

Terms of Reference for the Arrow Bowen Pipeline Project Environmental Impact Statement (EIS)

#29715

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Background

The proponent for the Arrow Bowen Pipeline Project is Arrow Bowen Pipeline Pty Ltd, a wholly-owned subsidiary of Arrow Energy Pty Ltd (Arrow Energy). The project would involve the construction of a 600 km long point-to-point transmission pipeline consisting of a main pipeline and several lateral pipelines to convey coal seam gas (CSG) from Arrow Energy's gas fields in the Bowen Basin, located approximately 90 km north of Moranbah in central Queensland, to Gladstone for eventual export as liquefied natural gas (LNG). The proposed pipeline would commence in the southern part of the Whitsunday Regional Council local government area, traverse the Isaac and Rockhampton regional councils' local government areas in a southerly direction, and terminate in the Gladstone Regional Council local government area.

The pipeline would have a minimum technical design life of 40 years and an operational life in excess of that figure. The proposed pipeline traverses primarily grazing and agricultural land. A 40 m wide right of way would be required for construction and a 30 m wide operational easement would be required for pipeline operation and maintenance. The Arrow Bowen Pipeline would be designed and constructed in accordance with Australian Standard (AS) 2885 Pipelines – Gas and Liquid Petroleum and would be buried at a minimum depth of cover of 750 mm. The final depth of cover would vary along the route and would be determined by the outcomes of a detailed AS 2885 safety management study. At key infrastructure and watercourse crossings, the minimum depth of cover would be increased to at least 1200 mm. The pipeline would include above-ground structures, such as main line valves and a gas gate/gathering station at the end of the line. Construction of the proposed pipeline is anticipated to commence in 2015 with the first gas supplied to an LNG plant in Gladstone in 2017.

Executive summary

The executive summary conveys the project's most important aspects and options to the reader in a concise and readable form. Use plain English and avoid the use of jargon and obscure 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

Provide a glossary of technical terms, acronyms and abbreviations before the main text of the EIS.

1. Introduction

Explain why the EIS has been prepared and what it sets out to achieve—in particular, the level of detail required to satisfy assessment of the approvals being sought. Define the audience of the EIS.

1.1 Project proponent

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

1.2 Project description

Provide and illustrate a brief description of the key elements of the project. Summarise any major associated infrastructure requirements. Detailed descriptions of the project should follow in section 3.

1.3 Project objectives and scope

State the objectives that have led to the development of the project and briefly outline the events leading up to the project'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 will also be discussed.

1.4 The EIS process

The purpose of this section is to clarify methodology and objectives of the EIS under the relevant legislation.

1.4.1 Methodology of the EIS

Describe the EIS process steps, timing and decisions to be made for relevant stages of the project. Provide a brief description of studies or surveys that have been undertaken to help develop the project and prepare the EIS. Describe any baseline studies or investigations used in the EIS that were undertaken before the EIS process started. Outline how the consultation process (which will be described in detail in section 1.5) integrated 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, make a succinct statement of the EIS objectives. The EIS's structure 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 guide 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 complete knowledge in advance of undertaking an EIS of what the EIS studies may find.

If it transpires while preparing the EIS that previously unforeseen matters not addressed in the terms of reference are found to be relevant to assessing potential impacts of the project, those matters will be included in the EIS.

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

The EIS assessment's depth and scope will be proportional to the values impacted and the scale of the impacts. When considering whether an impact is or is not significant, the proponent will 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 not only to provide information to regulatory agencies, but also to inform the public about the project's scope, impacts and mitigation measures. As such, the main text will be written in plain English avoiding jargon as much as possible. Additional technical detail may be provided in appendices. The main text will not assume that a reader would have prior knowledge of the project site and it will not be necessary for the reader to have visited the site to understand the issues involved in the project.

In brief, the EIS objectives are 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 protecting and enhancing environmental values. A key aspect of the EIS is discussing options and alternatives and their likely relative environmental management outcomes.

The role of the EIS in providing the project's draft EM plan will 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 approvals, environmental authorities and permits for the project.

1.4.3 Submissions

The reader will be informed about 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 will outline the methodology that will be adopted to identify and mitigate social and economic impacts of the project. Provide information about consultation that has already taken place and its results.

Submitting 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 under section 41 of the *Environmental Protection Act 1994*. Similar requirements, though non-statutory, are usually applied to EIS processes under other Queensland legislation.

The public consultation program should provide opportunities to educate and involve the community. It may include interviews with individuals, public meetings, interest group meetings, producing regular summary information and updates, and other means 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

Explain the legislation and policies controlling the approvals process. Make reference to the Queensland *Environmental Protection Act 1994*, *Sustainable Planning Act 2009* and other potentially relevant Queensland laws. Include any requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

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 was 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 land clearing) is not applicable, this section of the EIS will explain why.

Describe local government planning controls, local laws and policies applying to the development, and provide a list of the approvals required for the project and the expected program for approval of applications. The description should include any requirements for workers' camps or villages.

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.

1.6.2 Planning processes and standards

Discuss the project's consistency with existing land uses or long-term policy framework for the area (for instance, as reflected in local and regional plans), and with legislation, standards, codes or guidelines available to monitor and control operations on site. 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

Projects that are undergoing an EIS under a State statutory process may also be controlled actions under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In which case, the Commonwealth may accredit Queensland's EIS process for the purposes of the Commonwealth's assessment under Part 8 of the EPBC Act. When a state EIS process has been accredited, it will be necessary for the TOR to address potential impacts on the matters of national environmental significance identified in the 'controlling provisions' when the project was declared a controlled action.

The matters to be addressed in the EIS are set out in Schedule 4 of the Commonwealth's Environment Protection and Biodiversity Conservation Regulations 2000. Provide a stand-alone report as a separate chapter of the EIS that fully addresses the matters relevant to the controlling provisions.

2. Project need and alternatives

2.1 Project justification

Describe the justification for the project, with particular reference to the economic and social benefits, including employment and spin-off business development that the project may provide. Discuss the status of the project in a regional, state and national context.

2.2 Alternatives to the project

Describe feasible alternatives, including conceptual, technological and locality alternatives to the project, and discuss the consequences of not proceeding with the project. Summarise the comparative environmental, social and economic impacts of each alternative, with particular regard to the principles of ecologically sustainable development (ESD). Discuss alternatives in sufficient detail to enable an understanding of the reasons for preferring certain options and courses of action and rejecting others.

Explain the interdependencies of the project's components, particularly 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 part of the project, describe and provide a rationale for such infrastructure.

This information is required to assess how the scope of the project was derived, and to ensure that the ESD principles and sustainable development aspects have been considered and incorporated during the scoping and planning of the project.

3. Description of the project

Describe the project through its various stages, such as construction, operation and decommissioning. This information is required to allow complete assessment of a project from planning to its end-of-life. It also allows identification of approvals that may be required and how they may be managed through the life of the project. Maps or figures showing the position of features or boundaries will use latitudes and longitudes on the GDA94 datum. These latitudes and longitudes will 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

Describe the regional context of the project and illustrate it on maps at suitable scales.

3.1.2 Local context

Describe the local context of the project and include real property descriptions of the project site and adjacent properties. Provide maps at suitable scales that show the precise location of the project area, and in particular:

- the location and boundaries of land tenures, in place or proposed, to which the pipeline easement is or will be subject
- the location of any aquatic features (e.g. rivers, streams, creeks, swamps, other waterbodies and wetlands)
- the location and boundaries of the pipeline easement showing all key aspects.

Include a rectified aerial photo enlargement (preferably A3 size) to illustrate components of the project in relation to the land, mining and petroleum tenures, and natural and built features of the area.

3.1.3 Co-location

Describe opportunities that exist for efficiency gains and the mitigation of environmental and property impacts through the co-location of the pipeline with other proposed linear infrastructure in, near or parallel to the pipeline corridor.

The Queensland Government encourages the co-location of multi-user pipelines within an infrastructure corridor to provide certainty for industry proponents, and to diminish the impact on affected landowners.

Identify any other proposals to develop infrastructure within the vicinity of the pipeline investigation corridor. Any other proposals for linear infrastructure within the corridor that would be incompatible with the Arrow Bowen Pipeline should also be identified. Such proposals would be limited to those projects that are in the public arena during the period of preparation of this EIS and for which a proponent can be readily identified.

While this EIS would not evaluate the environmental impacts of other infrastructure not directly required for this project, the EIS should describe the implications of locating other forms of linear infrastructure within or near the pipeline corridor. Where co-location may be likely, the EIS should consider opportunities to coordinate or enhance any of the impact mitigation strategies proposed for the pipeline corridor through cooperation with other proponents in the locality. In particular, the potential implication of any infrastructure co-location on pipeline corridor width and alignment should be described.

