Department of Environment
and Resource Management

Terms of reference for the Arrow Energy Surat Gas Project Environmental Impact Statement (EIS)

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Prepared by:

Department of Environment and Resource Management

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Contents

Background

Arrow Energy Ltd

Arrow Energy is a Queensland-based company owned by a 50/50 joint venture between Shell and PetroChina which took ownership of Arrow Energy on 23 August 2010. Arrow Energy is an emerging leader in coal seam gas development.

The company operates gas projects at Moranbah in the Bowen Basin, and around Dalby in the Surat Basin. Arrow Energy's five producing projects currently account for more than 20 per cent of Queensland's overall gas consumption. Arrow Energy is seeking to develop additional gas reserves in the Surat Basin for growing domestic and overseas gas markets.

The Shell and PetroChina investment in Arrow Energy means that the Arrow Energy LNG Project will be underpinned by significant field development expertise, established LNG technology, production and supply experience, and industry and market knowledge.

Current Surat Basin activities

Arrow Energy's current petroleum operations in the Surat Basin are located approximately 20 to 40 km south-west of Dalby. These comprise several gas processing facilities and gas field developments, managed under petroleum leases (PL) granted under the *Petroleum and Gas (Production and Safety) Act 2003* (Qld) including PL 194, 198, 230, 238 and 252. Arrow Energy has also lodged petroleum lease applications (PLA) for PL 185 and 253 near Chinchilla, and PL 258 and 260, which lie adjacent to the existing petroleum leases.

The Dalby Expansion Project

The Dalby Expansion Project meets Arrow Energy's contractual obligations under current domestic gas supply agreements, as well as proving that a viable gas supply exists for proposed export LNG developments at, and adjacent to, Gladstone. Gas produced from the nominated facilities will be initially used to supply residential, commercial and industrial customers and generate electricity to sell to the National Electricity Market. Supply that exceeds domestic market requirements may later be directed to the proposed liquefied natural gas (LNG) developments should they achieve the necessary environmental approvals and financial commitments.

The Dalby Expansion Project will involve developing up to 300 new production wells and two integrated production facilities that include gas compression, water treatment and power generation infrastructure.

The Surat Gas Project

Arrow Energy is seeking to expand its operations in Queensland's Surat Basin with a major coal seam gas exploration, development and production project.

The proposed Surat Gas Project is expected to meet the growing demand for gas supply, including domestic and potential export markets. The area covered by the project extends from Wandoan to Dalby and south to Millmerran and towards Goondiwindi, an area in which Arrow Energy holds a number of petroleum exploration and production tenures. Arrow Energy's existing gas fields at Tipton West, Daandine, Stratheden and Kogan North near Dalby are also included in the project area.

The Surat Gas Project includes Arrow Energy's tenures, PL 194, 198, 230, 238 and 252, PLA 185, 253, 258 and 260, and Authority to Prospect (ATP) 676, 747 (part), 810 (part), 746 (part), 683 and 689.

The project will be Arrow Energy's largest gas exploration and development program in the Surat Basin to date, and will conceptually involve the staged development of approximately 7,500 production wells, 15 to 20 integrated production facilities, and associated infrastructure within the project area. Initial development within the Surat Gas Project will be within an area of known gas reserves adjacent to Arrow Energy's existing developments in the Surat Basin. Further stages of development are planned as domestic and export expansion opportunities arise in the energy market.

In addition to providing ongoing supply to the Queensland domestic gas market, Arrow Energy is presently pursuing an export LNG market opportunity, through the Arrow Energy LNG Project (formerly the Shell Australia LNG Project) at Curtis Island.

Arrow CSG (Australia) Pty Ltd is seeking approval of the Arrow Energy LNG Project at Curtis Island, near Gladstone. The proposed LNG facility is expected to produce up to 16 million tonnes a year, involving phased

construction of up to four LNG trains. Arrow intends to use gas resources from developing its tenures in the Surat Basin in south east Queensland and the Bowen Basin in central Queensland.

Before the Surat Gas Project can proceed, Arrow Energy must gain approval from the Queensland and Commonwealth governments. Regulatory authorities must be satisfied Arrow Energy's activities have been properly assessed, and that appropriate measures are in place to avoid or minimise environmental impacts. To do this, Arrow Energy will prepare an Environmental Impact Statement (EIS) that examines the entire development.

The project is a controlled action under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions are sections 18 and 18A (listed threatened species and communities) and sections 20 and 20A (listed migratory species). Queensland's EIS process has been accredited for the assessment under Part 8 of the EPBC Act in accordance with the Bilateral Agreement between the Commonwealth of Australia and the State of Queensland (2004).

CONTENT OF THE ENVIRONMENTAL IMPACT STATEMENT (EIS)

Executive summary

The executive summary conveys the project's most important aspects and options to the reader in a concise and readable form. It should 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. The executive summary should enable the reader to obtain a clear understanding of the project, its potential adverse and beneficial environmental, social and economic impacts, and measures to be implemented to avoid, minimise and mitigate any adverse impacts.

Glossary of terms

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

1. Introduction

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

1.1 Project proponent

Details of the project proponents should be listed, including details of any joint venture partners. This section should describe the experience of the project proponent, including the nature and extent of business activities, experience and qualifications, role and responsibilities and environmental record, including the proponent's environmental policy.

1.2 Project description

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

This section should also describe how the project relates to other relevant existing or proposed projects and any interdependency between these projects.

1.3 Project objectives and scope

A statement should be included of the objectives that have led to the project's development and a brief outline of 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 should also be discussed.

1.4 The EIS process

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

1.4.1 Methodology of the EIS

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

The information in this section is required to ensure:

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

1.4.2 Objectives of the EIS

Having described the methodology of the EIS, a succinct statement should be made of the EIS objectives. The 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 impacts of the project, those matters should be included in the EIS.

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

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

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

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

The proponent is proposing to use a framework approach to inform the siting of project activities and to identify the controls and procedures that should be applied to development of related infrastructure or the carrying out of project activities at the chosen site. The framework aims to address the uncertainty about the final location of petroleum activities (and infrastructure) by ensuring controls and procedures that recognise the environmental values of the location are in place. The framework is a decision-making tool.

The role of the EIS in providing the project's draft environmental management plan (EM) plan should also be discussed, with particular reference to the EM plan's role in providing management measures that can be carried over into conditions that would attach to any approvals, environmental authorities and permits for the project. The EM plan should also describe the standard operating procedures and site specific controls that will be implemented during the phases of the project – planning, construction, operation and decommissioning/rehabilitation.

1.4.3 Submissions

The reader should 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 should outline the methodology that will be adopted to identify baseline socio-economic conditions and to identify and address public and stakeholder concerns about the potential impacts of the project. Information about the consultation that has already taken place and its results should be provided.

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 the *Environmental Protection Act 1994* (see section 41). 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.

Consultation 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 and rehabilitation. Refer to the Department of Environment and Resource Management (DERM) guideline Issue Identification and Community Consultation.

1.6 Project approvals

1.6.1 Relevant legislation and policy requirements

This section should explain the legislation and policies controlling the approvals process. Reference should be made to the Queensland *Environmental Protection Act 1994*, *Sustainable Planning Act 2009* and other potentially relevant Queensland laws, such as:

- *Petroleum and Gas (Production and Safety) Act 2004*
- *Water Act 2000*
- *Water Supply (Safety and Reliability) Act 2008*
- *Forestry Act 1959*
- *Transport Infrastructure Act 1994*
- *Vegetation Management Act 1999*
- *Nature Conservation Act 1992*

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

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

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

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

1.6.2 Planning processes and standards

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

1.7 Accredited process for controlled actions under Commonwealth legislation

The project is a 'controlled action' (2010/5344) under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC)*. The Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) has accredited Queensland's EIS process for the purposes of the Commonwealth assessment under part 8 of the EPBC.

The following matters of national environmental significance (NES) are identified in the 'controlling provisions' when the project was declared a controlled action:

- listed threatened species and communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A).

The EIS should provide separate discussions under sub-headings in the relevant sections that describe the values and address the potential impacts on NES matters. The locations of those sub-headings should be readily identifiable from the table of contents.

Additional matters of NES identified prior to completion of the EIS should also be addressed.

2. Project need and alternatives

2.1 Project justification

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

2.2 Alternatives to the project

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

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

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

This information is required to assess why the scope of the project is defined 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

This section aims to describe the project through its lifetime – planning, construction and operation to decommissioning and rehabilitation. This information is required to allow complete assessment of a project. It also allows further assessment 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 should use latitudes and longitudes on the GDA94 datum. These latitudes and longitudes should also be used in the text to describe the locations of any features that may be relevant to subsequent approvals.

The EIS will need to recognise the uncertainty associated with the following aspects of implementing the project:

- timing of the development of the project
- nature and location of the project activities.

The uncertainty must be addressed in the description of the project and in fulfilling the requirements of sections 3.1 to 3.7.

