

Draft Terms of Reference for the Future Gas Supply Area Project Environmental Impact Statement (EIS)

Proposed by Santos Limited

June 2012



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Introduction

This environmental impact statement (EIS) assessment process is for the Future Gas Supply Area project (the project) under the *Environmental Protection Act 1994* (EP Act). It is separate to, but builds on, the information contained within the EIS completed for the Gladstone Liquefied Natural Gas (GLNG) project assessed through the *State Development and Public Works Organisation Act 1971* (SDPWO Act) EIS process in 2010.

The project would involve the production of coal seam gas (CSG) from gas fields over an area of approximately 4400 square kilometres (km²) (or 440 000 hectares) in central southern Queensland. The tenements are located across the Maranoa, Western Downs, Banana and Central Highlands local government areas and adjacent to the population centres of Roma, Taroom, Wandoan, Injune and Rolleston. The number, size and specific location of each component of the project are not yet determined, and will be influenced by the location, size and quality of the discovered CSG resource within the project area. For example, the maximum number of CSG production wells is currently estimated to be 4100; however this number would be confirmed through the EIS process. The project is described in more detail below.

The approach proposed for this EIS is subject to feedback from government community and industry. Santos proposes to directly incorporate the experience gained through their existing GLNG project into this EIS to define constraints of operation, proven mitigation and management strategies and extensions of existing monitoring. This will seek to define and manage the potential impacts of this proposal through the EIS process prior to confirmation of specific locations and numbers of activities and approvals being granted.

Consequently, it is proposed to develop the EIS primarily on the basis of desktop studies, supported by targeted field studies and through inclusion of adaptive management measures, based on in-field experience from the GLNG project rather than undertake conventional field based studies to prepare the EIS. The studies will be reported in the EIS and involve:

- desktop assessment of the CSG fields, the purpose of which is to identify regional environmental constraints over the project area and provide a focus for the subsequent targeted surveys
- limited targeted ecological surveys, which would be conducted to give a representation of the regional ecological values of the project area
- assessment of likely impacts from typical project elements. This would be based on identified impacts and confirmed mitigation measures deployed in existing Santos GLNG operations
- development of a set of protocols for the ongoing impact assessment of each element of the project, to be undertaken as the specific element's nature and location become evident.

The proposed approach will require additional specific impact assessment of each element of the project after the EIS process whenever approvals are sought, including implementation of the commitments and constraints provided in the EIS process to:

- conduct extensive survey work to identify features of the existing environment in locations where the infrastructure is proposed
- determine where CSG infrastructure may be located
- where there is an impact on the environment, implement the constraints and commitments presented in the EIS to achieve the agreed outcome of minimum impacts to the existing environment
- monitor and manage the ongoing operation.

Background

Santos Limited, herein referred to as Santos GLNG, proposes to develop the project, which involves the production of CSG in gas fields over an area of central southern Queensland. The gas fields were previously identified but not assessed in the Santos GLNG project EIS evaluated by the Queensland Coordinator-General. Construction of the GLNG project is currently underway. The project covers a reduced area compared to that identified as the 'Future Development Area' in the GLNG EIS. The development of the project is intended to complement existing GLNG gas field developments across the Surat and Bowen basins.

The project will involve the progressive development of CSG production wells and associated facilities across all or part of Petroleum Leases (PL) 10, 11 and 176, Authorities to Prospect (ATP) 655, 745, 803, 804, 708, 665, 631 and 868 (the project area), all held by Santos GLNG.

It should be noted that Environmental Authority (EA 100046407) applies for gas production at PL176. This production will continue during the assessment process. This project includes that PL176 production levels will be increased. Exploration and appraisal activities for the remainder of the tenements will continue as permitted under relevant ATPs.

Relationship to the existing GLNG project

The Santos GLNG project is one of Australia's major CSG to LNG projects involving the development of exploration and production wells and an underground pipeline connecting CSG fields with an LNG facility on Curtis Island. As outlined above, that particular project was assessed through an EIS process under the SDPWO Act by the Queensland Coordinator-General. Its key components include the construction and operation of 2650 wells in the Bowen and Surat basins, a 420 km pipeline from the Fairview gas fields to Gladstone and a LNG plant and export facility comprising two processing trains on Curtis Island off Gladstone.

The CSG produced by the project will be supplied to the GLNG facility on Curtis Island, via pipeline infrastructure. The project will not require changes to the ATP, GLNG processing facility or marine facilities which have been approved.

The development of the project will benefit from the Santos GLNG organisation, processes, learnings, and capability and project infrastructure developed and currently under development in the upstream sector of the broader Santos GLNG project. Consequently, the project is expected to apply adaptive management gains in the following key areas:

- minimisation of environmental and social impacts via maximum utilisation of existing and ongoing developments in Fairview, Roma and Arcadia
- minimisation of landholder and broader community impacts through the use of well-established protocols, processes, networks and experience
- energy efficiency gains, greenhouse gas (GHG) reductions and waste minimisation through maximum utilisation of existing facilities
- extension and expansion of local industry development potential
- broadening of the scientific and practical knowledge base in the areas of CSG water management, aquifer monitoring and cumulative impacts
- implementation of management plans, systems and procedures developed to comply with the GLNG project approval.

To this end, the Santos GLNG project has established a strong cross-functional and accountable organisational structure, supported by the requisite systems, processes and safeguards to ensure that current Future Gas Supply Area project activities are well planned and successfully implemented.

The gas field infrastructure will reflect best practice gas field and CSG water management and will be designed to minimise the environmental footprint and social impact. The specific configuration and location of infrastructure will be determined by the location and quality of discovered gas resources and subsequent agreements reached with landholders, including agreements for beneficial use of CSG water.

Proposed development

The project will involve progressive development of CSG resources across 11 petroleum tenements covering approximately 4400 km² in southern and central Queensland. The tenements are located across four local government areas including Maranoa, Western Downs, Banana and Central Highlands. Major population centres within proximity to the project include Roma, Taroom, Wandoan, Injune and Rolleston.

Tenure within the project area includes freehold, leasehold and crown land. The predominant land uses of the project area include agriculture, cattle grazing and CSG, oil and gas and mining development. There are areas of urban land use located within townships of the region.

Typical development activities across the project area would include:

- geophysical investigations
- drilling, installation, operation and maintenance of production wells and monitoring wells
- installation, operation and maintenance of gas and water pipeline gathering and transmission networks
- installation, operation and maintenance of water storage, management and treatment infrastructure
- installation, operation and maintenance of gas treatment and compression facilities
- installation, operation and maintenance of power supply (overhead and/or underground) and power generation
- support and ancillary activities and the installation, operation and maintenance of infrastructure including:
 - access roads
 - waste management areas
 - borrow pits
 - quarries
 - lay down and storage areas
 - workforce accommodation and associated facilities
- demolition, decommissioning and rehabilitation of infrastructure and disturbed areas.