3.2 Construction

Describe the extent and nature of the project's construction phase. Describe the type and methods of construction, the construction equipment to be used and the items of plant to be transported onto the construction site. Describe any staging of the project and illustrate site boundaries, development sequencing and timeframes. Outline the requirements for commissioning of the pipeline (i.e. the hydro-testing pressure build up with the introduction of coal seam gas into the pipeline and associated venting).

3.3 Operations

Describe the location and nature of the project's operational phase, and illustrate the description as required with maps, diagrams and artist's impressions. The operation of the pipeline should include, but not necessarily be limited to:

- a description of the pipeline
- the capacity of the pipeline
- operational controls for the pipeline
- any lubricants to be used during maintenance.

3.3.1 Tenements and tenures

Describe and illustrate any existing mining tenements, petroleum, geothermal and greenhouse gas tenures and licences overlying and adjacent to the project site, and any proposed applications required for this project. The tenure of the Arrow Bowen Pipeline route should also be described.

3.3.2 Workforce

Outline the workforce numbers to be employed by the project during its various phases, such as construction, commissioning, operation and decommissioning. Make comment on the anticipated basis of employment, such as permanent, contract, etc. A detailed profile of the workforce will be provided in the social impact of the EIS.

3.3.3 Workforce accommodation

Describe where personnel will be accommodated. In particular, describe and illustrate the number, size, locations and management of any workers camps or villages. The consequent impacts of constructing new or expanded accommodation will be addressed in the appropriate sections of the EIS even if the accommodation will be operated by a contractor.

3.4 Infrastructure requirements

Describe with concept and layout plans, requirements for constructing, upgrading or relocating all infrastructure associated with the project. Show the locations of any necessary infrastructure easements on the plans, including infrastructure such as roads, rail (and the rail corridor), level crossings, conveyors, bridges, jetties, ferries, tracks and pathways, dams and weirs, bore fields, power lines and other cables, wireless technology (such as microwave telecommunications), and pipelines for any services, whether underground or above.

3.4.1 Transport—road/rail/air/ship

Provide an overview of the arrangements for the transportation, importation or exportation of plant, equipment, materials, products, wastes and personnel during both the construction and operational phases of the project. Describe the use of existing facilities, including common user transport infrastructure, and all requirements for the construction, upgrading or relocation of any transport-related infrastructure.

3.4.2 Energy

Describe all energy requirements, including electricity, natural gas, and/or solid and liquid fuel requirements for the construction and operation of the project. Show the locations of any easements on the infrastructure plan. Energy conservation will be briefly described in the context of any Commonwealth, Queensland and local government policies.

3.4.3 Water supply and storage

Provide information on proposed water usage and storage by the project, including the quality and quantity of all water supplied to, or captured at, the site. In particular, describe the proposed and optional sources of water supply, such as capture of overland flow, taking from a watercourse, bores, coal seam gas water and associated pipelines, and any surface storages, such as dams and weirs, and municipal water supply pipelines.

Estimate the average and maximum rates of supply from each source for each phase of the project's life. Any proposed water conservation and management measures should be described.

Describe any approvals and water allocations the project may need under the *Water Act 2000* for water supply and storage.

Estimate potable water demand for the project, including the temporary demands during the construction period. Provide details of any existing water supply, including town water, which would meet the requirements. If water storage and treatment is proposed on site for use by the site workforce, describe the method of treatment and storage. Describe any waste streams from water treatment, and assess the potential impacts of disposal in the appropriate sections of the EIS.

3.4.4 Stormwater drainage

Provide a description of the proposed stormwater drainage system and the proposed disposal arrangements, including any off-site services.

3.4.5 Sewerage

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, provide in section 4.4 Waste an assessment of the capacity of the existing system to accept the effluent. For industrial effluent, this should detail the physical and chemical characteristics of the effluent.

3.4.6 Telecommunications

Describe any impacts on existing telecommunications infrastructure, such as optical cables and microwave towers, and identify the owners of that infrastructure.

3.4.7 Accommodation and other infrastructure

Describe 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.

3.5 Waste management

Provide an inventory of all wastes to be generated by the project 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:

Provide schematic diagrams, which for the operational phase may be simplified versions of those provided in section 3.3, for each distinct stage of the project. These should indicate the processes to be used and highlight their associated waste streams. This applies to all waste outputs—solid, liquid and gaseous—including recycling efforts such as stockpiling and reusing topsoil. The schematic diagrams, or an associated table, will cross-reference the relevant sections of the EIS where the potential impacts and mitigation measures associated with each waste stream are described. Describe the physical and chemical characteristics, and the variability of composition and generation rates of each waste material.

Each subsection on waste management will assess how the proposed methods for waste management at each stage of the project achieve the highest possible level on the waste management hierarchy with regard to the principles in the Environmental Protection (Waste Management) Policy 2000.

Describe how the project would achieve natural resource use efficiency (such as minimum use of energy and water, and minimum footprint on used land), integrated processing design, co-generation of power and by-product reuse as shown in a material/energy flow analysis. This information is required to enable the resource management agencies and other stakeholders to assess the efficiency of resource use, and allocation issues.

3.5.1 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 disturbance by wind action on stockpiles and conveyors, or by transportation equipment such as trucks or trains, either by entrainment from the load or by travel on unsealed roads.

3.5.2 Solid waste disposal

Describe the quantity and quality of solid wastes (other than subsoil addressed in other sections) and the proposed methods of their disposal. Describe the proposed location, capacity and suitability of any landfill that would receive solid waste from the project. Describe and illustrate any proposed on-site landfill, including its dimensions, volume and method of construction.

3.5.3 Liquid waste

Describe the origin, quality and quantity of wastewater and any immiscible liquid waste that would be produced by the project other than that addressed in previous sections. Give particular attention to the capacity of wastes to generate acid, and saline or sodic wastewater. A water balance for the project and processing plant is required to account for the estimated usage of water.

The EIS will consider the following effects:

- groundwater from excavations
- rainfall directly onto disturbed surface areas
- run-off from roads and chemical storage areas
- drainage (run-off plus any seepage or leakage)
- seepage from other waste storages

- water usage for:
 - o process use
 - o dust suppression
 - o irrigation
 - o domestic purposes
- evaporation
- domestic sewage treatment – disposal of liquid effluent and sludge
- treatment and disposal of hydrostatic test water.

3.6 Rehabilitation and decommissioning

Describe the options, strategic approaches and methods for progressive and final rehabilitation of the environment disturbed by the project. Develop a preferred rehabilitation strategy that would minimise the amount of land disturbed at any one time, and minimise the residual loss of land with ecological or productive value. Show the final topography of any excavations, waste areas and dam sites on suitably scaled maps.

Describe the means of decommissioning the pipeline and any above-ground facilities, and the methods proposed for the stabilisation of the affected areas. Provide information regarding the decommissioning and rehabilitation of the site, removal of any infrastructure and rehabilitation of disturbed areas. Discuss in sufficient detail the options for the disposal of any waste material from decommissioning to establish their feasibility and suitability.

Describe the reinstatement of creek banks disturbed by open trenching during construction of the pipeline. 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 will be discussed in the appropriate subsections of section 4 (Environmental values and management of impacts) particularly with regard to issues such as final landform stability (section 4.2.2) and rehabilitation of plants (section 4.9.2). Implications for the long-term use and fate of the site will also be addressed, particularly with regard to the on-site disposal of waste and the site's inclusion on the Environmental Management Register or the 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 project. Environmental values are defined in section 9 of the *Environmental Protection Act 1994*, environmental protection policies and other documents such as the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC & ARMCANZ, 2000). Environmental values may also be derived following recognised procedures, such as described in the ANZECC & ARMCANZ 2000 guidelines. Environmental values will be described referring to background information and studies, which will be included as appendices to the EIS.
- Describe the potential adverse and beneficial impacts of the project on the identified environmental values.
- Describe any cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned development or sources of contamination.
- Propose environmental protection objectives and commitments. All environmental protection commitments must be measurable and auditable.
- Examine viable alternative strategies for managing impacts. These alternatives will be presented and compared in view of the stated objectives and standards to be achieved. Discuss available techniques, including best practice, to control and manage impacts to the nominated objectives. This section will 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 will prevent, or where prevention is not possible, minimise environmental harm and maximise social, economic and environmental benefits of the project. Preferred measures will 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 will address the inputs, assumptions, limitations, sensitivities, accuracy and precision of the model.