3.1 Location

3.1.1 Regional context

The regional context of the project should be described and illustrated on maps at suitable scales. Maps should show the project in relation to:

- major infrastructure including road and rail networks
- towns, sensitive receptors, etc
- major watercourses and surface water bodies
- general topography

3.1.2 Local context

The EIS must assess the likely impacts of the proposed activities across the project area, including identifying potential areas to site infrastructure.

Accordingly, the local context of the project should be described and include cadastral information for properties within, and adjacent to, the project area. Maps at suitable scales should be provided showing the location of the project area, and in particular:

- the location and boundaries of land tenures, in place or proposed, to which the project area is, or will be, subject
- potential areas for works and infrastructure associated with the project
- the location and boundaries of the project area
- major transport corridors (including rail and road).

This section should include maps, preferably with an air photo base, at a scale of not smaller than 1:50,000 that illustrates the project area in relation to the land and petroleum tenures and natural and built features of the area.

3.1.3 Relationship to other projects

This section should describe how the project relates to, or integrates with, other relevant existing or proposed projects including gas field developments, pipeline and LNG projects that are not subject to this EIS process.

3.2 Life cycle of the project

Throughout the life of the Surat Gas project, exploration, construction, operation and decommissioning/rehabilitation phases may progress concurrently at different locations within the project area.

For example, exploration drilling for new gas fields may be undertaken in the north-west of the project area near Chinchilla, while construction associated with existing gas fields occurs near Dalby.

3.2.1 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.

3.2.2 Resource base, reserve life and extraction sequencing

Summarise the results of studies and surveys undertaken to identify the gas resources required to implement the project. The location, volume, tonnage and quality of gas resources required should be described. Specific details should be provided for the following:

- the proposed progression of development across the project development area
- the proposed life of field(s) and planned recovery of resources
- locations of any resources that would be sterilised by the planned activities
- the quantity of resources to be extracted annually including any proposed ramping of production or staging of development
- the proposed sequence and timing of extraction of the resource within the project area
- areas likely to be disturbed at each major stage of the project.

3.2.3 Ongoing evaluation and exploration activities

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

3.2.4 Gas field and facility development

Specific details should be provided about:

- equipment and methods to be used to access the gas resource (drilling and well installation etc.)
- equipment and processes for extracting the gas resource (dewatering wells and gas extraction)
- equipment and processes for taking the gas from the well head to gas and water gathering systems (gas/water separation, piping and compression)
- gas gathering and main transmission lines as well as link lines to main distribution mains including any equipment needed for maintenance like pipe cleaning facilities
- details of major transport corridors (rail and road) crossed by gas gathering links and main transmission pipelines as identified in points 3 and 4
- chemicals to be used during drilling or extraction operations
- details of gas processing facilities (design of gas compression, dehydration and flaring/venting)
- details of associated water management including storage, treatment and disposal
- details of power generation facilities to provide electricity to the compression, water treatment and wellhead facilities.

The description should refer to, and be complemented by, figures, design drawings, photos and maps.

3.2.5 Construction methods and equipment

The extent and nature of the project's construction activities should be described. The description should include:

- any requirements for early works
- proposed phasing of construction activities across the project area
- the type and methods of construction of facilities and associated infrastructure
- the construction equipment to be used
- methods and standards for crossing under rail and road corridors.

3.2.6 Typical infrastructure requirements

This section should provide descriptions of typical infrastructure requirements to support the entire life cycle of the project (in addition to those described in section 3.2.4). Descriptions should be supported with concept and layout plans (if available). Matters to be considered include infrastructure such as roads, rail, bridges, 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). Sources of the construction materials and their associated haulage routes will also need to be identified for the assessment purposes.

3.2.7 Workforce

Information should be provided about the workforce employed throughout the life of the project. Indicative workforce numbers and composition should be provided for the various phases and activities that will be undertaken; for example, the number of drillers, construction workers, operations and maintenance personnel required to install and operate production wells, gas compression and water treatment facilities.

The EIS should also provide a description of where employees will be recruited from, accommodation and/or transport to construction or operating sites. Comment should be made on the anticipated basis of employment (whether permanent, contract, etc).

3.2.8 Processing and products

This section should describe the quantities and characteristics of the products produced from various project activities annually. Data on products, waste and recycling streams should be provided.

This section does not include the gas resource, covered under section 3.2.2.

3.2.9 Operations and maintenance activities

This section should describe typical operations and maintenance activities.

Operational issues to be addressed should include, but may not be limited to:

- a description of plant and equipment to be used
- capacity of plant and equipment
- process flows for core products and by products
- details of materials to be handled, including the storage and stockpiling of raw materials and chemicals to be used.

Descriptions should be supported with figures (engineering drawings, concept and layout plans, photos, artist's impressions etc.).

3.2.10 Transport—road/rail/air/ship

Provide an overview of the arrangements for the transport of plant, equipment, products, wastes and personnel over the full life cycle of the project. The description should cover the use of existing facilities and all requirements for the construction, upgrading or relocation of any transport-related infrastructure.

3.2.11 Energy

The EIS should describe all energy requirements, including electricity, natural gas, and/or solid and liquid fuel requirements for the full life cycle of the project. Energy efficiency and conservation should be briefly described in the context of any Commonwealth, Queensland and local government policies.

3.2.12 Water supply and storage

The EIS should provide information on water usage by the project.

Determination of potable water demand should be made for the project, including the temporary demands during construction. The use of existing town water supply, on-site water storage and treatment for use by site workers, should be described. Note this section does not address extracting and managing water produced as a by-product of coal seam gas extraction.

3.2.13 Telecommunications

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

3.2.14 Accommodation and other infrastructure

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

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

3.2.15 Decommissioning and rehabilitation

This section should detail the strategic approach and typical measures for:

- decommissioning wells that are proved not viable or from which gas supplies are exhausted
- rehabilitating drilling sites and well sites (in part after drilling and fully after cessation of production)
- rehabilitating and decommissioning gas pipelines used for gathering and transferring gas from the production fields to distribution mains
- rehabilitating areas of associated infrastructure (flowlines, access tracks, utility lines)
- decommissioning and rehabilitating gas processing / compression facility sites
- decommissioning and rehabilitating water treatment facility sites
- decommissioning and rehabilitating raw water, treated water, and wastewater dams.

A preferred rehabilitation strategy should be developed with a view to minimising the amount of land disturbed for a petroleum activity at any one time. Strategies and methods should have the following objectives:

- Natural resource rehabilitation should aim to create a landform with the same or similar capabilities and/or suitability it had prior to the disturbance; unless other beneficial land uses are pre-determined and agreed upon (such as with the landholder).
- Wastes and disturbed land should be rehabilitated to a condition that is self-sustaining or to a condition where the maintenance requirements are consistent with an agreed post-disturbance land use.
- The means of decommissioning different types of petroleum activities, in terms of removing plant, equipment, structures and buildings, should be described along with the methods proposed for stablising the affected areas. Information should be provided on decommissioning and rehabilitating petroleum activity sites, removing processing plant, rehabilitating concrete footings and foundations, hardstand areas and storage tanks (including any potential for reuse of these facilities). Options and methods for disposing of wastes from the demolition of plant and buildings should include details on feasibility and suitability.
- Detail of the impacts of the preferred rehabilitation strategy should be discussed in the appropriate subsections of section 4 (environmental values and management of impacts) particularly with regard to such issues as final landform stability (section 4.2.2) and rehabilitation of flora and habitat (section 4.9.2). Implications for the long-term use and fate of petroleum activity sites should also be addressed, particularly with regard to the on-site disposal of waste and the site's inclusion on the Environmental Management Register or Contaminated Land Register (if applicable)
- Details of the strategy to continue monitoring of any decommissioned works for an appropriate period depending on the risk on environmental harm.

3.3 Waste management

Provide an inventory of all waste to be generated, and identify re-use options over the full life cycle of the project. Waste streams (gaseous, liquid and solid) should be described according to the different types of petroleum activities. Descriptions should be supported with diagrams, schematic drawings and/or tabulated data. Details on waste streams should cross-reference the relevant sections of the EIS where the potential impacts and mitigation measures associated with each waste stream are described. The physical and chemical characteristics of waste material from the project should be provided.

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

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

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

3.3.1 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 (including trucks or trains, either by entrainment from the load or by travel on unsealed roads).

This is addressed under section 4.6, which requires an air emission inventory.

3.3.2 Excavated waste

The main wastes of concern are:

- cuttings generated during drilling of exploration wells and installing production wells
- topsoil generated while preparing well sites, roads and facility sites
- waste cut/fill materials generated during construction of raw water, treated water and waste water dams.

The likely volumes, chemical and physical properties, and strategies for each of these excavated wastes (and any other excavated waste) should be described.