The number, size and locations of these components of the project have yet to be determined, but would be influenced by the location, size and quality of the discovered CSG resource within the project area. The timing of the field developments would also be determined by the timing and nature of the appraisal results as well as the proximity to and synergies with existing and planned facilities previously approved.

An overview of some of the key infrastructure components required for the project is described below.

Production wells

Production wells are drilled to extract water and gas. The distance between wells is dependent on factors such as depth, thickness and permeability of the coal and the technology utilised. There is some flexibility in the final placement of wells, which may be located to avoid sensitive areas.

Production wells usually require a fenced area of approximately 0.1 ha for safe operation. Directional drilling may allow multiple wells to be developed from the one location (pad), where technically viable. The wells would be connected to the gas collection field network by underground gas and water pipelines which, where possible, would be constructed along fence lines and existing tracks. Following collection, the gas would be compressed and transported to either the LNG facility on Curtis Island via the approved GLNG Gas Transmission Pipeline, or to the domestic gas market via existing pipelines.

The project area gas reserve quantities are not proven; therefore based on a preliminary well spacing the impact assessment approach will consider the maximum potential number of wells and maximum number of gas and water processing facilities across the project area. Based on this assumption a maximum of 4100 production wells would be constructed sequentially over the life of the project.

Centralised gas processing, compression and water treatment facilities

The gas processing and CSG water treatment facilities would be located throughout the gas fields to minimise the length of the gathering pipelines and pumping requirements. The size and number of gas and CSG water processing facilities would depend on the nature of the reservoirs, the number of wells and the volume and nature of CSG water.

A number of gas compressor stations, which would compress the gas for transport, would be located throughout the project area. Where possible these would be co-located with the CSG water treatment facilities. Compressor stations require a cleared fenced area and comprise a number of components, such as instrument and control systems, fuel tanks, safety flare systems, and operations related buildings.

Gas and CSG water pipeline gathering systems

There would be two types of pipeline installed within the CSG field gathering systems:

- Gas pipeline used to collect the gas and direct it into the main transmission pipeline, they are typically constructed of high density polyethylene (HDPE) and are buried.
- CSG water pipelines used to collect CSG water from CSG wells around the project area and transport it for treatment and/or management. The CSG water pipelines are typically constructed of HDPE and where practical are buried in the same trench as the gas pipeline.

Access roads

Roads would be constructed for access to wells and associated facilities. Some access will require construction of new roads, including grading and sealing of some roads, others will be 4WD vehicle access only. Some access will utilise existing tracks, roads or cleared/disturbed areas, with upgrading as required.

New access routes will require on-ground investigation and their location will depend on the location of CSG resources and environmental constraints.

Borrow pits, quarries and storage areas

Borrow pits and quarries are typically required as a source of gravel and other materials that are needed for well sites, access roads and storage areas. If required storage areas and lay down areas for equipment and materials would be generally placed in centralised locations to minimise disturbance.

Communication and electricity supply

Power supply for the project is anticipated to be a combination of power generated by CSG and grid connection, these options will be considered as part of the EIS.

A combination of telecommunication options could be used throughout the project area, including:

- telemetry services for field production through a series of radio towers
- extending the Santos GLNG existing fibre optic network
- using existing carrier services, where available
- satellite communication in remote locations.

Accommodation facilities

An accommodation study will be undertaken as part of the EIS to determine the estimated construction and operational workforce generated by the project and the availability of existing accommodation able to support this workforce. Subject to the results of that study, the construction workforce would be accommodated in a combination of purpose-built camps close to work sites and within local housing in the regional townships such as Roma, Wallumbilla, Wandoan, Taroom, Injune and Rolleston.

Executive summary

The executive summary conveys the project's most important aspects and options to the reader in a concise and readable form. Use plain English and avoid the use of jargon and obscure terms. The structure of the executive summary should follow that of the EIS, and focus strongly on the key issues and conclusions.

Glossary of terms

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

1 Introduction

Explain why the EIS has been prepared and what it sets out to achieve—in particular, the level of detail required to satisfy assessment of the approvals being sought. It should also define the audience to whom it is directed, and contain an overview of the structure of the document. Throughout the EIS, factual information contained in the document should be referenced.

1.1 Project proponent

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

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

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

State the objectives that have led to the development of the project and briefly outline the events leading up to the project's formulation, including alternatives, envisaged time scale for implementation and Project life, anticipated establishment costs and actions already undertaken within the project area.

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

1.4 The EIS process

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

1.4.1 Methodology of the EIS

Describe the EIS process steps, timing and decisions to be made for relevant stages of the project. Provide a brief description of studies or surveys that have been undertaken to help develop the project and prepare the EIS. Describe any baseline studies or investigations used in the EIS that were undertaken before the EIS process started. Outline how the consultation process (which will be described in detail in section 1.5) integrated with the other components of the impact assessment, including the stages, timing and mechanisms for public input and participation.

The information in this section is required to ensure:

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

1.4.2 Objectives of the EIS

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

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

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

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

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

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

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

It is necessary for all relevant sections of the EIS to provide details about the quality of the information given in the EIS, in particular:

- the source of the information
- how recent the information is
- how the reliability of the information was tested
- any uncertainties in the information.

The proponent is proposing to use a framework approach developed for the approved GLNG project 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 will be informed about how and when public submissions on the draft EIS can be made, and how they will be addressed and taken into account in the decision-making process.

1.5 Public consultation process

An appropriate public consultation program is essential to the impact assessment. This section will outline the methodology that will be adopted to identify and mitigate social and economic impacts of the project. Provide information about consultation that has already taken place and its results.

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

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

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

1.6 Project approvals

1.6.1 Relevant legislation and policy requirements

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

Identify all environmentally relevant activities that would be undertaken at the project site, including those that would otherwise require a development approval if the project was not covered by an environmental authority for a petroleum activity.

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

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

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

1.6.2 Planning processes and standards

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

1.7 Accredited process for controlled actions under Commonwealth legislation

The proposed project is a controlled action under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions for the project, with regard to its potential impacts on matters of national environmental significance are:

- wetlands of international importance (Ramsar wetlands) (sections 16 and 17B)
- listed threatened species and ecological communities (sections 18 and 18A)
- listed migratory species (sections 20 & 20A).