Any maps or figures showing the position of features or boundaries will use latitudes and longitudes on the GDA94 datum. Latitudes and longitudes on the GDA94 datum will 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 will 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 will address all elements of the environment, (such as land, water, coast, 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 will 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 background studies in appendices – note: such studies may be required over several seasons). Explain how the environmental values were derived, such as 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 project on the identified environmental values of the area. The cumulative impacts of the project 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, address any requirements and recommendations of the Great Barrier Reef Marine Park Authority, relevant state planning policies, environmental protection policies, national environmental protection measures and integrated catchment management plans.
- Cumulative impacts on the environmental values of land, air and water and cumulative impacts on public health and the health of terrestrial, aquatic and marine ecosystems must be discussed in the relevant sections. This assessment may include air and watersheds affected by the project and other proposals competing for use of the local air and water sheds.
- Where impacts from the project 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 project's area to undertake cooperative monitoring and/or management of environmental parameters. Describe such arrangements 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. Include objectives for progressive and final rehabilitation and managing contaminated land.
- 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 project. 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 and the draft *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) offsets policy.
- Monitoring programs: describe the monitoring parameters, monitoring points, frequency, data interpretation and reporting proposals.
- Auditing programs: describe how progress towards achieving 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 will 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 will be used to develop the environmental monitoring program for the project (see section 5).

4.1 Climate

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 project including air quality within the region of the project. Discuss extremes of climate (droughts, floods, cyclones, etc) with particular reference to water management at the project site. Address the vulnerability of the area to natural or induced hazards, such as floods and bushfires. Consider the relative frequency and magnitude of these events together with the risk they pose to management of the project.

The potential impacts due to climatic factors will be addressed in the relevant sections of the EIS. The impacts of rainfall on soil erosion will be addressed in section 4.2. The impacts of storm events on the capacity of waste containment systems, such as site bunding and stormwater management, will 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 will be addressed in section 4.7.

4.1.1 Climate change adaptation

Climate change, through alterations to weather patterns and rising sea level, has the potential for long-term impacts on developments. Most developments involve the transfer to, or use by, a proponent of a community resource in one form or another, such as granting 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 will assess 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, extreme weather and sea level (where appropriate) may affect the viability and environmental management of the project
- the preferred and alternative adaptation strategies to be implemented

- a commitment to undertake, where practicable, a cooperative approach with government, other industry and 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 will use their best efforts to incorporate adaptation to climate change in their EIS and project design.

4.2 Land

4.2.1 Description of environmental values

Describe the existing environment values of the land area that may be affected by the project. 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 achieving the objectives will be monitored, audited and managed.

4.2.1.1 Topography

Describe and illustrate the topography of the project site and the surrounding area, and highlight any significant features shown on the maps. Such features would include any locations subsequently referred to in the EIS (such as noise sensitive locations) that are not included on other maps in section 4.2. Maps will have contours at suitable increments (at least every metre in areas of low relief), shown with respect to Australian Height Datum (AHD) and drafted to the GDA 94 datum.

4.2.1.2 Land use

Describe and illustrate land uses in and around the project area in relation to current land tenures, show the location of existing dwellings, and make particular mention of any land with special attributes. Include any surrounding land or marine areas that could be affected by the project. Show the location of any native title applications or determinations. Describe and illustrate the zoning of land in and around the project area according to any existing town or strategic plan.

4.2.1.3 Geology and geomorphology

Provide a description, map and a series of cross-sections of the geology of the project area. Describe the geomorphology of the project site and the surrounding area. Make particular reference to the physical and chemical properties of surface and sub-surface materials and geological structures that could have an influence on, or be influenced by, the project's activities. Describe 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 project. Describe known sites of palaeontologic significance and address the potential for significant fossil finds in locations where the age and type of geology is such that significant specimens may be uncovered during construction or operations. Describe any sites of geomorphological significance, such as lava tubes or karst.

4.2.1.4 Soils

Conduct a soil survey of the area that would be affected by the project. Undertake soil tests and laboratory analyses of representative samples down the soil profile, 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. For pipeline routes, undertake the analysis and classification at least to the depth of excavation. Provide geotechnical information on the soils' stability and suitability for construction of project facilities.

Describe, map and illustrate soil types and profiles according to the Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain, 2009), Guidelines for Survey Soil and Land Resources (McKenzie et al, 2nd Ed., 2008) and Australian Soil Classification (Isbell, 2002).

For land where acid sulfate soils (ASS) may be present, undertake an investigation in accordance with the guidelines and methods published by the Queensland Acid Sulfate Soils Investigation Team (QASSIT) and the Queensland Acid Sulfate Soils Management Advisory Committee (QASSMAC). The management of ASS will address the State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils.

4.2.1.5 Land suitabilities

Provide an Agricultural Land Class map of the project site and the surrounding area according to the Planning Guideline: the Identification of Good Quality Agricultural Land (DPI/DHLGP, 1993).

Describe and map the land use suitabilities, and their classes, of the potentially affected area in accordance with the Land Suitability Assessment Techniques in the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (DME, 1995).

Describe and illustrate the usual agricultural use of the land of the project site and the surrounding area, including any crop rotations.

4.2.1.6 Contaminated land

Describe and illustrate the nature and extent of any areas listed on the Environmental Management Register (EMR) or the Contaminated Land Register (CLR) under the *Environmental Protection Act 1994*, and any existing potentially contaminated sites that are not on the registers but the history of the site suggests may be present.

Conduct a preliminary site investigation consistent with DERM's Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. If the results of the preliminary site investigation indicate potential or actual contamination, conduct 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. The results of the site investigations should be summarised in the EIS and provided in detail in an appendix.

4.2.1.7 Infrastructure

Describe and show on suitably-scaled maps the location and owners or custodians of all infrastructure and easements on the potentially affected land, including roads and road reserves, railways and rail reserves, stock routes, and power lines. Indicate the locations of any buried gas or water pipelines, power lines, or telecommunication cables. Describe the environmental values affected by the existing infrastructure.

4.2.1.8 Environmentally sensitive areas

Describe and show on suitably-scaled maps the proximity of the project to any category A or B environmentally sensitive areas under the Environmental Protection Regulation 2008. In particular, indicate if the land affected by the project is, or is likely, to become part of the protected area estate, or is subject to any treaty.

4.2.1.9 Landscape character

Describe in general terms the existing character of the landscape that will be affected by the project. Comment on any changes that have already been made to the natural landscape since European settlement. This section 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.

4.2.1.10 Visual amenity

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

- identifying 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 project 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

Define and describe the objectives and practical measures for protecting or enhancing the land-based environmental values identified through the studies outlined in the previous section. 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 Land use and suitability

Assess the potential for the project's construction and operation to change existing and potential land uses of the project site and adjacent areas. Detail the proposed land use options after construction of the pipeline, including the suitability of the area to be used for primary production, industry, or nature conservation. Assess the factors favouring or limiting the establishment of those options compared to land use and suitability prior to construction of the project and assess the potential liabilities for long-term management.

Assess the potential environmental harm caused by the project on the adjacent areas currently used for agriculture, urban development, recreation, tourism, other business. Assess the implications of the project for future developments in the impact area, including constraints on surrounding land uses. Propose mitigation measures for any potentially adverse impacts on stock route operations during the construction and operational phases of the development. If the development adjoins or potentially impacts on good quality agricultural land, assess the potential for land use conflict. Investigations will follow the procedures set out in the planning guideline The Identification of Good Quality Agricultural Land (DPI & DHLGP, 1993), which supports State Planning Policy 1/92: Development and the Conservation of Agricultural Land.

Assess incompatible land uses, whether existing or potential, adjacent to all aspects of the project, including essential and proposed ancillary developments or activities and areas directly or indirectly affected by the construction and operation of these activities. Propose measures to avoid or mitigate adverse impacts.

4.2.2.2 Land disturbance

Develop and detail a strategy that will minimise the amount of land disturbed at any one time. The strategy will address progressive rehabilitation and final decommissioning with particular regard to the impacts in the short, medium and long-term timeframes. Describe the methods to be used for managing disturbed land, including backfilling, covering, re-contouring, topsoil handling and revegetation. 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 will be first described in this section. However, the potential impacts of interfering with flow on the quantity and quality of water resources, the final drainage and seepage control systems, and any long-term monitoring plans will be assessed and described in section 4.5.

In addition to assessing the operational phase of land disturbance, address the ultimate changes following implementation of the decommissioning and rehabilitation plan described in section 3.7. Assess the proposed mitigation measures for land disturbance to be used on decommissioning the site in sufficient detail to decide their feasibility. In particular, address the long-term safety of access to the site after surrender of the lease, and the residual risks that will be transferred to the subsequent landholder.

Rehabilitation success criteria for land disturbance will be proposed in this section while rehabilitation success criteria for revegetation will be proposed in the section on ecology.

If geological conditions are conducive, the proponent should consider the possibility that significant fossil specimens may be uncovered during construction or operations and propose strategies to protect the specimens and alert the Queensland Museum to the find.

4.2.2.3 Land degradation or contamination

Assess the possible degradation or contamination of land that could result from any aspects of the project. The assessment should not be limited to activities that would result in the land being entered on the EMR or the CLR. Rather, it should include any activity that could have a detrimental impact on land. Matters to be considered include:

- the long-term use for dust-suppression of water with sufficient dissolved salts to affect soil condition
- disposal to land of any waste water
- disturbance of acid sulfate soils
- spills at chemical and fuel storage areas.

