



Queensland Curtis LNG Project (BG/QGC)

Initial Advice Statement

3 June 2008



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EXECUTIVE SUMMARY

Project Description

BG International Limited (BG) and Queensland Gas Company Limited (QGC) (the Proponents) propose to develop an integrated Liquefied Natural Gas (LNG) project in Queensland (the Project).

The Project will be one of Australia's largest capital projects and will have significant economic benefits for Australia and in particular for Queensland. The Project will supply up to 12 million tonnes per annum (mtpa) of LNG through the development of three LNG trains¹. The first LNG train and associated gas fields and pipeline infrastructure is estimated to involve a capital expenditure of A\$8 billion. The first LNG train is expected to be producing LNG in Q3 2013, with the second train in operation six to twelve months later, with the third train commissioned in subsequent years, depending on identification of adequate gas reserves. Subsequent development of the second and third trains would involve substantial additional investments.

The Project will comprise three principal Components:

- **Gas Field Component** – the expansion of QGC's coal seam gas (CSG) operations in the Surat Basin to provide gas for two of the three LNG trains and gas for domestic markets;
- **Pipeline Component** – the development, construction and operation of a main gas pipeline of approximately 380 km, capable of supplying gas for three LNG trains, together with a network of gas connection pipelines, to link the QGC gas fields and other nearby CSG resources to the LNG plant; and
- **LNG Component** – the development, construction and operation of an LNG processing plant and export facility, to be located in the Gladstone area, with an ultimate capacity of up to 12 mtpa. Nominally this will comprise three LNG trains, each of 3 to 4 mtpa production capacity.

The Project will also incorporate a number of ancillary or additional activities which may be developed by others, including:

- The treatment, transport and use of the associated water produced from the development of the Gas Field Component;
- The dredging of marine access channels to the LNG facility in Gladstone harbour; and
- The provision of road and bridge access to Curtis Island including a services corridor.

An overview of the Project Components is provided in *Figure A* on page iv.

This Initial Advice Statement (IAS) for the Project, has been prepared to initiate the Queensland environmental impact assessment process, pursuant to the *State Development and Public Works Organisation Act 1971 (Qld) (SDPWO Act)*.

¹ An "LNG train" is a term used to describe the basic production unit for LNG. Trains for this Project are planned to be of a capacity of 3 to 4 mtpa each, and are operated in parallel allowing the capacity of an LNG plant to be increased on a stepwise basis.



Project Benefits

The key benefits of the Project are:

- Provision of a clean and efficient energy source (LNG) that has lower CO₂ emissions than coal;
- Increased CSG delivery providing a new LNG supply to world markets and supporting expanded domestic gas markets;
- Immediate and future jobs for Queensland with approximately 3,600 jobs during construction and approximately 820 jobs during operation. Subsequent development of further LNG trains (and required Pipeline and Upstream Component expansions) would contribute ongoing and additional construction and operations jobs;
- Direct and indirect benefits for communities in the Surat Basin and the Gladstone region associated with employment opportunities and the demand for goods and services;
- The potential for the beneficial use of water produced as a by-product of CSG gas production;
- An increased international focus on Queensland as an area for future international investment;
- Clean, environmentally safe and economical removal of CSG, leaving the coal seams intact for potential future use; and
- Generation of significant royalties and tax revenues for Queensland and the Commonwealth over the life of the Project.

Project Schedule

The planned Project milestones are shown in *Table A*.

Table A Project Milestones for Train 1

Train 1 Project Milestone	Timing
IAS and EPBC referrals submitted	By June 2008
EIS Approval (State and Commonwealth)	By December 2009
Construction commences	Early 2010
First LNG Production	By October 2013

Project Regulatory Approvals

The Project will require a range of environmental, construction and operational regulatory approvals, including:

- **Commonwealth Government** – Environment Protection and Biodiversity Conservation Act 1999 (Cth) (*EPBC Act*);



- **Queensland State Government** – *State Development & Public Works Organisation Act 1971* (Qld) (*SDPWO Act*); *Petroleum and Gas (Production and Safety) Act 2004* (Qld) (*P&G Act*); and *Environmental Protection Act 1994* (Qld) (*EP Act*); and
- **Local Government** (eg. Gladstone Regional Council) - *Integrated Planning Act 1997* (Qld) (*IP Act*).

Summary of Project Impacts

Potential environmental impacts identified for the construction and operation of the **Gas Field Component** are due primarily to:

- Site preparation;
- Construction of roads and infrastructure;
- Management of associated water; and
- Operation of gas compressor stations.