The State's EIS process has been accredited *under An Agreement Between The Commonwealth And The State Of Queensland Under Section 45 Of The Environment Protection And Biodiversity Conservation Act 1999 Relating To Environmental Assessment* (the Bilateral Agreement) for the purposes of the Commonwealth's assessment of the project under Part 8 of the EPBC Act.

Information on the assessment of projects under the EPBC Act, including referrals and public notices, can be found at www.environment.gov.au/epbc/index.html

The EIS must assess the relevant impacts on matters covered by the controlling provisions and ensure that it gives enough information about the project and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether to approve the project under the EPBC Act. The matters to be addressed in the EIS are set out in section 6 and Schedule 1 of the Environmental Protection Regulation 2008, which mirrors Schedule 4 of the Commonwealth's Environment Protection and Biodiversity Conservation Regulations 2000.

This TOR outlines how the EIS will assess the relevant impacts on matters of national environmental significance listed as controlling provisions for the project. The information must be provided as a stand-alone report in the EIS that exclusively and fully addresses the matters relevant to the controlling provisions.

The information provided on these matters must be consistent with any relevant publicly available policy guidance provided by the Department of Sustainability, Environment, Water, Population and Communities.

2 Project need and alternatives

2.1 Project justification

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

2.2 Alternatives to the project

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. Environmental, economic and social elements of the 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

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

3.1 Location

3.1.1 Regional context

Describe the regional context of the project and illustrate it on maps at suitable scales. Identify any possibly constraining values that may need to be considered when designing and siting infrastructure.

3.1.2 Local context

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

- the location and boundaries of land tenures, in place or proposed, to which the project area is or will be subject
- general arrangement plans to show the typical extent of key aspects of the project including excavations, stockpiles, areas of fill, watercourses, plant locations, water storage, power and water supply lines, buildings, roads, railways, bridges, weirs, culverts, hardstands, car parks, etc.
- the location of any proposed buffers surrounding the working areas.

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

3.2 Construction

Describe the extent and nature of the project's construction phase. Describe the type and methods of construction, the construction equipment to be used and the items of plant to be transported onto the construction site. Describe any staging of the project and illustrate site boundaries, development sequencing and indicative timeframes.

3.3 Operations and maintenance

Describe the location and nature of the project's operational phase and proposed maintenance activities, and illustrate the description as required with maps, diagrams and artist's impressions. Operational issues to be addressed will include, but not necessarily 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.

Provide concept and layout plans highlighting proposed buildings, structures, plant and equipment associated with the processing operation. Describe the nature, sources, location and quantities of all materials to be handled, including the storage and stockpiling of raw materials.

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

3.3.1 Tenements and tenures

Describe and illustrate any existing mining tenements, petroleum (including coal seam gas), geothermal and greenhouse gas tenures and licences overlying and adjacent to the project site, and any proposed applications required for this Project.

Describe in detail any issues related to the overlap of tenements and tenures for different resources or purposes, including the sequential exploitation of the resources or uses to which the tenements and tenures may be put.

3.3.2 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 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.

3.3.3 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.

3.3.4 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.

3.3.5 Typical infrastructure requirements

This section should provide descriptions of typical infrastructure requirements to support the entire life cycle of the project. 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.

3.3.6 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).

3.3.7 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 3.3.2.

3.3.8 Transport—road/rail/air/ship

Provide an overview of the arrangements for the transportation, importation or exportation 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.

3.3.9 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.

3.3.10 Water supply and storage

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

Provide information on proposed water usage and storage by the project, including the quality and quantity of water supplied to, or captured by, the project. Describe the proposed options for water sources such as capture of overland flow, taking from a watercourse, bores, CSG water and associated pipelines, and any surface storages such as dams and weirs and municipal water supply pipelines.

Describe the rates of supply from each source for each phase of the project's life. Describe any proposed water conservation and management measures.

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

3.3.11 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.

3.3.12 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.

3.4 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, in the context of the Environment Protection (Waste Management) Policy 2000. Details on each subsection on waste management will assess how the proposed methods for waste management at each stage of the project achieve the highest possible level of waste management with regard to first avoiding the production of waste, then reusing or recycling waste, with disposal as the last option.

Describe how the project would achieve 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.

3.4.1 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).

3.4.2 Excavated waste

Describe the excavated waste generated by the project. In particular, focus on:

- 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.

Examine the likely volumes, chemical and physical properties, and strategies for each of these excavated wastes (and any other excavated waste), within the context of the Technical Guidelines for Environmental Management of Exploration and Mining in Queensland (DME 1995).

3.4.3 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.

3.4.4 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 will 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.

3.5 CSG water management

A CSG water management plan (CWMP) is to be incorporated into the environmental management plan required for an application for a level 1 environmental authority. The content requirements for the CWMP are specified in the guideline: Preparing an Environmental Management Plan (EM plan) for Coal Seam Gas (CSG).

This section must detail the strategy for management of CSG water produced as a by-product of extracting coal seam gas. The CWMP must state the following:

- the quantity of CSG water the applicant reasonably expects will be generated in connection with carrying out each relevant CSG activity
- the flow rate at which the applicant reasonably expects the water will be generated
- the quality of water, including changes in water quality, which the applicant reasonably expects will happen while each relevant CSG activity is carried out
- the proposed management of water, including the use, treatment, storage or disposal of the water
- the measurable criteria (management criteria) against which the applicant will monitor and assess the effectiveness of the management of water, including criteria for each of the following:
 - the quantity and quality of water used, treated, stored or disposed of
 - protection of environmental values affected by each relevant CSG activity
 - the disposal of waste, including, for example, salt generated from the management of water
- the proposed action to be taken if any of the management criteria are not satisfied, to ensure the criteria will be able to be satisfied in the future.

The CWMP must not provide for using a CSG evaporation dam in connection with carrying out a relevant CSG activity, unless the plan includes an evaluation of best-practice environmental management for CSG water and alternative ways for managing the water. The evaluation must show that there is no feasible alternative for managing the water other than a CSG evaporation dam.

The guideline: Approval of Coal Seam Gas Water for Beneficial Use describes the minimum standards for different types of beneficial use.

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.

3.6 Rehabilitation and decommissioning

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 stabilising 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) and rehabilitation of flora and habitat (section 4.9). 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.