Propose measures that would prevent or remediate any degradation or contamination of land due to the proposed activities. Also, propose any measures required for the management and possible remediation of any existing contamination on the site.

For activities that may disturb acid sulfate soils, also propose management measures that would prevent the contamination of groundwater or surface water. The proposed management measures will be in accordance with the State Planning Policy 2/02: Planning and Managing Development Involving Acid Sulfate Soils and the guidelines published by the Queensland Acid Sulfate Soils Investigation Team (QASSIT) and the Queensland Acid Sulfate Soils Management Advisory Committee (QASSMAC).

Assess any activities or proposed contamination that would result in the land being newly entered on the EMR or the CLR. Also assess the consequences, particularly for the subsequent landholder, of any intention to leave the site on either register when mining ceases. Prepare a site management plan for any land remaining on the EMR or the CLR, and describe when, how and by whom it will be implemented.

4.2.2.4 Erosion and stability

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

The report will 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
- access roads or other transport corridors
- water supply pipeline and electricity transmission corridors.

Methods proposed to prevent or control erosion will be specified and will be developed with regard to preventing soil loss in order to maintain land capability or suitability, and preventing significant degradation of local waterways by suspended solids. The mitigation measures will address the selective handling of capping material to maximise long-term stability of final landforms in regard to slumping and erosion both on and below the surface. Erosion control measures will be developed into an erosion and sediment control plan for inclusion in the EM plan.

4.2.2.5 Landscape character

Describe the potential impacts of the project on the landscape character of the site and the surrounding area. Make particular mention of any changes to the broad-scale topography and vegetation character of the area, such as broad-scale clearing.

Provide details of measures to be undertaken to mitigate or avoid the identified impacts.

4.2.2.6 Visual amenity

Assess and discuss the visual impact of the project on particular panoramas and outlooks. Assess the extent and significance of the changed skyline including views from places of residence, work, and recreation, from road, cycle and walkways, from the air and other known vantage points day and night, and during all stages of the project. Illustrate the visual impacts of the project structures and associated infrastructure using appropriate simulation. Use sketches, diagrams, computer imaging and photos to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations.

Provide detail of how impacts on visual amenity would be mitigated or avoided.

4.2.2.7 Lighting

Assess the potential impacts of lighting during all stages of the project particularly regarding:

- the effects of night operations, maintenance or increased vehicular traffic on residents
- changed habitat conditions for nocturnal animals
- the attraction of animals to lights at night.

Propose measures to mitigate or avoid all potential impacts due to lighting.

4.3 Transport

The transport section of the EIS will 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 the proposed use of existing infrastructure to transport materials, products or wastes to and from the project site. 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, separately describe in detail and illustrate the existing networks that would be used by the project. Describe and illustrate any stock routes potentially affected by the project.

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

In relation to importing or exporting materials and products, identify any port that would be used by the project. Provide details 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 material 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 will describe the:

- proposed construction, realignment, structural alteration, or changed use of any access roads, 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 of vehicles, rolling stock, vessels and craft to be used
- likely number and timing of trips.

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, provide sufficient information 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 will be discussed and measures proposed to avoid or mitigate the impacts.

Details will 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
- possible interruptions to transport operations
- risks of spills of products or hazardous materials during transport, prevention measures to be used, and the requirements for dealing with any spills.

Assess any impacts on stock routes due to the project's activities. Propose mitigation measures for any disruptions to movement of travelling stock on stock routes. 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 will 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 will include an assessment of impacts on:

- the safety, efficiency and condition of road operations and assets, including driver fatigue
- 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 will 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, such as due to dust, noise or vibration, will also consider the following matters:

- the likely size of trains and the number of train paths needed to move materials 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.

The direct impacts on any other transport infrastructure, such as those due to road or rail crossings, will be addressed in the transport section of the EIS, while the impacts on other matters (such as ecology, noise, etc) will be addressed in the appropriate sections of the EIS, but cross-referenced in the transport section.

In relation to the importation of materials, identify any aspects of the project that will increase the shipment of materials through any port. Provide details of the likely size and number of additional vessels that would use the port.

Assess any impacts on any port due to the import or export of materials or products, including the need for:

- new coastal works, such as berth construction or alteration, land reclamation, etc
- any dredging for shipping channels and swing basins
- new or altered stockpile areas
- new, altered, or increased use of existing, infrastructure to handle materials between ships and road or rail transport.

Also assess any impacts on nearby areas due to the handling or storage of materials at ports, including dust, noise or lighting.

Assess any potential impacts of the project on water traffic in rivers and dams.

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 will 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 (for example, dredging at a port), the EIS will clearly identify the entity that will be responsible and what approvals would be needed. Nevertheless, in this case, the EIS will 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.

Describe detailed measures to avoid or mitigate impacts on each transport mode. The mitigation measures will 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 will 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.

Also consider public transport requirements and links to, or development of pedestrian and cycle networks.

4.4 Waste

This section will 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

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 managing waste will be provided in the relevant sections of part 4 of the EIS.

Define and describe the objectives and practical measures for protecting or enhancing environmental values from impacts by wastes. Assess the management measures against the waste hierarchy, describe 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 except where issues related to waste have been addressed in section 3.6 (in which case reference will be made to the appropriate subsection), provide details of each waste with regard to:

- operational handling, storage, treatment, disposal and fate of all wastes
- any methods and locations to be used to transport and dispose of wastes off the project site
- 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
- methods to prevent seepage and contamination of surface water or groundwater from stockpiles and/or dumps
- design criteria to be used to ensure that waste containment and/or storage facilities perform satisfactorily
- market demand for recyclable waste
- waste minimisation processes
- measures to ensure wastes does not attract or propagate pests, disease vectors or vermin, and do not impact on public health
- decommissioning of the site.

Consider the physical, geo-mechanical and chemical properties of excavated soil when determining its suitability for backfilling operations.

4.5 Water

4.5.1 Description of environmental values

Describe the existing resources and environmental values of water that may be affected by the project. Environmental values will be defined according to the *Environmental Protection Act 1994*, Environmental Protection (Water) Policy 2009 (EPP(Water)), the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC & ARMCANZ, 2000), the Queensland Water Quality Guidelines 2009 (DERM, 2009) and the guideline Establishing Draft Environmental Values and Water Quality Objectives (EPA, 2002). Make reference to Queensland Wetland Mapping and any available Aquatic Conservation Assessments produced by DERM. Include estuarine and marine waters if they could be impacted by the project. The definition of waters in the EPP(Water) includes the bed and banks of waters, so this section will address benthic sediments as well as the water column.

Develop and describe suitable water quality and resource indicators for measuring environmental values, and objectives that would protect the identified values.

Describe and illustrate the surface watercourses, overland flow, palustrine and lacustrine wetlands, estuaries and marine waters. The description will include suitably scaled maps of catchments, watercourses, drainage pathways, wetlands, or sources of water supply (such as farm dams) potentially affected by the project, whether on or off the project site. Describe, with supporting photographs, the geomorphic condition of any watercourses likely to be affected by disturbance or stream diversion. The results of this description will form the basis for the planning and subsequent monitoring of rehabilitation of the watercourses during or after the operation of the project.

Describe the hydrology of watercourses and overland flow in the project area and any downstream locations potentially affected by the project.

Provide details of the likelihood and history of flooding, including the extent, levels and frequency of floods in and around the project site. Flood studies will include a range of annual exceedance probabilities for potentially 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 will include local flooding due to short duration events from contributing catchments on site, as well as larger scale regional flooding including waterways downstream.

Describe present and potential users and uses of water in areas potentially affected by the project, including municipal, agricultural, industrial and recreational uses of water.

Describe the quality of surface waters in the area potentially affected by the project with an outline of the significance of these waters to the river catchment system in which they occur (note: impacts on coastal water quality will be discussed in section 4.6 (Coastal environment)). The description will be based on a monitoring program, with sampling stations located upstream at reference sites that would not be impacted and downstream of the project. Monitoring will include sites closest to the proposed discharge points and at downstream locations that would be below any mixing zone. Sites will include permanent and semi-permanent water holes, known aquatic habitat, weirs or reservoirs. Available complementary stream-flow data will also be obtained from historical records to help interpretation. Describe seasonal variations in water quality and variations with flow. Monitoring of ephemeral streams will primarily focus on all times of natural flow. Measure a range of physical, chemical and biological parameters relevant to the potential environmental harm on any affected creek or wetland system. This will include but not necessarily be limited to water quality indicators likely to be affected by the project such as electrical conductivity, dissolved metals, turbidity, suspended sediments and pH. Biological indicators will include macroinvertebrate surveys undertaken at appropriate locations according to best practice methods. All sampling will be performed in accordance with the Monitoring and Sampling Manual 2009 (DERM, 2009) or the most current edition.

Describe the quality, quantity and significance of groundwater in the project area and any surrounding area potentially affected by the project's activities.