Potential environmental impacts identified for the construction and operation of the **Pipeline Component** are due primarily to:

- Right of Way (ROW) clearance;
- Access to pipeline construction sites; and
- Pipeline crossings across rivers and transport routes, and within marine and intertidal areas at The Narrows to access the LNG Component.

Potential environmental impacts identified for the construction and operation of the **LNG Component** are due primarily to:

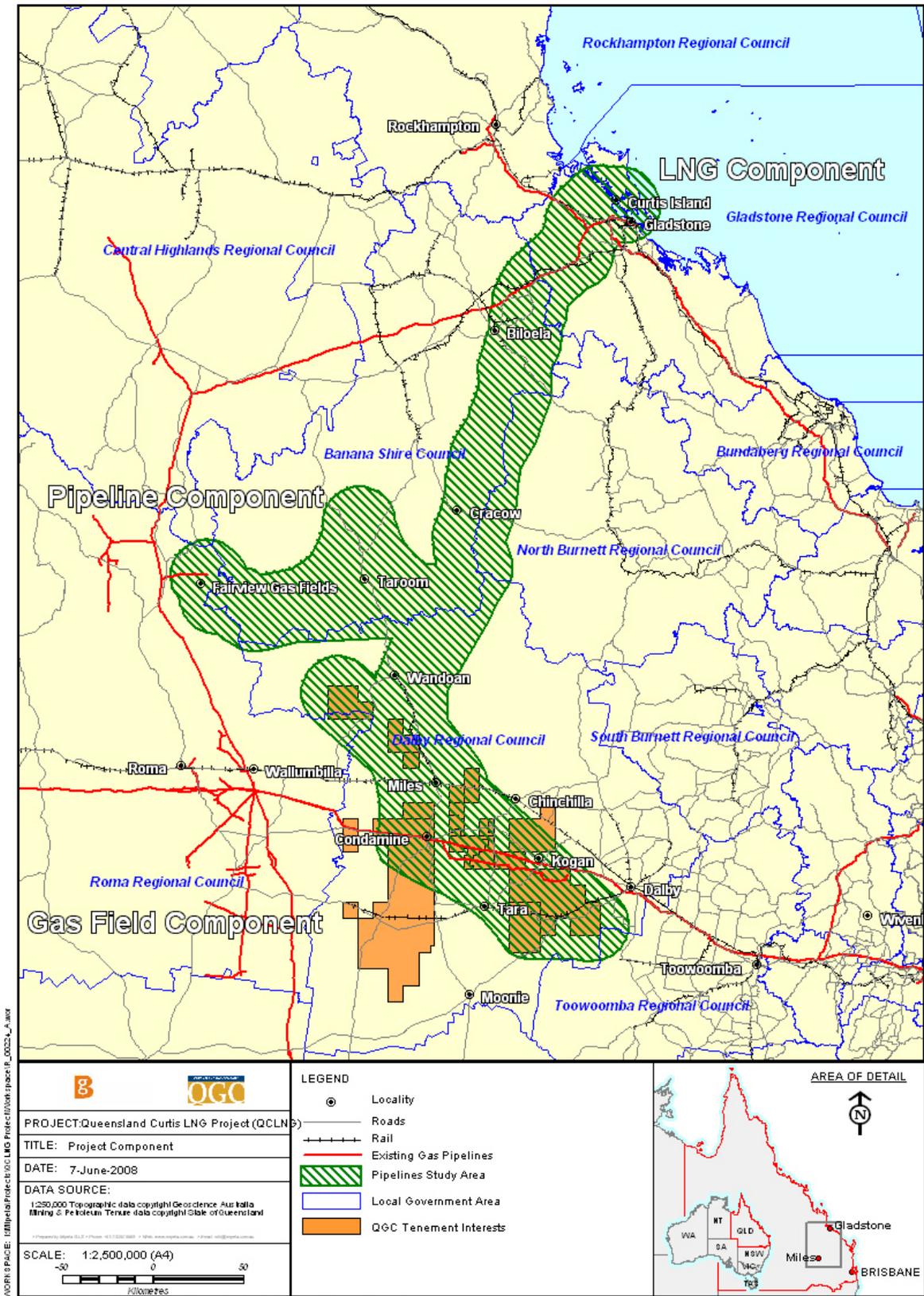
- Site clearance;
- Construction of the Bridge/Road to Curtis Island and construction docks, ferry terminals and associated marine facilities; and
- The operation of the LNG Plant and associated shipping movements.