3.3.3 Solid waste disposal

Describe the typical quantity and quality of solid wastes generated over the full life cycle of the project, at each project location (other than waste rock and subsoil addressed in other sections) and the proposed methods of their disposal. The proposed location, site suitability, approvals required, dimensions and volume of any landfill, including its method of construction and management, should be shown.

3.3.4 Liquid waste

A description should be provided of the origin, quality and quantity of wastewater and any immiscible liquid wastes generated over the lifecycle of the project. Particular attention should be given to the capacity of wastes to generate acid, and saline or sodic wastewater.

The EIS may need to consider the following effects:

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

- water supply treatment plant waste disposal.

3.4 Associated water management

This section must detail the strategy for management of associated water produced as a by-product of extracting coal seam gas. The following should be specifically addressed:

- chemical and physical properties of associated water
- likely volumes/rates and areas of production of coal seam gas water
- producing coal seam gas water over the full life cycle of the project
- storage of raw water
- methods for treatment of water
- physical and chemical properties of water after treatment
- proposed use of the treated water and factors that may influence this use
- managing any contaminants/associated waste arising from treatment of water
- managing saline waste products.

Strategies for the management of associated water must take account of the cumulative impacts of the production, storage and use of associated water that will be produced by all CSG activities within each field (including adjacent tenements) so that the associated water can be managed in an environmentally sustainable manner.

Details should be provided on the proposed monitoring of storages used for raw water or saline waste products.

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 ANZECC 2000 guidelines and South East Queensland Regional Water Quality Management Strategy. Environmental values may also be derived following recognised procedures, such as described in the ANZECC 2000 guidelines. Environmental values should be described by reference to background information and studies, which should be included as appendices to the EIS.
- Describe the potential adverse and beneficial impacts of the project on the identified environmental values. Any likely environmental harm on the environmental values should be described.
- Describe any cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned development or sources of contamination.
- Propose environmental protection objectives. Provide commitments to avoid or mitigate the potential impacts associated with the project. All environmental protection commitments must be measurable and auditable.
- Examine viable alternative strategies for managing impacts. These alternatives should be presented and compared in view of the stated objectives and standards to be achieved. Available techniques, including best practice, to control and manage impacts to the nominated objectives should be discussed. This section should detail the environmental protection measures to be used in the planning, construction, operations, rehabilitation and decommissioning stages of the project and any associated works. Measures should prevent, or where prevention is not possible, minimise environmental harm and maximise socio-economic and environmental benefits of the project. Preferred measures should be identified and described in more detail than other alternatives.
- Describe any computational model used to make predictions of impacts and/or outcomes of mitigation measures. The description should address the inputs, assumptions, limitations, sensitivities, accuracy and precision of the model.

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

Environmental protection objectives may be derived from legislative and planning requirements that apply to the project, 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 government, regional natural resource management bodies, local water boards or land care groups. Special attention should be given to those mitigation strategies designed to protect the values of any sensitive areas and any identified ecosystems of high conservation value within the area of possible project impact.

This section should 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 should be considered for each environmental value relevant to the project:

- Environmental values affected: describe the existing environmental values of the area to be affected including values and areas that may be affected by any cumulative impacts (refer to any background studies in appendices - note such studies may be required over several seasons). It should be explained how the environmental values were derived (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 impacts in the dimensions of scale, intensity, duration or frequency of the impacts. In particular, 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 should be addressed.
- Cumulative impacts on the environmental values of land, air and water and cumulative impacts on public health and the health of terrestrial, aquatic and marine ecosystems must be discussed in the relevant

sections. This assessment may include air- and watersheds affected by the project and other projects competing for use of the local air- and watersheds.

- 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. Such arrangements should be described in the EIS.
- Environmental protection objectives: describe qualitatively and quantitatively the proposed objectives for enhancing or protecting each environmental value. Include proposed indicators to be monitored to demonstrate the extent of achievement of the objective as well as the numerical standard that defines the achievement of the objective (this standard must be auditable). The measurable indicators and standards can be determined from legislation, support policies and government policies as well as the expected performance of control strategies. Objectives for progressive and final rehabilitation and managing contaminated land should be included.
- Control strategies to achieve the objectives: describe the control principles, 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 should also state the sources of the information, how recent the information is, how any background studies were undertaken (including intensity of field work sampling), how the reliability of the information was tested, and what uncertainties (if any) there are in the information.

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

4.1 Climate

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

The potential impacts due to climatic factors should be addressed in the relevant sections of the EIS. The impacts of rainfall on soil erosion should be addressed in section 4.2. The impacts of storm events on the capacity of waste containment systems (including site bunding/stormwater management) should be addressed in section 4.5 with regard to contamination of waterways and in section 4.4 with regard to the design of the

waste containment systems. The impacts of winds, rain, humidity, and temperature inversions on air quality should be addressed in section 4.7.

4.2 Land

4.2.1 Description of environmental values

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

4.2.1.1 Topography/geomorphology

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

4.2.1.2 Geology

The EIS should provide a description, map and a series of cross-sections of the geology of the project area, with particular reference to the physical and chemical properties of surface and sub-surface materials and geological structures within the proposed areas of disturbance, including areas outside the project site that could be influenced by the project's activities (such as by dewatering). 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 should be described. In locations where the age and type of geology is such that significant fossil specimens (such as of dinosaurs or their tracks) may be uncovered during construction or operations, the EIS should address the potential for significant finds.

4.2.1.3 Resources and reserves

The EIS should provide a summary of the results of studies and surveys undertaken to identify and delineate the gas resources within the project area.

The location, quantity and quality of the resources and reserves within the project area should be described in detail as indicated below and include the modifying factors and assumptions made in arriving at the estimates. The gas resources should be estimated and reported in accordance with the 2007 Petroleum Resources Management System approved by the Society *of* Petroleum Engineers (SPE-PRMS) and World Petroleum Council (WPC), American Association of Petroleum Geologists (AAPG) and Society of Petroleum Evaluation Engineers (SPEE).

In addition, maps (at appropriate scales) should be provided showing the general location of the project area, and in particular:

- the location and areal extent of the gas resources to be developed
- the location and boundaries of petroleum tenures, granted or proposed, to which the project area is, or will be, subject
- the location and boundaries of any project sites
- the location and boundaries of any other features that will result from the proposed production including water storage facilities and other infrastructure
- the location of any proposed buffers, surrounding the working areas
- any part of the resource not intended to be produced and any part of the resource that may be sterilised by the proposed production operations or infrastructure.

The EIS should consider information on any known occurrences of economic mineralisation and extractive resources, petroleum and gas deposits within the project area and the potential impact of the project on these operations and associated tenements.

4.2.1.4 Soils

A soil survey of the proposed sites affected by the project should be conducted at a suitable scale, with particular reference to the physical and chemical properties of the materials that will influence erosion potential, storm water run-off quality, rehabilitation and agricultural productivity of the land. Information should also be provided on soil stability and suitability for the various types of petroleum activities to be undertaken.

An assessment of the need for acid sulfate soil investigations should be carried out. If investigations and/or management of acid sulfate soils are required, these would be carried out according to Acid Sulfate Soils Management Advisory Committee (ASSMAC) guidelines, The State Planning Policy 1/00: Planning and Management of Coastal Development Involving Acid Sulfate Soils should also be addressed (including identification, management and format of environmental management plans).

Soil profiles should be mapped at a suitable scale and described according to the Australian Soil and Land Survey Field Handbook (National Committee on Soil and Terrain, 2009) and Australian Soil Classification (Isbell, 2002).

Detailed on-ground surveys and laboratory analyses should be conducted to provide physical and chemical analysis of soil types. The analysis should be undertaken to at least the depth of excavation.

Soils information should be assessed against the Planning Guideline: the Identification of Good Quality Agricultural Land (DPI, DLGP 1993), the State Planning Policy 1/92: Development and the Conservation of Agricultural Land. Consideration should also be given to the draft Strategic Cropping Land policy.

4.2.1.5 Land use

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

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

Describe the land use suitability of the affected area, in terms of the physical and economic attributes. The assessment should set out soil and landform subclasses assigned to soil mapping units in order to derive land suitability classes.

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

4.2.1.6 Infrastructure

The location and owner/custodians of all existing tenures, reserves, roads and road reserves, railways, rail level crossings to be used and rail reserves, stock routes and the like, covering the project area should be shown on maps of a suitable scale. Indicate locations of proposed gas and water pipelines, power lines and any other easements.

4.2.1.7 Sensitive environmental areas

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

In particular, the EIS should 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. Consideration should be given to national parks, conservation parks, wetlands, biodiversity corridors, declared fish habitat areas, wilderness areas, aquatic reserves, heritage/historic areas or items, national estates, World Heritage listings and sites covered by international treaties or agreements (including Ramsar, Australia and Japan (JAMBA), Australia and China (CAMBA), or Australia and the Republic of Korea (ROKAMBA)) and areas of cultural significance and scientific reserves (see section 4.9 for further guidance on sensitive areas).