Describe the nature and hydrology of the aquifers of the potentially affected area, including:

- geology and stratigraphy
- aquifer type – such as confined, unconfined, karst or perched
- depth to, and thickness of, 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)
- groundwater yield
- groundwater quality
- interaction with surface water
- interaction with saline water
- possible sources of recharge
- vulnerability to pollution.

The description will include a survey of existing groundwater supply facilities (bores, wells, or excavations) to the extent of any potential impacts. Include and analyse the following information:

- location of potentially affected bores or wells
- pumping parameters

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

4.5.2 Potential impacts and mitigation measures

For all phases of the project, this section of the EIS will:

- assess potential impacts on the water resource environmental values identified in the previous section
- define and describe the objectives and practical measures for protecting or enhancing water resource environmental values
- describe how the achievement of the objectives will be monitored, audited and managed.

Describe and illustrate with maps, plans and cross-sections any proposal to undertake in-stream works. Assess the potential impacts of in-stream works on hydrology and water quality, and propose measures for avoiding or mitigating the impacts and stabilising and rehabilitating any works.

Assess the hydrological impacts of the project, particularly with regard to the various components of flow that may be impacted by the project. The EIS will address: changes to catchment size or characteristics; changes to the direction or quantity of runoff in the local catchment and to accumulated downstream flows; scouring and erosion; and the consequent impacts of any subsidence. Any consequential impacts of changes to water flow or groundwater recharge on ecosystems and wildlife will be addressed in the ecology section of the EIS.

Describe the options for supplying water to the project, and assess the consequential impacts in relation to any water resource plan, and resource operations plan. Water allocation and water sources will be established in consultation with DERM. Where a licence or permit will be required under the *Water Act 2000* to take water or interfere with the flow of water, provide sufficient information and assessment for the administering authority to consider the suitability of approving any necessary works under the *Water Act 2000*. Similarly, provide sufficient assessment to consider any approval for waterway barrier works under the *Fisheries Act 1994*.

Describe in detail the proposed water management controls, addressing surface and ground water quality and quantity, drainage patterns and sediment movements. Describe and illustrate: the locations, catchments, footprints, cross-sections and method of construction of any dams on the site; their flood immunity; the quality of water or waste water they would contain, and indicate their hazard category. Provide the design storage allowances for sediment dams and process or waste water dams, and demonstrate that the design has been produced by a suitably qualified and experienced engineer using current best practice. Propose measures to manage sediment dams and process or waste water dams and their discharge, and to decommission and rehabilitate the dams when their use ends.

Assess the potential impacts on local and downstream water quality due to any controlled discharges from the site. Describe the proposed quality, quantities and locations of waste water discharges. Use stream flow data in combination with proposed discharge rates to estimate in-stream dilution and water quality. Compare the predicted contaminant levels to the water quality objectives and provide an assessment of the assimilative capacity of the receiving waters. Assess options for controlled discharge under times of natural stream flow that would ensure that adequate flushing of waste water is achieved. Assess the acute and chronic potential impacts of discharges including the cumulative impacts with other discharges from other projects or industry.

Describe any proposed no-release water systems, assess the management and fate of contaminants, and propose mitigation measures for any potential impacts.

Describe monitoring programs that will assess the effectiveness of management strategies for protecting water quality during the construction, operation and decommissioning of the project.

Conduct a risk assessment, based on conservative water quality estimates and hydrology, for uncontrolled emissions to water due to system or catastrophic failure, assess the potential impacts of such emissions on human health and natural ecosystems, and provide detailed measures to avoid or minimise impacts.

Assess the potential impacts on local groundwater resources and quality, and define the extent of the area where groundwater resources are likely to be affected by the proposed operations. Assess the potential impacts of the operations on groundwater draw-down, depletion or recharge, and propose management options to monitor and mitigate these effects. Assess the likely response of the groundwater resource after operation of the project. Assess the potential impacts on the local ground water regime due to altered porosity and permeability from any land disturbance, such as subsidence. Assess the potential for project operations or residual effects to contaminate groundwater resources. Propose measures to avoid, mitigate and remediate any impacts on groundwater resources or quality.

4.6 Coastal environment

4.6.1 Description of environmental values

Describe the existing coastal environment that may be affected by the project in the context of coastal resources and values identified in the State Coastal Management Plan and any applicable Regional Coastal Management Plans. When necessary to avoid duplication, cross-reference other sections of the EIS where coastal values, such as ecology or scenic amenity, are addressed.

Provide an assessment of physical and chemical characteristics of sediments within the littoral and marine zone potentially affected by the project.

Describe the physical processes of the littoral and marine environment, including currents, tides, freshwater flows and their interaction in relation to coastal morphology and the assimilation and transport of contaminants entering marine waters from, or adjacent to, the project area.

Develop and describe suitable indicators for measuring coastal values, and objectives that would protect the coastal resources and values.

4.6.2 Potential impacts and mitigation measures

Identify actions associated with the project that are assessable development within the coastal zone and would require approval under the *Coastal Protection and Management Act 1995*.

Assess the potential impacts that may be caused by the project on coastal processes, resources and values.

Compare the magnitude of the potential impacts to the objectives, and develop management measures that would avoid or mitigate the impacts to meet the objectives. Describe how the mitigation measures are in accordance with applicable coastal management plans, state planning policies (such as State Planning Policy 2/02 – Planning and Managing Development Involving Acid Sulfate Soils), and the Department of Employment, Economic Development and Innovation's series of fisheries guidelines.

Detail a monitoring program that would audit the success of mitigation measures, and describe corrective actions to be used if monitoring shows that objectives are not being met.

4.7 Air

4.7.1 Description of environmental values

Describe the quantity and quality of air emissions (commissioning and purging of the pipeline) during construction and operation.

Describe the existing air environment and that may be affected by the project. Discuss the background levels and sources of contaminants including suspended particulates, oxides of sulfur or nitrogen, greenhouse gases, odorous compounds and any other relevant constituent, whether major or minor, of the air environment that may be affected by the project.

Describe and illustrate the locations of existing residences, places of work, schools, etc, agricultural or ecologically significant areas that could be impacted by emissions from the project.

Describe the environmental values, appropriate indicators and air quality objectives for the potentially affected air environment according to the Environmental Protection (Air) Policy 2008 (EPP(Air)). Assess whether any air quality objectives are needed in addition to those in the EPP(Air).

4.7.2 Potential impacts and mitigation measures

Describe all the project's potential sources of emissions to air and expected composition of the emissions. The description will include oxides of sulfur or nitrogen, volatile organic compounds, carbon monoxide and dioxide, particulates (including dust, PM10, and PM2.5), trace metals, odours and any toxic, persistent and/or hazardous substances that would be emitted by the project.

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 waste.

Describe any situations where people, ecosystems or an agricultural use would experience concentrations above an objective. Assess the human health risk associated with emissions from the project for all contaminants whether or not they are covered by the National Environmental Protection Council (Ambient Air Quality) Measure or the EPP(Air). Assess potential impacts of emissions on ecosystems or agricultural uses of the environment.

If odour could be an issue, conduct odour impact assessment according to the DERM guideline Odour Impact Assessment from Developments.

Describe the pollution control equipment and pollution control processes to be employed during pipeline construction and operation and the features of the project designed to suppress or minimise emissions, including dusts and odours. Describe the backup 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.

Assess how the proposed emission control processes accord with the management hierarchy for air emissions in the EPP(Air).

Describe how the air quality objectives would be achieved, monitored and audited, and how corrective action would be taken when needed.

4.7.2.1 Greenhouse gases

Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO₂ equivalent' terms. Assess the potential impacts of the project on the state and national greenhouse gas inventories and propose greenhouse gas abatement measures, including:

- 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.

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)
- using less carbon-emitting transport modes or fuels
- 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
- co-locating coal seam methane use for energy production with coal extraction
- carbon sequestration at nearby or remote locations.

Include a specific module to address greenhouse abatement in the draft environmental management plan. That module will 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
- periodic energy audits with a view to progressively improving energy efficiency
- a process for regularly reviewing 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 by renewable energy uses
- commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures.

4.8 Noise and vibration

4.8.1 Description of environmental values

Describe the existing environmental values that may be affected by noise and vibration from the project. Environmental values and acoustic objectives for noise-sensitive receptors are defined in the Environmental Protection (Noise) Policy 2008 (EPP(Noise)).

If the proposed activity could adversely impact on the noise environment, undertake baseline monitoring at a selection of sensitive receptors potentially affected by the project. Sensitive receptors are defined in the EPP(Noise). Illustrate the locations of sensitive receptors on a suitably-scaled map.

Describe the results of any baseline monitoring of noise and vibration in the proposed vicinity of the project, including long-term measured background noise levels that take into account seasonal variations.

Report the daily variation of background noise levels at nearby sensitive receptors, with particular regard to detailing variations at different periods of the night. Monitoring methods will 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).

Describe any current activities near the project area that may cause a background level of ground vibration (for example major roads, quarrying activities, etc).