4 Environmental values and management of impacts

The functions of this section are to:

- Describe the existing environmental values of the area that may be affected by the project. Environmental values are defined in section 9 of the *Environmental Protection Act 1994*, environmental protection policies and other documents such as the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC & ARMCANZ, 2000). Environmental values may also be derived following recognised procedures, such as described in the ANZECC & ARMCANZ 2000 guidelines. Environmental values will be described referring to background information and studies, which will be included as appendices to the EIS.
- Describe the potential adverse and beneficial impacts of the project on the identified environmental values.
- Describe any cumulative impacts on environmental values caused by the project, either in isolation or by combination with other known existing or planned development or sources of contamination.
- Propose environmental protection objectives and commitments. All environmental protection commitments must be measurable and auditable.
- Examine viable alternative strategies for managing impacts. These alternatives will be presented and compared in view of the stated objectives and standards to be achieved. Discuss available techniques, including best practice, to control and manage impacts to the nominated objectives. This section will detail the environmental protection measures to be used in the planning, construction, operations, rehabilitation and decommissioning stages of the project and any associated works. Measures will prevent, or where prevention is not possible, minimise environmental harm and maximise social, economic and environmental benefits of the project. Preferred measures will be identified and described in more detail than other alternatives.
- Describe any computational model used to make predictions of impacts and/or outcomes of mitigation measures. The description will address the inputs, assumptions, limitations, sensitivities, accuracy and precision of the model.

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

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

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

- Environmental values affected: describe the existing environmental values of the area to be affected including values and areas that may be affected by any cumulative impacts (refer to background studies in appendices – note: such studies may be required over several seasons). Explain how the environmental values were derived, such as by citing published documents or by following a recognised procedure to derive the values.
- Impact on environmental values: describe the likely impacts of the project on the identified environmental values of the area, including:
 - a detailed assessment of the nature and extent of the likely short term and long term impacts
 - a statement about whether any impacts are likely to be unknown, unpredictable or irreversible
 - an analysis of the significance of the impacts
 - any technical data and other information used or needed to make a detailed assessment of the impacts.

- The cumulative impacts of the project must be considered over time or in combination with other (all) impacts in the dimensions of scale, intensity, duration or frequency of the impacts. In particular, address any requirements and recommendations of relevant state planning policies, environmental protection policies, national environmental protection measures and integrated catchment management plans.
- Cumulative impacts on the environmental values of land, air and water and cumulative impacts on public health and the health of terrestrial, aquatic and marine ecosystems must be discussed in the relevant sections. This assessment may include air and watersheds affected by the project and other proposals competing for use of the local air and water sheds.
- Where impacts from the project will not be felt in isolation to other sources of impact, it is recommended that the proponent develop consultative arrangements with other industries in the project's area to undertake cooperative monitoring and/or management of environmental parameters. Describe such arrangements in the EIS.
- Environmental protection objectives: describe qualitatively and quantitatively the proposed objectives for enhancing or protecting each environmental value. Include proposed indicators to be monitored to demonstrate the extent of achievement of the objective as well as the numerical standard that defines the achievement of the objective (this standard must be auditable). The measurable indicators and standards can be determined from legislation, support policies and government policies as well as the expected performance of control strategies. Include objectives for progressive and final rehabilitation and managing contaminated land.
- Control strategies and mitigation measures to be used 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, and relevant performance specifications of plant. Details are required to show that the expected performance is achievable and realistic.
- With regard to the project's proposed safeguards and mitigation measures, the EIS should include the following matters:
 - a description, and an assessment of the expected or predicted effectiveness, of the mitigation measures for dealing with the project's relevant impacts
 - any statutory or policy basis for the mitigation measures
 - the cost of the mitigation measures.
- 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, such as the Queensland Biodiversity Offset Policy (2011), and the most recent *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.
- Management actions: describe the actions to be used to ensure the control strategies are 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.
- The environmental protection commitments developed in the main body of the EIS should all be included in a draft environmental management plan (EM plan) that provides the following information:
 - the framework for continuing management, mitigation and monitoring programs for the project's relevant impacts, including any provision for independent environmental auditing
 - the name of the entity responsible for endorsing or approving each mitigation measure or monitoring program

- a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the project’s relevant impacts, including mitigation measures proposed to be taken by the State, a local government or the proponent

It is recommended that the final TOR and the EIS follow the heading structure shown below. The mitigation measures, monitoring programs, etc. identified in this section of the EIS will be used to develop the environmental monitoring program for the project (see section 6).

4.1 Climate

Describe the rainfall patterns (including magnitude and seasonal variability of rainfall), air temperatures, humidity, wind (direction and speed) and any other special factors (e.g. temperature inversions) that may affect management of the project including air quality within the region of the project. Discuss extremes of climate (droughts, floods, cyclones, etc.) with particular reference to water management at the project site. Address the vulnerability of the area to natural or induced hazards, such as floods and bushfires. Consider the relative frequency and magnitude of these events together with the risk they pose to management of the project.

The potential impacts due to climatic factors will be addressed in the relevant sections of the EIS. The impacts of rainfall on soil erosion will be addressed in section 4.2. The impacts of storm events on the capacity of waste containment systems, such as site bunding, stormwater management and tailings dams, will be addressed in section 4.5 with regard to contamination of waterways and in section 4.4 with regard to the design of the waste containment systems. The impacts of winds, rain, humidity, and temperature inversions on air quality will be addressed in section 4.7.

4.1.1 Climate change adaptation

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

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

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

4.2 Land

4.2.1 Description of environmental values

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

4.2.1.1 Topography

Describe and illustrate the topography of the project site and the surrounding area, and highlight any significant features shown on the maps. Such features would include any locations subsequently referred to in the EIS (such as noise sensitive locations) that are not included on other maps in section 4.2. Maps will have contours at suitable

increments (at least every metre in areas of low relief), shown with respect to Australian Height Datum (AHD) and drafted to the GDA 94 datum.

4.2.1.2 Land use

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

4.2.1.3 Geology and geomorphology

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

4.2.1.4 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 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
- 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 known 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.

4.2.1.5 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. Include an assessment of Strategic Cropping Land in accordance with the most recent Department of Natural Resources and Mines (DNRM) information based on the document Protecting Queensland's Strategic Cropping Land: A Policy Framework.

4.2.1.6 Land use and suitability

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.

Provide an Agricultural Land Class map of the project site and the surrounding area according to Guideline 1 for SPP1/92: The Identification of Good Quality Agricultural Land (DPI/DHLGP, 1992).

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

Include an assessment of Strategic Cropping Land in accordance with the most recent DNRM information based on the document Protecting Queensland's Strategic Cropping Land: A Policy Framework.

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.