To obtain copies of plans of declared fish habitat areas contact Queensland Primary Industries and Fisheries at the Department of Employment, Economic Development and Innovation or visit their website.

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

4.2.1.8 Landscape character

This section should describe in general terms the existing character of the landscape that will be affected by the project. Landscape character in this context is defined as the distinct, recognisable and consistent pattern of elements that make one area unique or different from another, including any changes that have already been made to the natural landscape since European settlement. It should 'set the scene' for the description and assessment of potential impacts on views and 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, including any particular features or characteristics considered to contribute to the 'sense of place', while the visual amenity section addresses potential impacts on likely viewers (such as panoramas from constructed lookouts, designated scenic routes) that has amenity value.

4.2.1.9 Visual amenity

This section should describe the existing visual resource, including 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 as appropriate, particularly where addressing the following issues:

- identifying elements within the project and surrounding area that contribute to the image of the town/city or landscape as discussed in the any local government strategic plan – within city image and townscape/landscape objectives and associated maps
- important views, view sheds, existing viewing outlooks, ridgelines and other features contributing to the scenic amenity of the area
- high-level consideration of representative views, from private residences likely to be affected by the project
- focal points, landmarks (built form or topography), gateways associated with project site and immediate surrounding areas, waterways, and other features contributing to the existing visual quality of the area and the project site
- character of the local and surrounding areas including character of settlement (pattern, scale, built form materials and colours) and landscape (natural and cultural vegetation) and land use
- identifying areas of the project that have the capacity to absorb land use changes without detriment to the existing visual quality and landscape character
- high-level consideration of visual function of existing vegetation including use as a visual screen.

4.2.2 Potential impacts and mitigation measures

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

4.2.2.1 Land use suitability

The potential for the project's construction and operation to change existing and potential land uses of the project area should be detailed. Post-operations land-use options should be detailed including suitability of the area to be used for primary production, industry, or nature conservation. The factors favouring or limiting the establishment of those options should be given in the context of land use suitability prior to the project and minimising potential liabilities for long-term management.

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

Identify implications of the Government's Protecting Queensland's strategic cropping land: a policy framework (Department of Environment and Resource Management) 2010, and identify any mitigation and management measures to be implemented, if required.

Outline incompatible land uses, whether existing or potential, on and 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. These should be identified and measures to avoid unacceptable impacts defined.

4.2.2.2 Land disturbance

A strategy should be developed that will minimise the amount of land disturbed at any one time. The strategic approach to progressively rehabilitating landforms and final decommissioning should be described with particular regard to the impacts in the short, medium and long timeframes. The methods to be used for the project, including backfilling, covering, re-contouring, topsoil handling and revegetation, should be described.

However, a description of erosion and sediment control could be deferred to section 4.2.2.4. Any proposals to disturb land that would impede or divert overland flow or waterways, and any subsequent reinstatement, during construction or operations should be first described in this section. However, the potential impacts of interfering with flow on the quantity and quality of water resources should be assessed in section 4.5. Also, the final drainage and seepage control systems and any long-term monitoring plans should be described.

In addition to assessing the operational phase of land disturbance, the EIS should address the ultimate changes following implementation of the decommissioning and rehabilitation plan described in section 3.2.15. The EIS should detail the proposed long-term changes that will occur to the land after petroleum activities cease compared to the situation before activities commenced. Those changes should be illustrated on maps at a suitable scale and with contours at intervals sufficient to assess the likely drainage pattern for ground and surface waters (though the assessment of the impacts on drainage and water quality should be provided in the water resources section of the EIS). The mitigation measures for land disturbance to be used during decommissioning should be assessed in sufficient detail to decide their feasibility. In particular, the EIS should address the long-term stability of disturbed sites, safety of access to sites and the residual risks that will be transferred to the subsequent landholder.

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

If geological conditions are conducive, the proponent should consider the possibility that significant fossil specimens (such as of dinosaurs or their tracks) 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 contamination

The EIS should:

- identify the potential nature and frequency of contaminated sites in project areas and assess the likelihood of contaminated sites occurring within the areas likely to be disturbed by project activities
- provide a documented strategy for ameliorating the range of types of contaminated land likely to be present when developing well sites and other facilities
- provide a documented strategy for dealing with previously unidentified contaminated land when developing well sites and facilities consistent with DERM's draft guidelines for the assessment and management of contaminated land in Queensland
- provide a documented strategy for minimising the contamination of land through the life of the development (exploration, construction, operations and decommissioning).

In short, the following information is required in the EIS:

- a description of the nature and extent of any contamination likely to occur in the project area
- a remediation plan (including validation sampling) to be undertaken prior to land disturbance if project works are proposed within a contaminated site.

The EIS should describe the possible contamination of land from aspects of the project including waste, and spills at chemical and fuel storage areas. Means of preventing and managing land contamination resulting from project activities should be described.

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 should be outlined. An erosion-monitoring program, including rehabilitation measures for erosion problems identified during monitoring, should also be outlined. Mitigation strategies should be developed to achieve acceptable soil loss rates, levels of sediment in rainfall runoff and wind-generated dust concentrations.

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

- areas cleared of vegetation
- dams, banks and creek crossings
- the plant site, including buildings
- access roads or other transport corridors
- bores
- pipelines for gas or water
- electricity transmission corridors.

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

Acid sulfate soils are characteristically found in coastal areas at elevations less than 5 m. They can also occur at higher elevations inland, where pyrite conditions are present, and where there are organically rich deposits on the edges of lakes and waterways. It is recognised that such conditions are highly unlikely to occur in the proposed development area. Managing acid sulfate soils should be based on assessment in accordance with the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998 and management and monitoring plans prepared in consultation with officers of DERM.

4.2.2.5 Landscape character

Describe the potential impacts of the project upon the landscape character of the development area and the surrounding area. Particular mention should be made of any changes to the broad-scale topography and vegetation character of the area, such as due to broad-scale clearing.

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

4.2.2.6 Visual amenity

This section should analyse and discuss the visual impact of the project on views and visual amenity. It should be written in terms of the extent and significance of the changes to the view as experienced. Such views should be representative of public and private viewpoints, including 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 as it relates to the surrounding landscape.

The assessment is to address the visual impacts of the project structures and associated infrastructure, using appropriate simulation. Sketches, diagrams, computer imaging and photos are to be used where possible to portray the near views and far views of the completed structures and their surroundings from visually sensitive locations including public roads, public thoroughfares, and places of residence or work, which are within the line-of-sight of the project.

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

4.2.2.7 Lighting

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

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

4.3 Transport

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

4.3.1 Description of existing infrastructure and values

Provide details on the proposed use of existing infrastructure to transport materials, products or wastes to and from the project development area including consideration of optimal transport mode alternatives to limit transport impacts. Also provide details, either in the transport section of the EIS or by cross reference to other sections, of the environmental values which would be affected by the altered use of existing transport infrastructure or the construction of new or altered infrastructure. The EIS should provide details of any project-related plant or utilities including gas pipelines, well infrastructure, gathering systems and overhead or underground power lines within, or impacting on, the jurisdiction of any transport authority. Also provide details of the likely traffic to be generated by workforce personnel and service providers.

For road and rail transport, describe in detail each existing or new road and rail network including level crossings that would be used by the project. Provide illustrations of the networks at suitable scales. Maps shall include (but not be limited to) the following:

- existing local and state-controlled roads network systems complete with road names
- location of existing towns and sensitive receptors
- location of construction activities
- surrounding land uses including other major developments, such as planned commercial and industrial development areas.

For each mode of transport and each phase of the project, the EIS should describe: the expected volumes and weights of materials, products, hazardous goods or wastes; the likely number and timing of trips; the types of vehicles to be used; and the routes. With consideration of the area of the project and the dispersed nature of the associated infrastructure, the description should include details of access roads, realignments, rail loops and load-out facilities, and level crossings used by any transport associated with the project. 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. Where it is not possible to provide specific details of this nature, the EIS should provide an indication of the types of transport infrastructure and activity that could reasonably be expected for various petroleum activities (such as building a gas compression or water treatment facility).

In relation to air transport, describe the existing, new, and/or altered air fields and associated infrastructure that would be used by the project. Describe the likely additional number of flights, frequency, timing (particularly any increase in night arrivals or take-offs), and size of aircraft. Describe any features of the project that could impact on air transport (such as flares beneath flight paths).

In relation to importing or exporting materials and products, the EIS should identify any aspects of the project that will increase the shipment of materials through any port. Details should be provided of the ports that would be used, the berths at those ports, likely size and number of vessels, and the associated infrastructure that moves and stores materials between the ships and the rail and/or road networks.

4.3.2 Potential impacts and mitigation measures

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

environmental values. In both cases, the impacts along the whole length of each affected route should be discussed and measures proposed to avoid or mitigate the impacts.