Develop and describe suitable indicators for measuring noise, and objectives that would protect the environmental values from significant noise and vibration impacts.

4.8.2 Potential impacts and mitigation measures

Using a suitable acoustic model, predict the likely generation of noise for different times of day under a range of climatic conditions, including the expected worse case. Describe the predictions using suitable indicators, and illustrate the predicted noise contours on suitably-scaled maps showing the locations of noise sensitive receptors. Assess the potential impacts of noise and vibration at all potentially sensitive receptors in comparison to the objectives and standards to be achieved. Give particular consideration to emissions of low-frequency noise; that is, noise with components below 200Hz. The assessment of noise impacts will include matters raised in the document *The Health Effects of Environmental Noise – Other Than Hearing Loss* published by the enHealth Council, 2004 (or later editions), ISBN 0 642 82304 9. Assess the potential environmental impacts of noise and vibration on terrestrial and marine animals and birds, including migratory species. Assess potential noise impacts on any nearby protected areas addressing amenity as well as impacts on animals. Provide information on blasting that might cause ground vibration or fly rock on, or adjacent to, the site with particular attention given to places of work, residence, recreation, worship and general amenity. Discuss the magnitude, duration and frequency of any vibration and assess the potential impacts on sensitive receptors. Reference will be made to the DERM guideline: *Noise and Vibration from Blasting*.

Assess potential off-site noise and vibration impacts that could arise due to increased road or rail transportation directly resulting from the project.

Define and describe practical measures for protecting or enhancing environmental values from impacts by noise and vibration, including details and illustrations of any screening, lining, enclosing or bunding. Provide a discussion of timing schedules for construction and operations with respect to minimising environmental nuisance and harm from noise and vibration. Also, describe how the achievement of the objectives will be monitored, audited and corrective action taken when needed. Describe how any complaints about noise or vibration would be managed and reported.

4.9 Ecology

4.9.1 Description of environmental values

Describe the existing ecological values that may be affected by the project. Address those ecological values in terms of:

- terrestrial and aquatic ecosystems, and their interaction
- biological diversity
- the existing integrity of ecological processes, including habitats of threatened or near threatened species
- the integrity of landscapes and places, including wilderness and similar natural places.

The description of the ecological values of the areas likely to be affected by the project will be illustrated by maps, diagrams and photographs. The description will start by addressing the ecology of the regional area and progress to a detailed description of the project site and any localities that could be affected by project related activities, including downstream and down-wind areas that could be significantly impacted by emissions. The description of ecological values will account for seasonal changes.

For all locations that may be affected by any aspect of the project, provide suitably-scaled maps of terrestrial vegetation based primarily on field surveys with descriptions of the mapped ecosystems and any items of special interest. Map adjacent areas to illustrate interconnectivity, including any larger scale interconnections between areas of remnant or regrowth vegetation where the project site includes vegetation that facilitates animal movement between those other areas. Field surveys will use the Queensland Herbarium methodology and proformas in the latest version of the publication *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (EPA, 2005), and survey a minimum of three sites, each at least 50 m by 10 m, within each defined (standard system) vegetation community.

The vegetation description and mapping, produced from aerial photographs and field surveys, and having a minimum scale of 1:10 000, will cover at least the following matters:

- location and extent of vegetation types using DERM's regional ecosystem type descriptions in accordance with the Regional Ecosystem Description Database
- category A or B environmentally sensitive areas under the Environmental Protection Regulation 2008
- any areas of state, regional or local significance identified in an approved Biodiversity Planning Assessment produced by DERM
- critical habitat within the meaning of the *Nature Conservation Act 1992*
- vegetation mapped as essential habitat
- remnant or regrowth vegetation, particularly essential regrowth habitat, high value regrowth, or a regrowth watercourse
- sensitive or important vegetation types, including riparian vegetation and any marine littoral and subtidal zone
- in-land or coastal wetlands
- wildlife breeding or roosting areas
- sites in, or adjacent to, areas containing important resting, feeding or breeding sites, or flight paths for migratory species 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 adjacent to nesting beaches, feeding, resting or calving areas of species of special interest, such as marine turtles and cetaceans
- sites containing common species that represent a distributional limit and are of scientific value or contain feeding, breeding, resting areas for populations of echidna, koala, platypus and other species of special cultural significance
- sites containing high biodiversity that may be dependent for their long-term survival or function on connectivity with other nearby areas of habitat
- a site containing other special ecological values, for example, high habitat diversity and areas of high endemism
- bat roosting and breeding caves, including existing structures such as adits and shafts
- habitat of threatened or near threatened animals
- the condition of vegetation and its habitat value, particularly in relation to the conservation of any threatened and near threatened plant and animal species, assemblages or community types
- a complete list of species present at each site
- the relative abundance of plant species
- species of protected plants highlighting those listed as threatened or near threatened under the Nature Conservation (Wildlife) Regulation 2006
- any other plant communities or species of conservation, cultural, commercial or recreational significance
- areas that may have low resilience to environmental change
- location and abundance of any pest, weed or exotic species
- any areas that would be subject to the *Vegetation Management Act 1999*.

Plants that could not be identified during the survey will be submitted to the Queensland Herbarium for identification. Specimens of plant species of conservation significance, including those listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006, other than common species, will be submitted to the Queensland Herbarium with sufficient information to enable their lodgement as voucher specimens.

The plant and animal surveys will address species structure, assemblage, diversity and abundance. Surveys will be sufficient to identify, or adequately extrapolate, the plant and animal values over the range of seasons, particularly during and following a wet season. The survey will account for the ephemeral nature of watercourses traversing the project area, and seasonal variation in animal populations. Existing information on plants and animals may be used to supplement new survey work provided that the existing data are still current and have been derived from previous surveys at the site that were consistent with current best practice methodologies.

Methodologies used for plant and animal surveys will be specified in the appendices to the EIS.

Undertake a comprehensive vertebrate animal survey of the project area at a sampling intensity that supports the scale of vegetation mapping (i.e. 1:10 000 or better). Surveys of terrestrial wildlife will be conducted in a manner that is sensitive to effects of seasonality and the different activity patterns and habitat use by species under different seasonal conditions.

Describe the terrestrial and riparian animals occurring in the areas affected by the project, noting the broad distribution patterns in relation to vegetation, topography and substrate. The description of the animals present or likely to be present in the area will address:

- a list of animal species, their diversity and abundance
- the existence of any threatened, near threatened or otherwise noteworthy species or communities in the study area, including discussion of range, habitat, breeding, recruitment, feeding and movement requirements, and current level of protection (such as any requirements of protected area management plans)
- any species that are poorly known but suspected of being threatened or near threatened
- habitat requirements and their sensitivity to changes
- movement corridors and barriers to movement
- the use of the area by migratory birds, nomadic birds, bats, and arboreal and ground-dwelling animals
- feral, pest or exotic animals.

In addition to the species found in the field survey, provide an indicative list of all other known or likely species within a 100 km area around the project site and the local bioregion, highlighting any threatened or near threatened species. Correlate the occurrence of animals of conservation significance to mapped vegetation units or habitats to facilitate the development of measures for their protection. Indicate how well any affected communities are represented and protected elsewhere in the province where the site of the project occurs.

Describe the aquatic plants and animals occurring in the areas affected by the project, noting the patterns and distribution in the waterways and any associated wetlands, lacustrine and marine environments. The description of the plants and animals present or likely to be present in the area will at least include:

- fish species, mammals, reptiles, amphibians, crustaceans and aquatic invertebrates occurring in the waterways within the affected area, and/or those in any associated lacustrine and marine environment
- any threatened or near threatened marine species and their habitat
- aquatic plants
- aquatic and benthic substrate
- habitat downstream of the project, or potentially impacted due to currents in associated lacustrine and marine environments.

Develop and describe suitable indicators for measuring ecological values, and objectives that would protect the environmental values from significant adverse impacts.

4.9.2 Potential impacts and mitigation measures

Assess the potential impacts on the ecological values of the area arising from the construction, operation and decommissioning of the project including clearing, salvaging or removal of vegetation. Cover terrestrial and aquatic (marine and freshwater) environments, including any potentially impacted benthic and inter-tidal communities, seagrass beds and mangroves. Assess the potentially significant environmental impacts on any plants and animals, whether on or off the project site, due to any alterations to the local surface and ground water environment.

Specifically assess any potential impacts on a category A or B environmentally sensitive area and propose measures to avoid impacts.

If available, provide electronic shapefiles in a format compatible with ArcGIS indicating the boundary of the project area and detailing the extent of proposed vegetation clearing in relation to surrounding vegetation both within the project area and in any off-site area to be used for project related infrastructure.

Assess the indirect impacts on remaining vegetation, such as those due to edge effects, reducing vegetation area below a viable size, or reductions in connectivity. Similarly, indirect impacts on animals should be assessed, such as the reduction of a habitat area below a viable size or increased predation due to reduced cover. Short-term and long-term effects should be considered with comment on whether the impacts are reversible or irreversible.

