conjunction with all known existing and planned projects within the area of influence. The assessment should address not only impacts on people and families directly affected by those matters, but also impacts on associated people and communities, such as those whose livelihoods would be affected by loss or gain of direct or indirect (e.g. service provision) employment.

With regard to its timeframe, the assessment of social impacts should cover:

- the state of affairs immediately before the project was proposed
- the period from when people first became aware of the project until it is commissioned, should approval be given
- the proposed active phases of the project (e.g. construction, operation and decommissioning)
- the phase after the project ceases to the extent that there may be residual impacts.

Describe the likely impacts on population numbers in the social and cultural area of influence and the associated demographic shifts.

Describe the social impacts of changes in land use, the alienation of property and loss of connection with the land. It should also address the impacts and stresses associated with relocations.

Describe likely recruitment schedules and locations, and how recruitment during the various phases of the project will impact on employment patterns, rates, and trends within the social and cultural area of influence. The assessment should at least address the following matters:

- estimated employment rates including the number of staff to be employed, with an estimate of the numbers in the various trades and sectors (e.g. clerical staff, unskilled labour, etc)
- estimated impacts on unemployment levels, including creation of labour shortages within skilled, semi-skilled and unskilled trades and sectors
- employment trends such as attraction (cross-over) of workforce between trades and sectors or changes to sector numbers due to the influx of new workers or the redeployment of existing workers within the area
- Indigenous education, training and employment initiatives
- recruitment of people from disadvantaged groups
- to the extent that information is available, include cumulative effects of other major employers in the area and their likely recruitment schedules.

Describe likely lay-off schedules and how reductions in the workforce at various stages will impact on employment patterns in the social and cultural area of influence. To the extent that information is available, include the cumulative effects of other major employers in the area and their likely lay-off schedules.

Describe the training opportunities to be provided during the various phases of the project, particularly for indigenous people, or people from disadvantaged groups, and describe the provisions to be made for apprenticeship and worker training schemes.

Describe where staff and their immediate families are likely to reside during the construction and operational phases, and assess the likely impacts on housing availability and affordability, including:

- the likely changes to residential patterns in the social and cultural area of influence during all stages of the project
- the effects of the commuting model (e.g. FIFO and/or DIDO versus local residency)
- locations, size and type of any workers camps
- purchase of existing housing for mine staff
- the availability and demand for land, including state land
- changes to residential occupation patterns (e.g. families versus house sharing by groups of singles)
- construction of new family housing

- availability of existing housing for purchase and rent, and the capability of the existing housing stock, including rental accommodation, to meet any additional demands created by the project
- effects on property values and rents
- effects on property marketability
- the potential displacement of existing residents who may no longer be able to afford accommodation
- impacts of the project on the availability of low cost housing within the social and cultural area of influence (e.g. assess whether pressure on rents would create a need for a local authority to build low cost housing for those in the community who would not benefit economically from the project).

The assessment should address not only the impacts on residential issues due to the accommodation of workers directly employed by the project, but also those due to the numbers of contractors and service providers that may be attracted by the opportunities offered by the project. The EIS should assess the impacts arising from alternative options for accommodation and develop a preferred accommodation strategy. Identify any approvals needed for the preferred option for new worker camps or housing, and cross-reference to those sections of the EIS that assess the potential impacts of new camps or housing.

The EIS should assess, for the various stages of the project, the demand for community services and the likely impacts on social infrastructure provided by local, state and federal governments. The assessment should provide sufficient information for affected government authorities to make informed decisions about how the proposal may affect their business and enable them to plan for the continuing provision of social infrastructure including health, education, community services, recreational activities and other services in the region.

Assess the likely cultural pressures and shifts both for indigenous and non-indigenous cultural groups. Particular attention should be paid to the effects on:

- likely changes to cultural identities in the social and cultural area of influence
- the ability of both indigenous and non-indigenous people, to live in accordance with their own values and priorities
- the use of, and access to, culturally important areas and landscapes.

The EIS should assess the likely impacts on lifestyle and amenity in the social and cultural area of influence, including:

- effects on families (and the demand for family support services) of parents being absent while on-roster
- changes to perceptions of safety and community in the established population
- changes to health and social wellbeing of families and communities including household consumption patterns; social dysfunction including alcohol and drugs, crime, violence, and social or cultural disruption due to population influx
- impacts on amenity of any changes in household composition patterns, such as sharing singles replacing families in residential areas, increased noise from social activities, and contractors parking commercial vehicles and machinery in residential areas.