Details should be provided of the:

- results of any modelling of transport impacts
- assessment methodology used, including a summary of consultation undertaken with transport authorities regarding the scope of the impact assessment and methodology to be used – this will include the use of the Australian Level Crossing Assessment Model (ALCAM) to assess impacts to level crossings
- base data assumptions, including an assessment of the current condition of the affected network and its performance
- possible interruptions to transport operations
- likelihood and nature of spills of products or hazardous materials during transport, prevention measures to be used, and the requirements for dealing with any spills.

The EIS should assess any impacts on stock routes due to the projects activities. Mitigation measures should be proposed for any disruptions to movement of travelling stock on stock routes. This section of the EIS should also outline, and cross-reference 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 affects.

The assessment of road impacts should be in accordance with the latest version of the Department of Transport and Main Road's Guidelines for Assessment of Road Impacts of Development, available from the website: <www.mainroads.qld.gov.au>. In relation to road impacts, the EIS should include an assessment of impacts on:

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

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

- impacts at interface points with other private and public transport pathways such as roadway level crossings or occupational crossings (that is, those crossings that form part of private access pathways to and from residential or business sites)
- impacts on passenger transport and services
- requirements for any approvals needed for rail crossings by roads or other infrastructure.

The EIS should assess impacts on any port caused by the import or export of materials or products. Matters to be assessed should include 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 or altered, or increased use of existing, infrastructure to handle materials between ships and road or rail transport.

The EIS should assess any impacts of the project on existing air fields and associated infrastructure that would be needed for the project. The likely additional number of flights, frequency, timing (particularly any increase in night arrivals or take-offs), and size of aircraft should be described, along with any features of the project that could impact on air transport (like the placement of waste dumps, stacks or flares beneath flight paths).

The EIS should assess any impacts on environmental values due to the need to redevelop or construct new airfields and any impacts on amenity due to increased air traffic. The project and assessment should have regard

to State Planning Policy 1/02: Development in the Vicinity of Certain Airports and Aviation Facilities. With regard to air safety, matters to be assessed include the raising of landforms or the construction of stacks, flares or lighting within flight paths.

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

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

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

Mitigation strategies must include:

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

The EIS should also consider public transport requirements and links to, or development of pedestrian and cycle networks.

4.4 Waste

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

4.4.1 Description of environmental values

This section should introduce and briefly describe the existing environment values that may be affected by the project's wastes. Refer to each of the waste streams described in section 3.3 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 should be provided in the relevant sections of part 4 of the EIS.

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

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

- operational handling and fate of all wastes including storage
- on-site treatment methods proposed for the wastes
- methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes
- hazards associated with the handling and storage of wastes
- the potential level of impact on environmental values
- proposed discharge/disposal criteria for liquid and solid wastes
- measures to ensure stability of the dumps and impoundments should be described
- methods to prevent, seepage and contamination of surface water or groundwater from stockpiles and/or dumps should be given
- design criteria to be used to ensure that waste containment and/or storage facilities perform satisfactorily
- market demand for recyclable waste (where appropriate) should be addressed
- waste minimisation techniques processes proposed
- measures to ensure wastes do not attract or propagate pests, disease vectors or vermin, and do not impact on public health
- decommissioning of the site.

Having regard for the Environmental Protection (Waste Management) Policy 2000 (EPP (Waste)) and local government waste management strategies, the EIS should indicate the results of investigating the feasibility of using waste minimisation and cleaner technology options during all phases of the project. Waste minimisation and treatment, and applying cleaner production techniques, should also be applied to gaseous wastes, particularly methane, nitrogen oxides, sulfur oxides, particulates and carbon dioxide. Particular attention should be paid to measures that will maximise energy efficiency and minimise internal energy consumption by the project.

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

4.5 Water resources

4.5.1 Description of environmental values

This section describes the existing environment for water resources that may be affected by the project in the context of environmental values as defined or considered in such documents as the *Environmental Protection Act 1994,* Environmental Protection (Water) Policy 1997 (EPP (Water), ANZECC 2000, the National Water Quality Management Strategy (NWQMS), the DERM guideline: Establishing Draft Environmental Values and Water Quality Objectives and the Queensland Water Quality Guidelines 2009*.* The definition of waters in the EPP (Water) includes the bed and banks of waters, so this section should address benthic sediments as well as the water column.

4.5.1.1 Surface waterways

A description should be given of the surface watercourses, overland flow, and palustrine and lacustrine wetlands. The description should address their quality and quantity in the area affected by the project with an outline of the significance of these waters to the river catchment system in which they occur. Details provided should include a description of existing surface drainage patterns, and flows in major streams and wetlands. Also provide details of the likelihood of flooding, history of flooding including extent, levels and frequency, and a description of present and potential water uses downstream of the areas affected by the project. The description should include mapping, at a suitable scale, of any watercourses, drainage pathways, wetlands on a subcatchment basis. Flood studies should include a range of annual exceedance probabilities for affected waterways, based on observed data if available, or use appropriate modelling techniques and conservative assumptions if there are no suitable

observations. The flood assessment should, where possible, include local flooding due to short-duration events from contributing catchments on site/s, as well as larger scale regional flooding including waterways downstream.

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

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

The water quality should be described, including seasonal variations or variations with flow where applicable. A relevant range of physical, chemical and biological parameters should be measured to gauge environmental harm on any affected creek or wetland system. Where representative sampling is not possible within the duration of the study (due to the seasonal idiosyncrasies of the regional climate) the assumptions made with respect to seasonal variation should be clearly stated. Assumptions must consider existing literature and other publicly available information.

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

- values identified in the Environmental Protection (Water) Policy 2009
- sustainability, including both quality and quantity
- physical integrity, fluvial processes and morphology of watercourses, including riparian zone vegetation and form
- any water resource plans, land and water management plans relevant to the affected catchment.

Surface water quality objectives should be determined after consideration of the EPP (Water), ANZECC & ARMCANZ Water Quality Guidelines (2000), the Queensland Water Quality Guidelines (2009) and local reference data.

4.5.1.2 Groundwater

The EIS should assess the quality, quantity and significance of groundwater in the project area, including:

- an overview of groundwater use in areas in or adjacent to the project area
- details of any springs or outflows of groundwater
- identification of intake areas for local and regional groundwater aquifiers
- an assessment of the potential extent of impact caused by the project.
- an assessment of baseline data from existing groundwater supply facilities (bores, wells, etc) within the proponent's current field development areas
- a process and commitment for gathering baseline data from existing groundwater supply facilities (bores, wells, etc) for future field development areas.

The review should include a survey of existing groundwater supply facilities. The information to be gathered for analysis is to include:

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

A monitoring program, including a network of observation points that would satisfactorily monitor groundwater resources both before and after commencement of operations, should be developed and described in the EIS.

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

- geology/stratigraphy – such as alluvium, volcanic, metamorphic
- 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)
- interaction with surface water
- interaction with sea/salt water
- possible sources of recharge
- vulnerability to pollution.

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

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

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

4.5.2 Potential impacts and mitigation measures

This section is to assess potential impacts on water resource environmental values identified in the previous section. It will also define and describe the objectives and practical measures for protecting or enhancing water resource environmental values, to describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

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

Where a licence or permit will be required under the *Water Act 2000* to take water or interfere with the flow of water, this section of the EIS should provide sufficient information and assessment for the administering authority to consider the suitability of approving any necessary works under the *Water Act 2000*. Similarly, waterway barrier works may need approval under the *Fisheries Act 1994* and, if so, should be addressed in the EIS.

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

Key water management strategy objectives include:

- protecting the integrity of the marine environment, and ultimately the Great Barrier Reef Marine Park and World Heritage property
- protecting important local aquifers and protection of their waters
- maintaining sufficient quantity and quality of surface waters to protect existing beneficial downstream uses of those waters including maintenance of in-stream biota and the littoral zone
- minimising impacts on flooding levels and frequencies both upstream and downstream 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, implications of such emissions for human health and natural ecosystems. Also provide detailed mitigation measures to prevent, minimise and contain impacts.

4.5.2.1 Surface water and water courses

The potential environmental harm to the flow and the quality of surface waters from all phases of the project should be discussed, with particular reference to their suitability for the current and potential downstream uses, including the requirements of any affected riparian area, wetland, estuary, littoral zone, and any marine and in-stream biological uses. The impacts of surface water flow on existing infrastructure should be considered with reference to the Environmental Protection (Water) Policy 1997 and *Water Act 2000*.

The hydrological impacts of the project should be assessed, particularly with regard to the various components of flow that may be impacted by the project. The EIS should address: stream diversions (whether temporary or permanent); any changes to overland flows due to works or infrastructure; scouring and erosion; the consequent impacts of subsidence; and, changes to flooding levels and frequencies both upstream and downstream of the project. Any consequential impacts of changes to water flow or groundwater recharge on ecosystems and species should be addressed in the appropriate sections of the EIS. When flooding levels will be affected, modelling of afflux should be provided and illustrated with maps.