Assess the capacity of the environment to assimilate discharges or emissions. Assess the potential impacts due to chronic, low-level exposure to contaminants or the bio-accumulation of contaminants.

Assess the potential impacts on animals of wastes during construction and operation of the pipeline. Propose measures to prevent harm to wildlife.

Describe and assess the potential impacts of any actions of the project 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 assessment and supporting information should be sufficient for the administering authority to decide whether an approval should be granted and developing recommended conditions.

Propose practical measures for protecting or enhancing ecological values, and assess how nominated quantitative standards and indicators may be achieved for nature conservation management. In particular, address measures to protect or preserve any threatened or near threatened species.

Describe measures that would adequately mitigate potential impacts on habitats that would inhibit animal movement, propagation or feeding patterns, or change food chains. Specifically address any obligations imposed by Queensland or Commonwealth legislation or policy or international treaty obligations, such as JAMBA, CAMBA or ROKAMBA. Assess the need for buffer zones and the retention, rehabilitation or planting of movement corridors, and propose measures that would avoid waterway barriers or mitigate their construction and operation. Assess works in a waterway considering Waterway Barrier Works Development Approvals, Queensland Primary Industries and Fisheries Fish Habitat Management Operational Policy FHMOP 008, 2009.

Identify and quantify any potential net loss of environmental values. Propose environmental offsets that would counterbalance the remaining loss of environmental values. Proposed environmental offsets will be consistent with the requirements set out in any applicable specific-issue offset policies under the framework of the Queensland Government's Environmental Offset Policy (2008). Specific-issue offset policies that will be considered are:

- Policy for Vegetation Management Offsets, DERM, 2009
- Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss: Departmental Procedures, Fish Habitat Management Operational Policy, Queensland Department of Primary Industries, FHMOP 005, 2002
- Offsets for Net Benefit to Koalas and Koala Habitat, EPA, 2006.

Propose detailed measures to remove and control the introduction or spread of weeds and feral or pest animals. This should include a risk assessment of high biosecurity risk species and their sites, and the development of threat mitigation plans for them, such as clean down and inspections at high risk sites. The biosecurity management strategies will include mitigation measures relevant to protecting any potentially affected primary production areas. When determining control strategies, reference will be made to the latest Biosecurity Queensland's Annual Pest Distribution Survey data, published biosecurity management strategies, local government pest management plans and any applicable model local laws dealing with locally declared pest plants and animals. Develop management strategies to ensure no new marine pests are introduced as a result of the project's activities. Include all management measures for pest plants and animals in a biosecurity management plan, which will form part of the project's draft EM plan.

Propose measures for the progressive rehabilitation of disturbed areas, including rehabilitation success criteria that would be used to measure the progress. Describe how the achievement of the objectives would be monitored and audited, and how corrective actions would be managed. Proposals for the rehabilitation of disturbed areas will incorporate, where appropriate, provision of nest hollows and ground litter.

4.10 Cultural heritage

4.10.1 Description of environmental values

Unless an exemption applies under s86 of the *Aboriginal Cultural Heritage Act 2003*, an Indigenous cultural heritage plan must be prepared in accordance with the requirements of Part 7 of that Act.

For non-Indigenous historical heritage, a study will 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 (such as a physical investigation) of the area potentially affected by the project.

The desktop component of the study will, as a minimum, review the following sources for information on non-Indigenous 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
- results of previous cultural heritage studies conducted in the region.

The scope of the archaeological investigation will be based upon the results of the desktop analysis for non-Indigenous cultural heritage. The archaeological investigation is to be conducted by an appropriately qualified person, and will address all types of historical heritage places located within the project area including built, archaeological and non-Indigenous 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*.

4.10.2 Potential impacts and mitigation measures

4.10.2.1 Indigenous cultural heritage

Unless an exemption applies under s86 of the *Aboriginal Cultural Heritage Act 2003*, development of a Cultural Heritage Management Plan (CHMP) must be prepared in accordance with the requirements of Part 7 of that Act. The gazetted Cultural Heritage Management Plan Guidelines may assist in the development of the CHMP. 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.

4.10.2.2 Non-Indigenous historical cultural heritage

The potential impacts on non-Indigenous historical cultural heritage values and their avoidance or mitigation will 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 will be negotiated with DERM and any other relevant stakeholders.

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

- processes for mitigating, managing and protecting 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 collecting any artefact material, including appropriate storage and conservation
- historical cultural heritage awareness training or programs for project staff.

The training will be provided during the site induction, and will address the legislative requirements and practical measures for the recognition, reporting and preservation of cultural heritage material. A plain English manual summarising the training will be given to all site workers for their future reference.

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

4.11 Social values

The description of social and cultural values potentially impacted by the project, and the assessment of the impacts on those values, will be conducted in consultation, through the EIS coordinator, with the Social Impact Assessment Unit of the Department of Employment, Economic Development and Innovation . The proponent will engage at the earliest practical stage with stakeholders and potentially affected parties to discuss and explain the project, and to identify and respond to issues and concerns regarding social impacts. The stakeholder engagement processes will continue throughout the EIS and contribute to the identification of social and cultural values and to the assessment of impacts.

4.11.1 Description of existing social values

Define the social and cultural values within the project's area of influence, including the local, district, regional and state level as appropriate, taking into account the:

- potential for social and cultural impacts to occur
- location of other relevant proposals or projects
- location and types of physical and social infrastructure, settlement and land use patterns
- social values that might be affected by the project, including integrity of social conditions, liveability, social harmony and wellbeing, and sense of community
- Indigenous social and cultural characteristics, such as areas under native title rights or application.

Undertake a targeted baseline study of the people in the project's social and cultural area to identify social values that may be impacted by the project. The social baseline study will be based on qualitative, quantitative, and participatory methods supported by stakeholder engagement processes.

It will reference relevant data contained in local and state government publications, reports, plans, guidelines and documentation, including regional plans and any available community plans.

The social baseline study should describe and analyse a range of demographic and social statistics determined relevant to the project's social and cultural area including:

- total enumerated population and the full time equivalent transient population
- existing or anticipated major population trends and changes irrespective of the project
- family structures
- age and gender distributions
- education, including schooling levels
- measures of community safety, health and wellbeing
- cultural and ethnic characteristics
- Indigenous population including age and gender
- personal and household income
- labour force by occupation and industry
- housing tenure type and landlord type for rental properties
- housing availability:
 - o private ownership: number and percentage of houses for sale
 - o rental market: size, vacancy rate and seasonal variations
 - o availability of social housing
- housing costs:
 - o private ownership: typical costs of houses for sale in project area and monthly housing repayments with percent of dwellings in each category published by the Australian Bureau of Statistics (ABS)
 - o rental: weekly rent with percent dwellings in each category published by the ABS
- housing affordability separately for private ownership and rent
- household and family type
- disability prevalence
- the social and economic index for areas, index of disadvantage—score and relative ranking
- types and prevalence of crime, including domestic violence
- any other indicators determined through the community engagement process as relevant.

The social baseline study should also take account of and address issues such as:

- the social infrastructure including community and civic facilities, services and networks (for definition see South East Queensland Plan 2005–2026 Implementation Guideline No.5, <www.dip.qld.gov.au/resources/guideline/Implementationguideline5.pdf>)
- settlement patterns including the names, locations, size, history and cultural aspects of settlement in the social and cultural area
- identity, values, lifestyles, vitality, characteristics and aspirations of communities in the social and cultural area, including Indigenous communities
- land use and land ownership patterns including:
 - o the number of properties potentially directly or indirectly affected by the project
 - o rural properties, farms, croplands and grazing areas including on-farm activities near the proposed activities
 - o properties used for other primary, secondary or tertiary industries

- o residential acreage properties
- o townships or other relatively small block residential areas
- the number of families potentially directly or indirectly affected by the project including Indigenous traditional owners and their families, property owners, and families of workers either living on the property or workers where the property is their primary employment
- use of the social and cultural area for forestry, fishing, recreation or tourism
- Indigenous cultural use of plants and animals.

4.11.2 Potential impacts and mitigation measures

Describe the stakeholder engagement processes and summarise their outcomes, including the response of Indigenous and non-Indigenous communities to the project.

Assess and describe the type, level and significance of the project's beneficial and adverse impacts on social and cultural values identified in the social baseline study and address issues raised in the stakeholder engagement processes. Assess the cumulative potential beneficial and adverse impacts of the project in relation to other major projects or known proposals in the social and cultural area. Discuss whether impacts would be felt at a local, regional or national level.

Assess the impacts in sufficient detail for local and state authorities to make informed decisions about the project's potential effect on their business and social infrastructure. If the project is likely to result in a significant increase in the population of the area, then the proponent should consult the relevant state authorities and summarise the results of the consultations in the EIS.