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

4.2.1.7 Contaminated land

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

Conduct a preliminary site investigation consistent with EHP's Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. If the results of the preliminary site investigation indicate potential or actual contamination, conduct a detailed site investigation progressively managed in accordance with the stages outlined in Appendix 5 of the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. The results of the site investigations should be summarised in the EIS and provided in detail in an appendix.

4.2.1.8 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.

4.2.1.9 Environmentally sensitive areas

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

4.2.1.10 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.

4.2.1.11 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 Resource utilisation

With regard to resource stewardship, analyse the effectiveness of the proposal in achieving optimum utilisation of the gas resource and consider the impact of other resources. Demonstrate that the proposal will best develop the gas resource, minimise wastage and avoid sterilisation of any other resources.

4.2.2.2 Land use suitability

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

establishment of those options should be given in the context of land use suitability prior to the 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.

Include an assessment of Strategic Cropping Land in accordance with the most recent information based on the document 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 measured to avoid unacceptable impacts defined.

4.2.2.3 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 4.2.2.3. 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 3.6. 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.

4.2.2.4 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 EHP'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.

4.2.2.5 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 from EHP.

4.2.2.6 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.

4.2.2.7 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.

4.2.2.8 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.

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

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. The transport section should expand on the Road Impact Assessments completed for the GLNG project

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. 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.

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.

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

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

4.3.2 Potential impacts and mitigation measures

For each mode of transport and each phase of the project, the EIS 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).

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 analysis of transport impacts and modelling of impact mitigation measures
- assessment methodology used, including a summary of consultation undertaken with both state and local government 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 and background traffic volumes
- possible interruptions to transport operations caused by the project
- 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 effects.

The assessment of state-controlled 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>. The assessment of local government road impacts should be in accordance with the relevant Council's guidelines. 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 3.4 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

4.5.1 Description of environmental values

Describe the existing resources and environmental values of water that may be affected by the project.

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

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

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

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

Map flood risk areas for major creeks. The flood risk area identifies that further flood investigation must be carried out for any critical infrastructure (including critical access routes) located within the flood risk area during later stages of the project approval process. The flood risk area will be defined by reference to a single extreme flood event that will be verified or derived from flood studies, topographical data, observed flood data and, if required, flood modelling.

Describe how the potential for flooding would affect access to proposed infrastructure and the ability to undertake mitigation strategies.

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

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

will be performed in accordance with the Monitoring and Sampling Manual 2009 Version 2 (DERM, 2010) or the most current edition.

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

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

- geology and stratigraphy
- aquifer type – such as confined, unconfined, karst or perched
- depth to, and thickness of, the aquifers
- the significance of the resource at a local and regional scale
- depth to water level and seasonal changes in levels
- groundwater flow directions (defined from water level contours)
- groundwater yield
- groundwater quality
- interaction with surface water
- interaction with saline water
- possible sources of recharge
- vulnerability to pollution.

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

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

Develop and describe a network of observation points and a monitoring program that would satisfactorily monitor groundwater resources both before and after commencement of operations. The data obtained from the groundwater survey will be sufficient to enable specification of the major ionic species, pH, electrical conductivity, total dissolved solids and any potentially toxic or harmful substances.

4.5.2 Potential impacts and mitigation measures

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

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

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

Assess the hydrological impacts of the project, particularly with regard to the various components of flow that may be impacted by the project. The EIS will address: changes to catchment size or characteristics, changes to the direction or quantity of runoff in the local catchment and to accumulated downstream flows, scouring and erosion, and the consequent impacts of any subsidence. Any consequential impacts of changes to water flow or groundwater recharge on ecosystems and wildlife will be addressed in the ecology section of the EIS. When flooding levels will be affected, model the afflux and illustrate the predictions with maps. Describe how operations would be protected from flooding.

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

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

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

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

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

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

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

4.6 Coastal environment

4.6.1 Description of environmental values

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

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

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

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

4.6.2 Potential impacts and mitigation measures

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

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

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

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

4.7 Air

4.7.1 Description of environmental values

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

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

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

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

4.7.2 Potential impacts and mitigation measures

Describe all the project’s potential sources of emissions to air and expected composition of the emissions. The description will include oxides of sulfur or nitrogen, volatile organic compounds, carbon monoxide and dioxide, particulates (including dust, PM₁₀, and PM_{2.5}), trace metals, odours and any toxic, persistent and/or hazardous substances that would be emitted by the project. Also, specify the oxygen content of the flue gases. 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.

Provide a separate air emission inventory of any offsite activities directly associated with the project, including fugitive emissions such as from rail or road transport of product or waste.

Use a recognised atmospheric dispersion model to predict the fate of all significant emissions. Use estimates of emission rates 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. State all input parameters, data sets and assumptions used in the modelling in the main text of the EIS or an appendix. The model inputs will be as detailed as possible, reflecting any variation of emissions with time and including at least a full year of representative hourly meteorological data. Provide stack parameters such as stack height, diameter, temperature, exit velocity and volume flow rate.

If there is no single atmospheric dispersion model that is able to handle the different atmospheric dispersion characteristics exhibited in the project area (such as sea breezes, strong convection, terrain features, temperature inversions and contaminant re-circulation), apply a combination of acceptable models.

Provide contour maps of predicted ground level concentrations and frequency contour plots for typical and maximum emissions under the expected range of meteorological conditions including the worst case. The averaging period for ground-level concentrations of contaminants modelled will 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 (Ambient Air Quality) Measure. For example, the modelling of sulfur dioxide must be conducted for 1-hour, 24-hours and annual averaging periods.

Compare the predicted ground level concentrations to the air quality objectives, and best practice national and international source emission standards. Describe any situations where people, ecosystems or an agricultural use would experience concentrations above an objective. Assess the human health risk associated with emissions from the project for all contaminants whether or not they are covered by the National Environmental Protection (Ambient Air Quality) Measure or the EPP (Air). Assess potential impacts of emissions on ecosystems or agricultural uses of the environment.

Assess the potential cumulative impacts between the emissions from the project and other emissions in the airshed. Evaluate qualitatively the potential for the project to impact on regional air quality e.g. generation of photochemical smog.

Describe airshed management and the contribution of the project to airshed capacity in view of existing and future users of the airshed for assimilation and dispersion of emissions.

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

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 between the project and neighbouring sensitive receptors will be adequate

Describe the pollution control equipment and pollution control processes to be employed on the premises and the features of the project designed to suppress or minimise emissions, including dusts and odours. Describe the backup measures to be incorporated that will act in the event of failure of primary measures to minimise the likelihood of plant upsets and adverse air impacts.