A risk assessment of the potential impacts on all local and downstream waters due to any controlled or uncontrolled discharges from the site should be provided. If controlled discharges are proposed, (a) stream flow data will be used in combination with proposed discharge rates to estimate in-stream dilution and water quality and (b) assessment should be provided of the available assimilative capacity of the receiving waters given existing background levels and other potential point source discharges in the catchment. Options for controlled discharge under times of natural stream flow should be investigated to ensure that adequate flushing of waste water is achieved.

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

Reference should be made to the properties of the land disturbed and processing plant wastes, the technology for settling suspended clays from contaminated water, and the techniques to be employed to ensure that contaminated water is contained and successfully treated on the site. An assessment should be made of the potential impacts of applying saline waters to land to suppress dust over the lifetime of the project, or disposing of water from storages.

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

The need or otherwise for licensing of any dams (including referable dams) or creek diversions, under the *Water Act 2000* should be discussed. Water allocation and water sources should be established in consultation with DERM.

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

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

The Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC& ARMCANZ, 2000)), Queensland Water Quality Guidelines for Fresh and Marine Waters (2009), and the Environmental Protection (Water) Policy 2009 should be used as a reference for evaluating the effects of various levels of contamination.

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

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

4.5.2.2 Groundwater

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

The impact assessment should define the extent of the area where groundwater resources are likely to be affected by the proposed operations. It should assess the significance of the project to groundwater depletion or recharge, potential for impacts across or from aquifer to aquifer, and propose management options available to monitor and mitigate these effects. The response of the groundwater resource to the progression and eventual cessation of the project should be described.

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

An assessment of the potential to contaminate groundwater resources including, but not limited to, surface storage of untreated associated water/residual brine and cross contamination between aquifers. Measures to prevent, mitigate and remediate such contamination should also be discussed.

4.6 Air

4.6.1 Description of environmental values

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

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

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

The environmental values of the airshed for the affected area(s) should be described in terms of the Environmental Protection (Air) Policy 2008 (EPP (Air)).

4.6.2 Potential impacts and mitigation measures

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

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

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

- An accurate description of the activities carried out on the project area.
- An assessment of the effects of air emissions during construction and operations on air environmental values, particularly as they relate to human health.

- A description of the pollution control equipment and pollution control techniques to be employed on the premises and the features of the project designed to suppress or minimise emissions, including dusts and odours.
- A description of the back-up measures to be incorporated that will act in the event of failure of primary measures to minimise the likelihood of plant upsets and adverse air impacts.
- Provide an air emission inventory of the proposed activities, including site for all potential point, line, area and volume sources including fugitive emissions.
- Provide a separate air emission inventory of any off-site activities directly associated with the project, including fugitive emissions such as from rail or road transport of product or wastes.
- Provide a complete list of emissions to the atmosphere. The list should address SOx, NOx, VOC, CO, CO2, particulates (including dust), PM10, PM2.5, trace metals, odours and any toxic, persistent and/or hazardous substances that would be emitted by the project. Present the concentrations of all components of emissions at standard temperature and pressure, and provide the mass emission rate, exit velocity, volume flow rate and temperature at exit. Also, specify the oxygen content of the flue gases.
- Where possible, estimates of emission rates should be based on actual measurements from samples taken from similar facilities, preferably full-scale facilities operating elsewhere or otherwise from experimental or demonstration-scale facilities. Where this is not possible, use published emission factors and/or data supplied by manufacturers of process and control equipment.
- The proposed level of emissions must be compared with the best practice national and international source emission standards.
- For other than insignificant emissions, undertake an impact assessment with relevant inputs of emissions and local meteorology using an air dispersion model to provide estimates of the likely impacts on the surrounding environment. The model inputs should be as detailed as possible, reflecting any variation of emissions with time and including at least a full year of representative hourly meteorological data. The model input parameters must be based on the actual stack conditions for the licence conditions. Provide stack parameters such as stack height, diameter, temperature, exit velocity and volume flow rate. Estimate ground level concentration (GLC) at the nearest sensitive receptor/s based on one-hour average for maximum (99.9 percentile) and 99.5 percentile values. Results of the dispersion modelling must be presented as concentration contour plots and frequency contour plots. The predicted average ground level concentration should be made for both normal and expected maximum emission conditions and the worst case meteorological conditions should be identified and modelled where necessary. Ground level predictions should be made at any residential, industrial and agricultural developments believed to be sensitive to the effects of predicted emissions. The techniques used to obtain the predictions should be referenced, and key assumptions and data sets explained.
- Evaluate the cumulative impacts of the proposed emissions on the receiving environment by considering the project in conjunction with existing and known likely future emission sources within the region. Describe airshed management and the project's contribution to airshed capacity in view of existing and future users of the airshed for assimilating and dispersing emissions
- Identify 'worst case' emissions that may occur at start-up, shut-down or during 'upset' operating conditions. If these emissions are significantly higher than those for normal operations, it will be necessary to evaluate the worst-case impact, as a separate exercise to determine whether any planned buffer distance/s between the facility and neighbouring sensitive receptors will be adequate.
- If odour could be an issue, conduct an odour impact assessment using the criteria described in the DERM Guideline Odour impact assessment from developments. The guideline sets out various approaches to assess potential impacts from development proposals, and provides for the use of air dispersion modelling as a tool to predict ground level odour concentrations. Comparison must be made with guideline values to determine the likelihood of adverse odour impacts.
- The averaging period for ground level concentrations of contaminants that are modelled should be consistent with the relevant averaging periods for air quality indicators and goals in the Environmental Protection (Air) Policy 2008 and the National Environmental Protection Measure (NEPM) Air. For example, the modelling of sulfur dioxide must be conducted for one-hour, 24-hour and annual averaging periods.
- Modelled air quality concentrations at the most exposed existing or likely future off-site sensitive receptors must be compared with the appropriate national and international ambient air quality standards including

the Environmental Protection (Air) Policy 2008 and the National Environmental Protection Council (Ambient Air Quality) Measure.

- To assess chemical species not listed in the EPP (Air), risk factors and best practice design criteria published by other jurisdictions could be used.
- The human health risk of all hazardous or toxic contaminants associated with emissions from the facility should be assessed whether they are, or are not, covered by the National Environmental Protection Council (Ambient Air Quality) Measure or the Environmental Protection (Air) Policy 2008.
- Where there is no single atmospheric dispersion model that is able to handle the different atmospheric dispersion characteristics exhibited in the project area (including strong convection, terrain features, temperature inversions and contaminant re-circulation), a combination of acceptable models will need to be applied.
- The limitations and accuracy of the applied atmospheric dispersion models should be discussed.
- Evaluate the extent to which any significant nitrogen oxides and volatile organic compounds emissions from the project and existing emission sources within the region will contribute to generating photochemical smog.
- Evaluate the extent to which any significant sulfur dioxide emissions from the project and existing emission sources within the region will contribute to generating acid rain or acidification of other atmospheric condensation, such as dew.
- For any project that does not meet the Environmental Protection (Air) Policy 2008 air quality objectives, the proponent should undertake a risk assessment of the potential for adverse impacts off-site. Risk management strategies should be developed that identify options that will reduce exposure of local communities to levels of indicators that may be of concern and enable the proponent to meet the objectives of Environmental Protection (Air) Policy 2008.

4.6.3 Greenhouse gas emissions

4.6.3.1 Greenhouse gas inventory

This section of the EIS should:

- detail the applicable international, national and state regulatory framework for greenhouse gas emissions, and which regulations would apply to emission sources associated with the proposed development
- provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO2 equivalent' (using global warming potentials defined in current National Greenhouse and Energy Reporting (NGER) legislation) terms for scope 1, scope 2 and readily identifiable scope 3 (as defined by the World Resources Institute / World Business Council for Sustainable Development Greenhouse Gas Protocol). In determining scope 3 emissions, the assessment should confine its consideration to direct associations such as product usage, fuel cycles, associated project fuel usage and third party infrastructure required to export product, provide essential services and manage wastes produced.
- describe method/s by which estimates were made
- present the CO2 equivalents emissions as a percentage of Queensland's and Australia's annual greenhouse gas emissions
- include intended audit and critical review procedures.

The Australian Department of Climate Change's National Greenhouse Accounts (NGA) Factors and current methodologies that underpin the National Greenhouse and Energy Reporting Scheme (National Greenhouse and Energy Reporting (Measurement) Determination 2008) are to be used as the reference source for emission estimation and supplemented by other sources where practicable and appropriate.

4.6.3.2 Greenhouse gas abatement

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

- a description of the proposed measures (alternatives and preferred) to avoid and/or minimise greenhouse gas emissions directly resulting from activities of the project, including such activities as transporting products and consumables, and energy use by the project

- an assessment of how the preferred measures minimise emissions and achieve energy efficiency
- a comparison of the preferred measures for emission controls and energy consumption with best practice environmental management in the relevant sector of industry
- a description of any opportunities for further offsetting greenhouse gas emissions through indirect means.