Describe likely effects on the prevalence of crimes against the person and against property in the social and cultural area of influence based on evidence of equivalent social changes elsewhere.

Assess the likely adverse and beneficial social impacts of the project on local and regional service industries and the families that depend in whole or part on the income that comes from those service industries (the financial effects should be discussed in section 4.12 Economy of the EIS).

Describe the implications of the proposal for future developments in the social and cultural area of influence including constraints on surrounding land uses.

The EIS should summarise the net adverse or beneficial social impacts of the proposed project with an estimation of the overall significance of those impacts.

For identified social impacts, social impact mitigation strategies and measures should be presented to address:

- the demographic changes in the profile of the social and cultural area of influence

- the recruitment and training of the construction and operational workforces and the social and cultural implications this may have for the host community
- housing and accommodation issues, in consultation with relevant local authorities and state government agencies, with proposals for accommodating the project workforce and their families that avoid, mitigate or offset any short and medium term adverse effects on housing affordability and availability, including the rental market, in the social and cultural area
- capacity of current social infrastructure, particularly health and welfare, education, policing and emergency services - if the assessment of the capacity of social infrastructure identifies shortfalls, the demand for further land should be discussed with particular attention to the impact on State land
- the adequate provision of education, training and employment for all groups, including women, people with a disability, and Indigenous people.

The proponent should describe any consultation with government agencies and the communities regarding the acceptability of proposed mitigation strategies and the implementation of practical management and monitoring regimes. The EIS should clearly indicate whether any nominated party other than the proponent accepts responsibility for implementing the measure(s).

Any increases in transport intensity (road and rail) due to the project that would impact on the amenity and safety associated with sensitive sites including schools, hospitals, shopping areas, etc. should be identified and mitigation measures described.

A draft social impact management plan should be presented that promotes an active and ongoing role for impacted communities, local authorities and government agencies through the project life cycle from planning, construction, operations and decommissioning. The draft plan should cover:

- action plans for the implementation of mitigation strategies and measures
- assignment of accountability and resources
- reporting mechanism for activities and commitments
- mechanisms to respond to public enquiries and complaints
- mechanisms to resolve disputes with stakeholders
- periodic evaluation of the effectiveness of community engagement processes
- practical mechanisms to monitor and adjust mitigation strategies and action plans to achieve best outcomes.

4.11 Health and safety

4.11.1 Description of values

This section describes the existing community values for public health and safety that may be affected by the proposal. Projects that could discharge contaminants, even accidentally, into water bodies should identify and describe any downstream extraction for potable use. For projects proposing air emissions, and/or those with the potential to emit odours, nearby and other potentially affected populations should be identified and described. Particular attention should be paid to those sections of the population, such as children and the elderly, who are especially sensitive to environmental health factors.

4.11.2 Potential impacts and mitigation measures

This section defines and describes the objectives and practical measures for protecting or enhancing health and safety community values, describes how nominated quantitative standards and indicators may be achieved for health impacts management, and how the achievement of the objectives will be monitored, audited and managed.

The EIS should assess the impacts on the community in terms of health, safety, and quality of life from project operations and emissions. Any impacts on the health and safety of any members of the community should be detailed in terms of health, safety, quality of life from factors such as air emissions, odour, dust and noise.

Map(s) should be provided showing the locations of sensitive receptors such as, but not necessarily limited to, kindergartens, schools, hospitals, aged care facilities, residential areas, and centres of work (e.g. office buildings, factories and workshops). The EIS, illustrated by the maps, should discuss how planned discharges from the project could impact on public health in the short and long term, and should include an assessment of the cumulative impacts on public health values caused by the proposal, either in isolation or by combination with other known existing or planned sources of contamination.

The EIS should address the project's potential for providing disease vectors. Measures to control mosquito and biting midge breeding should be described. Any use of recycled water should be assessed for its potential to cause infection by the transmission of bacteria and/or viruses by contact, dispersion of aerosols, and ingestion (e.g. via use on food crops). Similarly, the use of recycled water should be assessed for its potential to cause harm to health via the food chain due to contaminants such as heavy metals and persistent organic chemicals. Practical monitoring regimes should also be recommended in this section.

4.12 Economy

4.12.1 Description of values

This section describes the existing economic environment that may be affected by the proposal. The character and basis of the local and regional economies should be described including:

- economic viability (including economic base and economic activity, future economic opportunities, current local and regional economic trends, in particular drought and rural downturn etc)
- historical descriptions of large-scale resource developments and their effects in the region.

The economic impact statement should include estimates of the opportunity cost of the project and the value of ecosystem services provided by natural or modified ecosystems to be disturbed or removed during development.