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

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

4.7.2.1 Greenhouse gases

Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in 'CO₂ equivalent' terms. Estimate emissions from upstream activities associated with the proposed project, including the fossil fuel based electricity to be used. Briefly describe the methods used to make the estimates. The Australian Department of Climate Change and Energy Efficiency's National Greenhouse Accounts (NGA) Factors can be used as a reference source for emission estimates and supplemented by other sources where practicable and appropriate. Coal mining projects will include estimates of coal seam methane to be released as well as emissions resulting from such activities as transportation of products and consumables, and energy use by the project.

Assess the potential impacts of the project on the state and national greenhouse gas inventories and propose greenhouse gas abatement measures, including:

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

Means of reducing greenhouse gas emissions could include such measures as:

- minimising clearing at the site (which also has imperatives besides reducing greenhouse gas emissions)
- using less carbon-emitting transport modes or fuels
- integrating transport for the project with other local industries such that greenhouse gas emissions from the construction and running of transport infrastructure are minimised
- maximising the use of renewable energy sources
- carbon sequestration at nearby or remote locations.

Include a specific module to address greenhouse abatement in the draft environmental management plan. That module will include:

- commitments to the abatement of greenhouse gas emissions from the project with details of the intended objectives, measures and performance standards to avoid, minimise and control emissions
- periodic energy audits with a view to progressively improving energy efficiency
- a process for regularly reviewing new technologies to identify opportunities to reduce emissions and use energy efficiently, consistent with best practice environmental management
- any voluntary initiatives such as projects undertaken as a component of the national Greenhouse Challenge Plus program, or research into reducing the lifecycle and embodied energy carbon intensity of the project's processes or products
- opportunities for offsetting greenhouse emissions by renewable energy uses
- commitments to monitor, audit and report on greenhouse emissions from all relevant activities and the success of offset measures.

4.8 Noise and vibration

4.8.1 Description of environmental values

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

If the proposed activity could adversely impact on the noise environment, undertake baseline monitoring at a selection of sensitive receptors potentially affected by the project. Sensitive receptors are defined in the EPP (Noise). Illustrate the locations of sensitive receptors on a suitably-scaled map. Describe the results of any baseline monitoring of noise and vibration in the proposed vicinity of the project, including long-term measured background noise levels that take into account seasonal variations.

Report the daily variation of background noise levels at nearby sensitive receptors, with particular regard to detailing variations at different periods of the night. Monitoring methods will adhere to accepted best practice methodologies, relevant guidelines and Australian Standards, and any relevant requirements of the Environmental Protection Regulation 2008 and the EPP (Noise).

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

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

4.8.2 Potential impacts and mitigation measures

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

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

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

4.9 Ecology

4.9.1 Description of environmental values

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

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

A discussion should be presented on the ecological 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 EHP.

Survey effort should be sufficient to confirm the findings of a thorough desk-based assessment and allow extrapolation of the plant and animal values over the entire project area.

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 at a suitable scale, 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
- location and extent of vegetation types using EHP's regional ecosystem type descriptions in accordance with the Regional Ecosystem Description Database
- category A or B environmentally sensitive areas under the Environmental Protection Regulation 2008
- any areas of state, regional or local significance identified in an approved Biodiversity Planning Assessment produced by EHP
- critical habitat within the meaning of the *Nature Conservation Act 1992*
- important habitats of species listed under the *Nature Conservation Act 1992* and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as endangered, critically endangered, vulnerable or near threatened
- vegetation mapped as essential habitat
- remnant or regrowth vegetation, particularly essential regrowth habitat, high value regrowth, or a regrowth watercourse
- sensitive or important vegetation types, including riparian vegetation and any marine littoral and subtidal zone
- in-land or coastal wetlands
- wildlife breeding or roosting areas, or areas likely to support wildlife breeding or roosting areas
- sites in, or adjacent to, areas containing important resting, feeding or breeding sites, or flight paths for migratory species listed under the Convention of Migratory Species of Wild Animals, and/or bilateral agreements between Australia and Japan (JAMBA), Australia and China (CAMBA), or Australia and the Republic of Korea (ROKAMBA)
- sites adjacent to nesting beaches, feeding, resting or calving areas of species of special interest, such as marine turtles and cetaceans
- sites containing or likely to contain common species that represent a distributional limit and are of scientific value or contain feeding, breeding, resting areas for populations of echidna, koala, platypus and other species of special cultural significance
- sites containing or likely to contain high biodiversity that may be dependent for their long-term survival or function on connectivity with other nearby areas of habitat
- a site containing or likely to contain other special ecological values, for example, high habitat diversity and areas of high endemism
- bat roosting and breeding caves or areas likely to support bat roosting or breeding caves, including existing structures
- habitat or likely habitat of threatened or near threatened animals
- the condition of vegetation and its habitat value, particularly in relation to the conservation of any threatened and near threatened plant and animal species, assemblages or community types
- a list of species likely to occur within the project site
- species of protected plants highlighting those listed as threatened or near threatened under the Nature Conservation (Wildlife) Regulation 2006
- any other plant communities or species of conservation, cultural, commercial or recreational significance
- areas that may have low resilience to environmental change

- in indication of the location of any pest, weed or exotic species, if known
- any areas that would be subject to the *Vegetation Management Act 1999*.

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 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 and pest 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.

Existing information on plants and animals may be used instead of new survey work provided that the existing data are still current and have been derived from previous methodologies consistent with current best practice. Information presented will be sufficient to identify, or adequately extrapolate, the plant and animal values over the range of seasons, particularly during and following a wet season and take account of the ephemeral nature of watercourses traversing the project area, and seasonal variation in animal populations.

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

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

Provide an indicative list of all other known or likely species within a 25km area around the project site, highlighting any threatened or near threatened species. Correlate the occurrence of animals of conservation significance to mapped vegetation units or habitats to facilitate the development of measures for their protection. Indicate how well any affected communities are represented and protected elsewhere in the province where the site of the project occurs.

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

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

Conduct a desktop assessment of the potential for stygofauna to occur within the zone of influence of the project proposal. Develop and describe suitable indicators for measuring ecological values and objectives that would protect the environmental values from significant adverse impacts.

Assess the regional significance of ecological communities potentially affected by the project. Describe how the ecological communities in the project area form part of a larger interconnected system of ecological communities.

4.9.2 Potential impacts and mitigation measures

Assess the potential impacts on the ecological values of the area arising from the construction, operation and decommissioning of the project including clearing, salvaging or removal of vegetation. Cover terrestrial and aquatic environments. Assess the potentially significant environmental impacts on any plants and animals, whether on or off the project site, due to any alterations to the local surface and ground water environment.