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

- minimising clearing at the site (which also has imperatives besides reducing greenhouse gas emissions)
- using less carbon-emitting transport modes or fuels
- integrating transport for the project with other local industries such that greenhouse gas emissions from building and running transport infrastructure are minimised
- maximising the use of renewable energy sources.
- co-locating coal extraction with coal seam methane used for energy production.

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

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

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

- commitments to abate greenhouse gas emissions from the project with details of the intended objectives, measures and performance standards to avoid, minimise and control emissions
- commitments to manage energy, including undertaking 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, including, if appropriate, carbon sequestration and renewable energy uses
- commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures.

4.6.3.3 Climate change adaptation

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

- a risk assessment of how changing patterns of rainfall and hydrology, temperature, 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
- commitments to undertaking, where practicable, a cooperative approach with government, other industry and other sectors to address adaptation to climate change.

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

4.7 Noise and vibration

4.7.1 Description of environmental values

This section of the EIS should 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.

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

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

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

4.7.2 Potential impacts and mitigation measures

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

Information, including mapped noise contours from a suitable acoustic model, should be submitted based on the proposed generation of noise. The potential environmental harm of noise and vibration at all potentially sensitive receptors should be quantified in terms of objectives, standards and indicators to be achieved. Particular consideration should be given to emissions of low-frequency noise; that is, noise with components below 200Hz. The assessment should also include environmental impacts on terrestrial animals and birds, including migratory species. The assessment must include an assessment of noise on any nearby protected areas, which are defined as a sensitive receptor in the EPP (Noise). The assessment of impacts on protected areas should address not only the amenity of the areas as required by the EPP (Noise), but also the impacts on animals. Proposed measures to minimise or eliminate impacts should be provided, including details and illustrations of any screening, lining, enclosing or bunding. A discussion should be provided of timing schedules for construction and operations with respect to minimising environmental nuisance and harm from noise.

Information should be supplied 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. The magnitude, duration and frequency of any vibration should be discussed. A discussion should be provided of measures to prevent or minimise environmental nuisance and harm. Reference should be made to the DERM guideline: Noise and Vibration from Blasting.

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

4.8 Nature conservation

4.8.1 Description of environmental values

This section describes the existing environmental values for conserving nature that may be affected by the project.

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

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

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

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

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

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

- protected areas, including nature refuges, which have been proclaimed under the *Nature Conservation Act 1992* and *Marine Parks Act 1982* or are under consideration for proclamation:
- critical habitat identified under the *Nature Conservation Act 1992*
- vegetation mapped as essential habitat
- sites listed under international treaties such as Ramsar wetlands and World Heritage areas
- important habitats of species listed under the *Nature Conservation Act 1992* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as presumed extinct, endangered, critically endangered, vulnerable or rare
- regional ecosystems listed as 'endangered' or 'of concern' under Queensland legislation, and/or ecosystems listed as presumed extinct, endangered, critically endangered or vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- good representative examples of remnant regional ecosystems or regional ecosystems which are described as having ‘medium’ or ‘low’ representation in the protected area estate as defined in the regional ecosystem description database (REDD) available at DERM’s website
- high-value regrowth vegetation
- sites containing near-threatened or bio-regionally significant species or essential, viable habitat for near-threatened or bio-regionally significant species
- sites in, or adjacent to, areas containing important resting, feeding or breeding sites for migratory species of conservation concern listed under the *Environment Protection and Biodiversity Act 1999*, and/or 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, for example, marine turtles and cetaceans
- sites containing common species that represent a distributional limit and are of scientific value, or which contain feeding, breeding, resting areas for populations of echidna, koala, platypus and other species of special cultural significance
- sites containing high biodiversity that are of a suitable size, or with connectivity to corridors/protected areas to ensure survival in the longer term, such land that may contain:
  - natural vegetation in good condition or other habitat in good condition (including wetlands)
  - degraded vegetation or other habitats that still supports high levels of biodiversity or acts as an important corridor for maintaining high levels of biodiversity in the area
- a site containing other special ecological values; for example, high habitat diversity and areas of high endemism
- ecosystems that provide important ecological functions such as wetlands of national, state and regional significance, such as coral reefs, riparian vegetation, or an important buffer to a protected area, or important habitat corridor between areas
- sites of palaeontologic significance such as fossil sites
- sites of geomorphological significance, such as lava tubes or karst.

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

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

4.8.1.1 Terrestrial vegetation

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

The location of any horticultural crops in the vicinity of the site should be shown. The existence of important local and regional weed species (including declared species under the *Land Protection (Pest and Stock Route Management) Act* (Qld) *2002*, and environmental or problem weed species identified within Commonwealth, Queensland or local government pest management plans) should also be discussed.

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

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

- location and extent of vegetation types using DERM's regional ecosystem type descriptions in accordance with the REDD
- location of vegetation types of conservation significance based on DERM's regional ecosystem types and occurrence of species listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006 and any subsequent amendments, as well as areas subject to the *Vegetation Management Act 1999*
- the current extent (bioregional and catchment) of protected vegetation types of conservation significance within the protected area estate (national parks, conservation parks, resource reserves, nature refuges)
- any plant communities of cultural, commercial or recreational significance should be identified
- location and abundance of any exotic or weed species (including declared species under the *Land Protection (Pest and Stock Route Management) Act 2002*, and environmental or problem weed species identified within Commonwealth, Queensland or local government pest management plans).

Within each defined (standard system) vegetation community, that has been identified through extensive desktop study as being impacted or potentially impacted by the development, a minimum of three sites (numbers should be discussed with DERM) should be surveyed for plant species, as follows:

- site data shall be recorded using the Queensland Herbarium methodology and proformas in the latest version of the Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland, (DERM, 2005)
- the minimum site size should be 10 by 50 metres
- a complete list of species present at each site should be recorded
- the relative abundance of plant species present should be recorded
- any plant species of conservation, cultural, commercial or recreational significance should be identified.

Plants that could not be identified during the survey need to be submitted to the Queensland Herbarium for identification. Voucher specimens of plant species of conservation significance, including those listed as protected plants under the Nature Conservation (Wildlife) Regulation 2006, other than common species, are to be submitted to the Queensland Herbarium for identification and entry into the HERBRECS database. These specimens should be collected with sufficient information to enable their lodgement as vouchers. A full list of these species will be furnished in the report.

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

4.8.1.2 Terrestrial wildlife

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

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

A comprehensive vertebrate animal survey should be undertaken of the project area at a sampling intensity that supports the scale of vegetation mapping. Apart from the species recorded in the survey, an indicative list of all known and potential species and threatened species in the project area should be provided, by reference to the regional ecosystems within the project area and a 10 to 25 km buffer, and knowledge of species present in the local bioregion. The occurrence of wildlife of conservation significance should be geo-coded to mapped vegetation units or habitats, which can then be used in section 4.9.2 to propose areas to be protected.

Surveys of terrestrial animals 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.

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

4.8.1.3 Aquatic biology

The aquatic plants and animals occurring in the areas affected by the project should be described, noting the patterns and distribution in the waterways and any associated wetlands and lacustrine and marine environments.

The description of the plants and animals present or likely to be present in the area should include:

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

4.8.2 Potential impacts and mitigation measures

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

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

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

Strategies for protecting the Great Barrier Reef Marine Park and World Heritage property, and any rare or threatened species should be described, and any obligations imposed by State or Commonwealth legislation or policy or international treaty obligations (e.g. JAMBA, CAMBA or ROKAMBA) should be discussed.

The potential environmental harm to the ecological values of the area arising from building, operating and decommissioning the project, including clearing, salvaging or removing vegetation, should be described, and the indirect effects on remaining vegetation should be discussed. Short-term and long-term effects should be considered with comment on whether the impacts are reversible or irreversible. The environment's capacity to assimilate discharges/emissions should be assessed. The assessment should address the potential for impacts due to chronic, low-level exposure to contaminants or the bio-accumulation of contaminants.

Key plants and animal indicators should be identified for future monitoring.

The EIS should propose and describe in detail measures to be taken to avoid and minimise potential adverse impacts of the project on nature conservation and biodiversity values. Any potential net loss of environmental values should be identified and quantified. Environmental offsets should be described that would counterbalance the remaining loss of environmental values. Proposed environmental offsets should be consistent with the requirements set out in the specific-issue offset policies under the framework of the Queensland Government's Environmental Offset Policy (2008) and consider Use of Environmental Offsets draft policy under the *Environment Protection & Biodiversity Act 1999*.

The potential environmental harm on plants and animals due to any alterations to the local surface and ground water environment should be discussed, with specific reference to environmental impacts on riparian vegetation or other sensitive vegetation communities. Measures to mitigate the environmental harm to habitat or the inhibition of normal movement, propagation or feeding patterns, and changes to food chains should be described. The EIS should assess the potential impacts of wastes on animals at the site, particularly those related to any form of toxicants. Measures should be proposed to prevent harm.