4.12.2 Potential impacts and mitigation measures

The function of this section is to define and describe the objectives and practical measures for protecting or enhancing economic values, to describe how nominated quantitative standards and indicators may be achieved for economic management, and how the achievement of the objectives will be monitored, audited and managed.

An economic analysis, including a cost-benefit analysis, should be presented from national, state, regional and local perspectives as appropriate to the scale of the project. The general economic benefits from the project should be described.

At a level of detail appropriate to the scale of the project, the analysis is to consider:

- the significance of this proposal on the local and regional economic context
- the long and short-term beneficial (e.g. job creation) and adverse (e.g. competition with local small business) impacts that are likely to result from the development
- the potential, if any, for direct equity investment in the project by local businesses or communities
- the cost to all levels of government of any additional infrastructure provision
- implications for future development in the locality (including constraints on surrounding land uses and existing industry)
- the potential economic impact of any major hazard identified in section 4.14
- the distributional effects of the proposal including proposals to mitigate any negative impact on disadvantaged groups
- the value of lost opportunities or gained opportunities for other economic activities anticipated in the future
- impacts on local property values.

Consideration of the impacts of the project in relation to energy self-sufficiency, security of supply and balance of payments benefits may be discussed. Attention should be directed to the long and short-term effects of the project on the land-use of the surrounding area and existing industries, regional income and employment and

the state economy. The scope of any studies should be referred to the government for input before undertaking the studies.

For identified impacts to economic values, suggest mitigation and enhancement strategies and facilitate initial negotiations towards acceptance of these strategies. Practical monitoring regimes should also be recommended.

4.13 Hazard and risk

This section of the EIS should describe the potential hazards and risk to people and property that may be associated with the proposal as distinct from hazards and risk to the natural environment, which should be addressed in other sections of the ToR. When addressing natural hazards, particularly in regard to places where people would work and live (such as a mine's accommodation camp), the EIS should consider the principles of natural hazard management in State Planning Policy 1/03 (SPP1/03), *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*, even if the development is exempt development under the *Sustainable Planning Act 2009*. SPP1/03 may not be applicable as a statutory instrument for exempt development, but it contains information that guides best practice for all development.

4.13.1 Description of values

Detail the values related to people and property that could be affected by any hazardous materials and actions associated with the proposal.

4.13.2 Potential impacts and mitigation measures

This section of the EIS should describe the potential hazards and risk that may be associated with the proposal, including consideration of both natural and man-made hazards. The assessment of risk should be in accordance with relevant standards, such as AS/NZS ISO 31000:2009, *Risk Management - Principles and Guidelines*.

This section should also define and describe the objectives and practical measures for protecting people and places from hazards and risk, describe how nominated quantitative standards and indicators may be achieved for hazard and risk management, and how the achievement of the objectives will be monitored, audited and managed.

An analysis is to be conducted into the potential impacts of both natural and induced emergency situations and counter disaster and rescue procedures as a result of the proposal on sensitive areas and resources such as forests, water reserves, state and local government controlled roads, places of residence and work, and recreational areas. The degree and sensitivity of risk should be detailed.

The EIS should provide an inventory for each class of substances listed in the Australian Dangerous Goods Codes to be held on-site. This information should be presented by classes and should contain:

- chemical name
- concentration in raw material chemicals
- concentration in operation storage tank
- U.N. number
- packaging group
- correct shipping name
- maximum inventory of each substance.

Details should be provided of:

- safeguards proposed on the transport, storage, use, handling and on-site movement of the materials to be stored on-site
- the capacity and standard of bunds to be provided around the storage tanks for classified dangerous goods and other goods likely to adversely impact upon the environment in the event of an accident
- the procedures to prevent spillages, and the emergency plans to manage hazardous situations.

The proponent should develop an integrated risk management plan for the whole of the life of the project including construction, operation and decommissioning phases. The plan should include a preliminary hazard analysis (PHA), conducted in accordance with appropriate guidelines for hazard analysis (e.g. HAZOP Guidelines, NSW Department of Urban Affairs and Planning (DUAP)). The assessment should outline the implications for and the impact on the surrounding land uses, and should involve consultation with Department of Community Safety including Emergency Services. The preliminary hazard analysis should incorporate:

- all relevant major hazards both technological and natural
- the possible frequency of potential hazards, accidents, spillages and abnormal events occurring
- indication of cumulative risk levels to surrounding land uses
- life of any identified hazards
- a list of all hazardous substances to be used, stored, processed, produced or transported
- the rate of usage
- description of processes, type of the machinery and equipment used
- potential wildlife hazards such as crocodiles, snakes, and disease vectors
- public liability of the state for private infrastructure and visitors on public land.