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

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

Describe the potential for stygofauna to be impacted by changes in the quality, level or quantity of groundwater, and describe any further studies that are required and any mitigation measures that may be applied

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

Assess the potential impacts on animals of wastes at the site and. propose measures to prevent harm to wildlife.

Describe and assess the potential impacts of any actions of the project that require an authority under the *Nature Conservation Act 1992*, and/or would be assessable development for the purposes of the *Vegetation Management Act 1999*. The assessment and supporting information should be sufficient for the administering authority to decide whether an approval should be granted and developing recommended conditions.

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

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

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

- Queensland Biodiversity Offset Policy (DERM, 2011)
- Policy for Vegetation Management Offsets (DERM, 2009)
- Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss: Departmental Procedures, Fish Habitat Management Operational Policy, Queensland Department of Primary Industries, FHMOP 005, 2002
- Offsets for Net Benefit to Koalas and Koala Habitat in the Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006 - 2016 (EPA, 2006).

Propose detailed measures to remove and control the introduction or spread of weeds and feral or pest animals. This should include a risk assessment of high biosecurity risk species and their sites, and the development of threat mitigation plans for them, such as clean down and inspections at high risk sites. The biosecurity management

strategies will include mitigation measures relevant to protecting any potentially affected primary production areas. When determining control strategies, reference will be made to the latest Biosecurity Queensland's Annual Pest Distribution Survey data, published biosecurity management strategies, local government pest management plans and any applicable model local laws dealing with locally declared pest plants and animals. Develop management strategies to ensure no new marine pests are introduced as a result of the project's activities. Include all management measures for pest plants and animals in a biosecurity management plan, which will form part of the project's draft EM plan.

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

4.10 Cultural heritage

4.10.1 Description of environmental values

Describe existing Indigenous and non-Indigenous 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.

For Indigenous cultural heritage, provide for a process to assess Aboriginal cultural heritage values of the project and ensure that cultural heritage is managed in accordance with the *Aboriginal Cultural Heritage Act 2003*.

For Non-Indigenous cultural heritage, provide for a process to assess non-Indigenous cultural heritage and ensure there is compliance with the *Queensland Heritage Act 1992* including assessment of the known and potential historical cultural heritage values of the affected area.

This may be through a desktop study which will, 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.

Following the desktop study, it may be necessary to undertake an archaeological investigation which will be conducted by an appropriately qualified person, as required by the *Queensland Heritage Act 1992*, and will 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 any historical cultural heritage study must comply with part 9 of the *Queensland Heritage Act 1992*.

4.10.2 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.

4.10.2.1 Indigenous cultural heritage

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

Santos GLNG has already concluded the development of the CHMPs that cover the entire project area and they have been approved by the chief executive of EHP.

The EHP EIS coordinator would be made aware of the agreement to the CHMPs by the Aboriginal groups affected by the proposal, progress of the CHMP approval process and of any related issues that should be addressed in the EIS assessment report.

4.10.2.2 Non-Indigenous historical cultural heritage

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

The development of a historical heritage management plan will be negotiated with the Cultural Heritage Branch of EHP, local history organisations and 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.

4.11 Social values

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

4.11.1 Description of existing social values

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
- 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

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.

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 4.10, cultural heritage, and section 4.13, economy.

4.11.2 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, a cumulative effect 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.

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

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
- 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.

Assess the likely adverse and beneficial social impacts of the project on local and regional 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 measures.

Describe consultation with local and state authorities and stakeholders about their acceptance of proposed mitigation strategies and how practical management and monitoring regimes are to be implemented through GLNG's approved Social Impact Management Plan. A Future Gas Supply Area Project Action plan associated with GLNG's SIMP will outline mitigation strategies including:

- assignment of accountability and resources
- updates on activities and commitments
- mechanisms to respond to public enquiries and complaints
- mechanisms to resolve disputes with stakeholders
- periodic evaluation of the effectiveness of community engagement processes
- action plans to implement mitigation strategies and measures where appropriate
- practical mechanisms to monitor and adjust mitigation strategies and action plans

Further guidance on matters for inclusion in the Future Gas Supply Area Action plan is available in 'Social Impact Assessment: Guideline to preparing a Social Impact Management Plan' Department of Infrastructure and Planning (2010).

4.12 Health and safety

4.12.1 Description of values

Describe the existing community values for public health and safety that may be affected by the project. Provide maps showing the proximity of the project to any potentially affected places of human residence, work or recreation including, but not necessarily limited to, kindergartens, schools, hospitals, aged care facilities, office buildings, factories and workshops. Projects that could discharge contaminants, even accidentally, into water bodies should identify and describe any downstream extraction for potable use. For projects proposing air emissions, and/or those with the potential to emit odours, identify and describe nearby and other potentially affected populations. Pay particular attention to those sections of the population, such as children and the elderly who are especially sensitive to environmental health factors.

4.12.2 Potential impacts and mitigation measures

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

Assess the potential extent of contamination and public health risk should an extreme meteorological event, flood or catastrophic failure cause the release of toxic material from such infrastructure as tailings dams or chemical store. Describe strategies to notify relevant stakeholders during such an event.

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

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

4.13 Economy

4.13.1 Description of potentially affected economies

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

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

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

4.13.2 Potential impacts and mitigation measures

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

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

- the separate phases of the project, such as construction, operation and after ceasing operations
- the effects of this project on the local and regional economies, including goods and services supplied to, or received from, local or regional markets
- the long and short-term beneficial (such as job creation) and adverse impacts (such as increased labour costs, or competition with local small business) that are likely to result from the development
- impacts on the economic value of existing resources
- stimulus, catalytic or second-order effects
- cumulative effects of the project in relation to other economic development opportunities
- a benefit-impact table that disaggregates the benefits and impacts or costs
- the potential, if any, for direct equity investment in the project by local businesses or communities
- the cost to all levels of government of any additional regulatory function or infrastructure provision
- implications for future economic development in the locality (including constraints on surrounding land uses and existing industry)
- the potential economic impact of any major hazard identified in section 4.14
- the distributional effects of the project including proposals to mitigate any negative impact on disadvantaged groups
- the value of lost opportunities or gained opportunities for other economic activities anticipated in the future
- economic impacts on local property values.

Prepare a Local Industry Participation Plan (LIPP) in accordance with the Local Industry Policy – A Fair Go for Local Industry (Qld Gov., 2010). The Local Industry Policy – A Fair Go for Local Industry Guidelines (Qld Gov., 2011), also known as the Local Industry Policy Guidelines, provide advice on how to develop the LIPP.