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

Weed management strategies are required for containing existing weed species (including parthenium and other declared plants) and ensuring no new declared plants are introduced to the area. Feral animal management strategies and practices should also be addressed. The study should develop strategies to ensure that the project does not contribute to increased encroachment of a feral animal species or high biosecurity risk species. This should include a risk assessment of high biosecurity risk species and sites, and the development of threat mitigation plans for them, such as clean down and inspections at high-risk sites. Biosecurity management strategies should include mitigation measures relevant to protecting any potentially affected primary production areas. When determining control strategies, reference should be made to Biosecurity Queensland's Annual Pest

Distribution Survey 2008 data, published biosecurity management strategies, Local Government Pest Management Plans and any applicable model local laws dealing with locally declared pest plants and animals. The strategies for both plants and animals should be discussed in the main body of the EIS and provided in a working form in a Pest Management Plan as part of the overall EM plan for the project.

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

Relevant specific-issue policies that should be addressed are:

- Vegetation management – Policy for Vegetation Management Offsets, October 2009, (or more recent version), Department of Environment and Resource Management.
- Marine fish habitat – Mitigation and Compensation for Works or Activities Causing Marine Habitat Loss, 2002, Department of Primary Industries and Fisheries.
- Koala habitat – Offsets for Net Benefit to Koalas and Koala Habitat, 2006, Department of Environment and Resource Management.
- Offsets framework – Queensland Government's Environmental Offset Policy (2008).

4.9 Cultural heritage

4.9.1 Description of environmental values

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

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

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

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

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

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

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

4.9.2 Potential impacts and mitigation measures

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

4.9.2.1 Indigenous cultural heritage

Unless an exemption applies under s86 of the *Aboriginal Cultural Heritage Act 2003*, the potential impacts on Indigenous cultural heritage values in the vicinity of the project must be managed under a cultural heritage management plan (CHMP) developed and approved under part 7 of that Act.

Development of the CHMP should follow the guidelines gazetted under section 85 of the *Aboriginal Cultural Heritage Act 2003*. DERM's EIS Coordinator must be made aware of the progress of the CHMP approval process and of any related issues that should be addressed in the EIS assessment report.

4.9.2.2 Non-Indigenous historical cultural heritage

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

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

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

- processes for 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 the collection of any artefact material, including appropriate storage and conservation.
- historical cultural heritage awareness training or programs for project staff.

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

4.10 Social

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

4.10.1 Description of social and cultural values

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

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

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

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

- the locations and types of other significant places of employment
- numbers employed in relevant industry sectors and demographic cohorts (including disadvantaged groups)
- shift patterns and hours of work
- type and level of qualifications and skills
- unemployment rates or shortage levels within relevant skill levels and sectors
- any other relevant historical or anticipated changes or shifts in these employment patterns, rates and trends.

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

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

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

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

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

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

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

4.10.2 Potential impacts and mitigation measures

The assessment of impacts (both beneficial and adverse) must be supported by evidence-based discussions, and be developed in consultation with all relevant government agencies and community groups. It should include information obtained so far through the project's community engagement process, and provide a description of how consultation feedback has identified and informed the assessment of impacts and the development of mitigation measures. The assessment should not consider the impacts of the project in isolation, rather it should discuss the likely direct, indirect and cumulative impacts of the project in conjunction with all known existing and planned projects within the area of influence. The assessment should address not only impacts on people and families directly affected by those matters, but also impacts on associated people and communities, such as those whose livelihoods would be affected by loss or gain of direct or indirect (such as service provision) employment.

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

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

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

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

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

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

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

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

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

- the likely changes to residential and agricultural patterns in the social and cultural area of influence during all stages of the project
- the effects of the commuting model, for example fly in/fly out (FIFO) or drive in/drive out (DIDO) versus local residency
- locations, size and type of any workers camps
- purchase of existing housing for project staff
- the availability and demand for land, including state land
- changes to residential occupation patterns, such as families versus house-sharing by groups of singles
- construction of new family housing
- availability of existing housing for purchase and rent, and the capability of the existing housing stock, including rental accommodation, to meet any additional demands created by the project
- effects on property values and rents
- effects on property marketability
- effects on land values in relation to agricultural pursuits

- the potential displacement of existing residents who may no longer be able to afford accommodation
- impacts of the project on the availability of low cost housing within the social and cultural area of influence (for example, assess whether pressure on rents would create a need for a local authority to build low cost housing for those in the community who would not benefit economically from the project).

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

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

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

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

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

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

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

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

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

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

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

- demographic changes in the profile of the social and cultural area of influence
- recruitment and training of the construction and operational workforces and the social and cultural implications this may have for the host community
- housing and accommodation issues, in consultation with relevant local authorities and Queensland Government agencies, with proposals for accommodating the project workforce and their families that avoid, mitigate or offset any short and medium term adverse effects on housing affordability and availability, including the rental market, in the social and cultural area

- capacity of current social infrastructure, particularly health and welfare, education, policing and emergency services
- adequate provision of education, training and employment for all groups, including women, people with a disability, and Indigenous people.

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

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

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

4.11 Health and safety

4.11.1 Description of values

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

4.11.2 Potential impacts and mitigation measures

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

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

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

The EIS should provide an assessment of risk to the community arising from the operation of the project. This assessment should include consideration of controlled, uncontrolled and emergency situations arising from natural events such as bushfire, flood and extreme storms. 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.

The EIS should address the project's potential for providing disease vectors. Measures to control mosquito and biting midge breeding should be described, including measures to be used for any residual ponding after the project activities cease. Any use of recycled water should be assessed 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 health via the food chain due to contaminants such as heavy metals and persistent organic chemicals. Practical monitoring regimes should also be recommended in this section.

4.12 Economy

4.12.1 Description of values

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

- economic viability (including economic base and economic activity, future economic opportunities, current local and regional economic trends, in particular drought and rural downturn etc)
- economic development in the region, with consideration 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.

4.12.2 Potential impacts and mitigation measures

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

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

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

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

Consideration of the impacts of the project in relation to energy self-sufficiency, security of supply and balance of payments benefits may be discussed. Attention should be directed to the long and short term effects of the project on the land-use of the surrounding area and existing industries, regional income and employment and the state economy. The scope of any studies should be referred to the government for input before undertaking the studies.

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

4.13 Hazard and risk

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

4.13.1 Description of values

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

4.13.2 Potential impacts and mitigation measures

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

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

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

The EIS should provide an assessment of risk to the community arising from the operation of the project. This assessment should include consideration of controlled, uncontrolled and emergency situations arising from natural events such as bushfire, flood and extreme storms. 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.

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

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

Details should be provided of:

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

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

- all relevant majors hazards both technological and natural
- the possible frequency of potential hazards, accidents, spillages and abnormal events occurring
- an indication of cumulative risk levels to surrounding land uses
- the life of any identified hazards
- a list of all hazardous substances to be used, stored, processed, produced or transported

- the rate of usage
- a description of processes, type of the machinery and equipment used
- potential wildlife hazards such as crocodiles, snakes, and disease vectors
- public liability of the Queensland Government for private infrastructure and visitors on public land.

The integrated risk management plan should include the following components:

- operational hazard analysis
- regular hazard audits
- information on how fire safety and, emergency events will be managed
- information on how the proponent will develop and maintain emergency response plan/s
- qualitative risk assessment
- preliminary information on construction safety management.

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

4.14 Siting and management of petroleum activities – constraints analysis

Due to the nature of the proposal, it is accepted that the EIS will not be able to address the exact locations of all wells, pipelines and other associated infrastructure throughout the life of the project. The framework approach proposed by the proponent incorporates a constraints analysis to identify land where particular petroleum activities may and may not occur. The constraints analysis must use appropriate environmental, social and economic factors based on the values identified in the preceding sections of the EIS. Details of those factors must be provided in the EIS together with a description of the assumptions, methods and any weightings used in the constraints analysis.

Details should be provided about the information and criteria used to inform site selection and decision-making on the siting of project activities, infrastructure and choice of construction method, as well as the standard operating procedures and site specific controls that will be applied (how, where and when) to the range of petroleum activities that may occur throughout the project area.

The resolution of the analysis must be sufficient to determine the potential for petroleum activities to occur on any individual lot of land in the project area. The EIS should detail both general environmental management methods for all petroleum activities and any specific environmental management methods that would apply to particular lots of land.

4.15 Cross-reference with the terms of reference

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

5. Environmental management plan

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

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

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

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

6. Commitments not included in the EM plan

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

7. References

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

8. Recommended appendices

A1. Final terms of reference for this EIS

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

A2. Development approvals

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

A3. Study team

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

A4. The standard criteria

A brief summary should be presented of the 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 Commonwealth Government in December 1992 (available from the Australian Government Publishing Service), each principle should be discussed and conclusions drawn as to how the project conforms. A life-of-project perspective should be shown.

A5. Consultation report

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

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

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

A6. Specialist studies

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

A7. Research

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