The integrated risk management plan should include the following components:

- operational hazard analysis
- regular hazard audits
- fire safety, emergency
- response plans
- qualitative risk assessment
- construction safety.

Where relevant, each of these components should be prepared in accordance with the relevant NSW DUAP Hazardous Industry Planning Advisory Paper (HIPAP).

4.14 Cross-reference with the terms of reference

This section provides a cross reference of the findings of the relevant sections of the EIS, where the potential impacts and mitigation measures associated with the project are described, with the corresponding sections of the ToR.

5 Environmental management plan

The environmental management plan (EM plan) should be developed from the mitigation measures detailed in part 4 of the EIS. Its purpose is to state the proponents environmental protection commitments in a way that allows them to be measured and audited.

The EM plan is an integral part of the EIS, but should be capable of being read as a stand-alone document without reference to other parts of the EIS. For a mining project the EM plan must meet the content requirements of section 203 of the *Environmental Protection Act 1994*, while the EM plan for a petroleum project must meet the content requirements of section 310D of that Act. The general contents of the EM plan should comprise:

- the environmental values likely to be affected by the proposed activities
- the potential adverse and beneficial impacts of the activities on the environmental values
- the proponents commitments to acceptable levels of environmental performance, including environmental objectives (i.e. levels of expected environmental harm, performance standards and associated measurable indicators, performance monitoring and reporting)
- impact prevention or mitigation actions to implement the commitments
- corrective actions to rectify any deviation from performance standards.

Through the EM plan, the EIS's commitments to environmental performance can be used to develop regulatory controls as conditions to apply to project approvals. Therefore, the EM plan is a relevant document for project approvals, environmental authorities and permits, and may be referenced by them. The EM plan may suggest conditions that will form the basis for developing the draft environmental authority.

6 Commitments not included in the EM plan

This section of the EIS should summarise any commitments made by the proponent that are not included in the EM plan (such as a commitment to assist a local council mitigate social impacts). It should be clear how and when the commitments will be fulfilled.

7 References

All references consulted should be presented in the EIS in a recognised format.

8 Recommended appendices

A1. Final Terms of Reference for this EIS

A copy of the final ToR should be included in the EIS. Where it is intended to bind appendices in a separate volume from the main body of the EIS, the ToR at least should be bound with the main body of the EIS for ease of cross-referencing. A summary, cross-referencing specific items of the ToR to the relevant section of the EIS, should also be provided in section 4.15 of the EIS. For this purpose the ToR should be line numbered.

A2. Approvals

A list of the approvals required by the project, for the development should be presented.

A3. Study team

The qualifications and experience of the study team and specialist sub-consultants and expert reviewers should be provided.

A4. The standard criteria

A brief summary should be presented of the proposal's compatibility with the standard criteria as defined by the *Environmental Protection Act 1994*, which include the principles of ESD and other relevant policy instruments. With regard to the principles of ESD, as listed in The National Strategy for Ecologically Sustainable Development, published by the Commonwealth Government in December 1992 (available from the Australian Government Publishing Service), each principle should be discussed and conclusions drawn as to how the proposal conforms. A life-of-project perspective should be shown.

A5. Consultation report

The summary consultation report appendix for an EIS under the EP Act should commence by including the details of affected and interested persons, and the statement of planned consultation with those persons, originally provided with the draft terms of reference. It should describe how 'interested' and 'affected persons', and any 'affected parties' as defined in the EPBC Act, were identified.

A further list should be provided that includes the Commonwealth, state and local government agencies consulted, and the individuals and groups of stakeholders consulted.

The consultation report appendix should summarise the results of the community consultation program, providing a summary of the groups and individuals consulted, the issues raised, and the means by which the issues were addressed. The discussion should include the methodology used in the community consultation program including criteria for identifying stakeholders and the communication methods used.

A6. Specialist studies

All reports generated on specialist studies undertaken as part of the EIS are to be included as appendices.

A7. Research

Any proposals for researching alternative environmental management strategies or for obtaining any further necessary information should be outlined in an appendix.

Disclaimer

While this document has been prepared with care, it contains general information and does not profess to offer legal, professional or commercial advice. The Queensland Government accepts no liability for any external decisions or actions taken on the basis of this document. Persons external to DERM should satisfy themselves independently and by consulting their own professional advisors before embarking on any proposed course of action.

Approved By

Stuart Cameron

Signature

5 May 2010

Date

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