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

Define and describe the objectives and practical measures for avoiding or mitigating impacts or enhancing economic benefits. Describe how nominated quantitative standards and indicators may be achieved for economic management, and how the achievement of the objectives will be monitored, audited and managed.

4.14 Hazard and risk

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

4.14.1 Description of values

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

4.14.2 Potential impacts and mitigation measures

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

Provide an inventory for each class of substances listed in the Australian Code for the Transport of Dangerous Goods by Road and Rail to be held on-site. This information should be presented by classes and should contain:

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

Details should be provided of:

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

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

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

Develop an integrated risk management plan for the whole of the life of the project including construction, operation and decommissioning phases. The integrated risk management plan should include the following components:

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

4.15 Siting and management of petroleum activities

Due to the nature of the proposal and the unknown quantity of the resource base within each tenement, 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 approach proposed for the impact assessment 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 weighting used in the constraints analysis.

Following the constraints analysis the assessment will then consider the total available remaining acreage within the tenement and will generate a maximum total number of expected wells and associated infrastructure based on minimum well spacing. These maximum numbers of wells and associated infrastructure will form the basis of the project description.

The maximum number of expected wells and associated infrastructure should be used to assess the range of impacts upon the environmental values of the area within the EIS. 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.

4.16 Cross-reference with the terms of reference

Provide a cross-reference of the findings of the relevant sections of the EIS, where the potential impacts and mitigation measures associated with the project are described, with the corresponding sections of the TOR.

5 Matters of national environmental significance

This chapter of the EIS will provide a standalone assessment of the relevant impacts of the project on the controlling provisions and provide enough information about the project and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether to approve the project under the EPBC Act. The information provided on these matters must be consistent with the relevant aspects of other sections of the EIS, for example that section dealing with ecology, and the proposed mitigation measures for matters of national environmental significance must be consistent with those proposed to cover matters regulated by the State.

The matters to be addressed in this chapter are set out in Schedule 4 of the Commonwealth's Environment Protection and Biodiversity Conservation Regulations 2000.

State the controlling provisions for the project under the EPBC Act, and describe the individual matters of national environmental significance for this project. For example, describe and illustrate the location and extent of habitat for threatened species and/or ecological communities listed under the EPBC Act that could be directly or indirectly impacted by the project.

This section must enable interested stakeholders and the Minister to understand the consequences of the proposed action on relevant matters of national environmental significance. When assessing impacts on matters of national environmental significance the following information must be provided for each relevant species, community, wetland or value:

- discuss the relevant species, community, wetland or value in respect of known threats and those threats posed the proposed action
- quantify and discuss likely direct, indirect, downstream and cumulative impacts from the proposed action
- describe and assess effectiveness of avoidance and mitigation measures to deal with relevant impacts and provide supporting information
- quantify and discuss residual impacts
- make an assessment on the level of impact and its acceptability, and provide a rationale for this assessment

- discuss any proposed offsets where there is a residual impact, or provide a rationale why residual impacts will not be compensated for.

Take into consideration relevant Commonwealth guidelines, statements or policies. For example, survey guidelines, species recovery plans and the EPBC Act Significant Impact Guidelines, available at:

<www.environment.gov.au/epbc/guidelines-policies.html>. Surveys conducted for the project must demonstrate that they comply with relevant Commonwealth survey guidelines, unless adequate justification for alternative survey methodology can be provided.

A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. You should consider all of these factors when determining whether an action is likely to have a significant impact on the environment.

Mitigation measures that are specifically related to matters of national environmental significance should be included in a separate section of the project's EM plan. It is a statutory requirement that that section should set out the framework for continuing management, mitigation and monitoring programs for the project's relevant impacts, including any provision for independent environmental auditing. It is also a statutory requirement that the plan should provide:

- the name of the entity responsible for endorsing or approving each mitigation measure or monitoring program
- a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the project's relevant impacts, including mitigation measures proposed to be taken by the state, a local government or the proponent.

Any proposed environment management plans for matters of national environmental significance must include estimates of relevant impacts from the proposed action (e.g. habitat clearance, including estimates for individual listed species and ecological communities, where relevant) and include appropriate measures to avoid or minimise impacts on the matters protected by the controlling provisions for the project. Methodology of estimates must be explained and justified.

For any residual impacts that are of sufficient magnitude, the proponent must propose offsets to compensate for these impacts that are in accordance with the Commonwealth's most recent policy on offsets. Proposed offsets for EPBC protect matters must reflect the scale and intensity of the unavoidable impacts on each individual matter of national environmental significance. Proposed offsets must contain long-term conservation outcomes and demonstrate how these outcomes will be achieved. Any areas used as offsets must be permanently protected and managed and appropriate surveying and assessment must be provided which verifies the suitability of the offset.

This part of the EIS should also provide information on other requirements set out in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 that have not been addressed in other sections of the EIS, such as details of the proponent's environmental record including:

- any proceedings under a law of the Commonwealth or the State for the protection of the environment or the conservation and sustainable use of natural resources (an environmental law) against the proponent or the applicant for any permit under an environmental law for the project
- if the proponent is a corporation, details of the corporation's environmental policy and planning framework.

6 Environmental management plan

Provide an environmental management plan (EM plan) that includes all the mitigation measures detailed in the various sections of the EIS, provides a framework for continuing management, monitoring programs and addresses any provision for independent environmental auditing. It should state the proponent's 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 legible 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.

6.1 CSG water management plan

A CSG water management plan (CWMP) is to be incorporated into the environmental management plan required for an application for a level 1 environmental authority. The content requirements for the CWMP are specified in the guideline: *Preparing an Environmental Management Plan (EM plan) for Coal Seam Gas (CSG) Activities* and are outlined in section 3.5.

7 Commitments not included in the EM plan

Summarise any commitments made by the proponent that are not included in the EM plan (such as a commitments to assist a local community group). It should be clear how and when the commitments will be fulfilled.

8 References

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

9 Recommended appendices

A1. Final terms of reference for this EIS

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

A2. Regulatory approvals

List the regulatory approvals required by the project.

A3. The standard criteria

Provide a brief summary of the project's compatibility with the standard criteria as defined by the *Environmental Protection Act 1994*, which include the principles of ESD and other relevant policy instruments. With regard to the principles of ESD, as listed in the National Strategy for Ecologically Sustainable Development, published by the Australian Government in December 1992 (available from the Australian Government Publishing Service), discuss how the project conforms with each principle from inception to decommissioning.

A4. Specialist studies

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

A5. Research

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

A6. Study team

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