Provide separate profiles of the expected workforce for the construction, operational and decommissioning phases of the project that describe the:

- numbers and variations of personnel to be employed
- skills base of the required workforce
- likely sources of personnel, such as local, regional, national or overseas.

Provide an outline of the proponent's and contractors' recruitment schedules and their policies for recruitment of workers; describe initiatives for local employment business opportunities; and address the recruitment of Indigenous workers, people from culturally and linguistically diverse backgrounds and people with a disability. Outline training that would be provided to increase the skills levels of workers.

Assess the social and cultural impacts of recruiting and training the construction or operational workforces from within the host community and of bringing in workers from outside.

Estimate the population growth due to the proposal, directly, indirectly (such as due to service industry growth) and cumulatively with other projects, providing detail on gender, age and any other relevant cohorts. Assess the potential impacts on:

- demographic patterns
- local, regional and state labour markets for separate occupational groupings of the workforce, particularly highlighting any potential skill shortages
- disruptions to existing lifestyles
- health and social wellbeing of families and communities
- social dysfunction, including use of alcohol and drugs
- crime and violence.

Assess the potential impacts of the project on vulnerable groups including women, children and young people, the aged and people with a disability.

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

Assess the impacts of construction and operational workforces, their families, and associated contractors on land, housing and accommodation availability and affordability. Assess the capability of existing housing and rental accommodation, including public housing, to meet any additional demands created by the project including direct impacts on disadvantaged groups and Indigenous people.

Estimate how much service revenue and wages from the project would be likely to flow to the project's social and cultural area, and assess the beneficial and adverse impacts of that financial inflow.

Describe the transport operations that would be used to move staff between their residences, dormitory camps and work sites. Modes of transport should be described in section 4.3, but this description should address the mix of privately-owned, public or chartered transport operators. Assess the potential social impacts of transport operations on the local and regional communities, including any road safety issues.

Propose measures, developed in consultation with relevant local authorities, state government agencies and stakeholders that would avoid, mitigate or offset any short, medium or long-term adverse impacts, particularly those on:

- housing affordability and availability, including the rental market, in the social and cultural area
- demographic changes in the profile of the region
- the capacity of social infrastructure to meet community needs, particularly in the areas of health, welfare, early childhood education and care, other education and training, policing and emergency services
- provision of education, training and employment opportunities for women, people with a disability, and Indigenous peoples.

Describe consultation with local and state authorities and stakeholders about their acceptance of proposed mitigation strategies and how practical management and monitoring regimes are proposed to be implemented.

Provide a draft social impact management plan that promotes an active and ongoing role for impacted communities and local authorities through the project life cycle. The draft plan should cover:

- an overview of the project
- all proposed mitigation measures and benefit strategies
- action plans to implement mitigation measures and benefit strategies
- assignment of accountability and resources for mitigation measures and project benefits
- practical mechanisms to monitor and adjust mitigation measures and action plans
- ongoing updates to stakeholders on activities and commitments
- mechanisms to respond to public enquiries and complaints
- mechanisms to resolve disputes with stakeholders
- stakeholder engagement processes including periodic review mechanisms.

4.12 Health and safety

4.12.1 Description of values

Describe the existing community values for public health and safety that may be affected by the project. Provide maps showing the proximity of the project to any potentially affected places of human residence, work or recreation including, but not necessarily limited to, kindergartens, schools, hospitals, aged care facilities, office buildings, factories and workshops. 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, identify and describe nearby and other potentially affected populations. Pay particular attention to those sections of the population, such as children and the elderly who are especially sensitive to environmental health factors.

4.12.2 Potential impacts and mitigation measures

Assess the potential impacts on the community in terms of health, safety, and quality of life from project operations and emissions, including odour, dust and noise. Assess potential impacts on public health in the short and long term, and the cumulative impacts on public health either in isolation or by combination with other known existing or planned sources of contamination. The assessment should address the potential contamination not only of public water supplies but also of private water sources such as rainwater tanks with roof collection.

Assess the potential extent of contamination and public health risk should an extreme meteorological event, flood or catastrophic failure cause the release of toxic material from activities associated with the project (i.e. chemical storage). Describe strategies to notify relevant stakeholders during such an event.

The EIS should undertake a high level safety management study in accordance with the requirements of AS2885.1:2007 to determine potential threats to the integrity of the pipeline and the management of these threats.

This should include discussion of how construction in an existing operating pipeline corridor will be managed.

Assess the project's potential for providing disease vectors. Propose measures to control mosquito and biting midge breeding, including measures to be used for any residual ponding after mining ceases, such as due to subsidence. Assess any proposed use of recycled water for its potential to cause infection by transmitting bacteria and/or viruses by contact, dispersion of aerosols, and ingestion (including via use on food crops). Similarly, the use of recycled water should be assessed for its potential to cause harm to human health via water supply or the food chain due to contaminants such as heavy metals and persistent organic chemicals.

Define and describe the objectives and practical measures for protecting or enhancing health and safety community values. Describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.13 Economy

4.13.1 Description of potentially affected economies

Describe the existing local, regional or national economies that may be affected by the project, including:

- appropriate statistics of economic activity, such as gross regional product and aggregate regional income
- trends in relevant economic indicators
- industries and businesses that could be beneficially or adversely affected by the project, their current and historical contribution to local, regional or national economies, and their current input costs
- the economic value of existing resources that could be impacted or sterilised by the project
- local, regional and national governments' aspirations, objectives, strategies and policies for the economic and industrial sectors that may be affected
- economic viability
- 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 that would be disturbed or removed during development.

4.13.2 Potential impacts and mitigation measures

Provide an assessment from national, state, regional and local perspectives of the direct and indirect economic benefits and impacts of the project. Describe the methods used, assumptions and sensitivity of the assessment.

At a level of detail appropriate to the scale of the project, the assessment will consider:

- the separate phases of the project, such as construction, operation and after ceasing operations
- the effects of this project on the local and regional economies, including goods and services supplied to, or received from, local or regional markets
- the long and short-term beneficial (such as job creation) and adverse impacts (such as increased labour costs, or competition with local small business) that are likely to result from the development
- impacts on the economic value of existing resources
- stimulus, catalytic or second-order effects
- cumulative effects of the project in relation to other economic development opportunities
- a benefit-impact table that disaggregates the benefits and impacts or costs
- 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 regulatory function or infrastructure provision
- implications for future economic 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 project 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

- economic impacts on local property values.

The assessment must consider the Local Industry Policy – A Fair Go for Local Industry (Qld Gov., 2008).

Consider the impacts of the project in relation to energy self-sufficiency, security of supply and balance of payments benefits.

Define and describe the objectives and practical measures for avoiding or mitigating impacts or enhancing economic benefits. 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.

4.14 Hazard and risk

Describe the potential hazards and risk to people and property that may be associated with the project 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 work and live (such as a worker'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.

4.14.1 Description of values

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

4.14.2 Potential impacts and mitigation measures

Describe the potential hazards and risk that may be associated with the project, including consideration of both natural and man-made hazards. The assessment of risk should be in accordance with relevant standards.

Provide an inventory for each class of substances listed in the Australian Code for the Transport of Dangerous Goods by Road and Rail 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.

Assess the potential impacts and risks of both natural and induced emergency situations and counter disaster and rescue procedures as a result of the project on resources such as forests, water reserves, state and local government-controlled roads, places of residence and work, and recreational areas. The assessment should outline the implications for and the impact on the surrounding land uses, and should involve consultation with Department of Community Safety, Queensland Fire and Rescue Service, and Queensland Ambulance Service. Undertake a preliminary hazard analysis, conducted in accordance with appropriate guidelines for hazard analysis, and addressing:

- 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.

Develop an integrated risk management plan for the whole of the life of the project including construction, operation and decommissioning phases. 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.

4.15 Cross-reference with the terms of reference

Provide 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

Provide an environmental management plan (EM plan) that includes the mitigation measures detailed in section 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 will be capable of being read as a stand-alone document without reference to other parts of the EIS. The EM plan for a petroleum project must meet the content requirements of section 310D of that Act.

The EM plan will be used by the administering authority to develop 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

Summarise any commitments made by the proponent that are not included in the EM plan (such as a commitments to assist a local community group). 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

Provide a copy of the final TOR bound with the main body of the EIS. Other appendices can be provided in separate volumes.

A2. Regulatory approvals

List the regulatory approvals required by the project.

A3. The standard criteria

Provide a brief summary of the project'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 Australian Government in December 1992 (available from the Australian Government Publishing Service), discuss how the project conforms with each principle from inception to decommissioning.

A4. Specialist studies

Include all specialist study reports undertaken for the EIS as appendices.

A5. Research

Outline in an appendix any proposals for researching alternative environmental management strategies or for obtaining any further necessary information.

A6. Study team

In a separate appendix that will not be included in the public version of the EIS, describe the qualifications and experience of the study team, specialist sub-consultants and expert reviewers.