Impact Management and Mitigation

Potential impacts will be fully investigated as part of the EIS for the Project. Appropriate mitigation measures will be employed to ensure that all impacts are managed in an acceptable manner.

Figure A overleaf provides an overview of the location of the Project.

Figure A – Project Location Overview





1 INTRODUCTION

1.1 Scope of the Project

BG International Limited (BG) and Queensland Gas Company Limited (QGC) (the Proponents) propose to develop an integrated liquefied natural gas (LNG) project in Queensland (the Project), comprising three principal Components:

- **Gas Field Component** – the expansion of QGC’s coal seam gas (CSG) operations in the Surat Basin to provide gas for the LNG plant and domestic gas markets;
- **Pipeline Component** – the development, construction and operation of a gas pipeline network of approximately 800 km to link the QGC gas fields and other nearby CSG resources to the LNG plant, through a number of gas gathering pipelines and a lateral that feeds into a Main Pipeline of approximately 380 km to transport gas from the gas fields to the LNG plant; and
- **LNG Component** – the development, construction and operation of an LNG plant, storage tanks and marine export facilities, to be located in the Gladstone area, with an ultimate production capacity of up to 12 million tonnes per annum (mtpa).

The Project will also incorporate a number of ancillary or additional activities which may be developed by others, including:

- The treatment, transport and use of the associated water produced from the development of the Gas Field Component;
- The dredging of marine access channels to the LNG facility in Gladstone harbour; and
- The provision of roads and bridge access to Curtis Island including a services corridor.

1.2 Purpose of this Document

This Initial Advice Statement (IAS) for the Project, has been prepared to initiate the Queensland environmental impact assessment process, pursuant to the *State Development and Public Works Organisation Act 1971* (Qld) (*SDPWO Act*).

This IAS:

- Describes the Proponents;
- Provides a summary of the rationale for the Project and associated benefits;
- Details the proposed Components of the Project;
- Describes the existing natural and human environments; and
- Describes anticipated Project impacts on the existing environment arising from construction and operation of the Project.



Following submission of the IAS, the Proponents will submit referrals to the Commonwealth Department of the Environment, Water, Heritage and the Arts, pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (*EPBC Act*) to determine whether certain activities undertaken by the Proponents in developing the Project require assessment under the *EPBC Act*. Following review of the IAS, the Coordinator-General will then develop Terms of Reference (TOR) for the Environmental Impact Statement (EIS) for the Project.

1.3 Project Proponents

The Proponents for the Queensland Curtis LNG Project are:

- BG International Limited (BG); and
- Queensland Gas Company Limited (QGC).

Table 1, below sets out the business details for each proponent, the nominated persons for any correspondence related to the Project and the business and mailing addresses.

Table 1 Proponent Details

Name	BG International Limited	Queensland Gas Company Limited
ABN/Company No:	ARBN: 114 818 825	ABN: 11 089 642 533
Nominated Contact:	Gary Thompson	David Wolf
Registered Office Address:	Level 5, 126 – 130 Phillip Street, Sydney, NSW 2000	30 Herschel Street, Brisbane QLD 4001
Mail Address:	Level 2, 10 Felix Street, Brisbane QLD 4000	GPO Box 3107, Brisbane, QLD 4001

1.3.1 Introduction to BG Group

BG International Limited (BG) is a wholly owned subsidiary of the BG Group plc, a top-10 publicly listed company on the London Stock Exchange with a market capitalisation of more than £41.5 billion (A\$85.3 billion), as of June 2008. In 2007, BG's operating profit before tax was £3.25 billion (A\$7.1 billion). BG operates worldwide throughout the gas supply chain in exploration and production, power, transmission and distribution, and LNG and has interests in 27 countries. In 2007, BG sold more than 3.5 million tonnes of LNG into the Asia-Pacific market and BG has recently been selected by the Energy Market Authority of Singapore to supply up to 3 million tonnes per annum (mtpa) of LNG to the Singaporean market for a period of up to 20 years.

1.3.2 Introduction to QGC

QGC is a leading integrated energy company focusing on gas exploration, production and electricity generation. It has leases over 7,500 km² in the gas-rich Surat Basin of southern Queensland and firm long-term contracts to supply growing volumes of coal seam gas.

QGC's market capitalisation of \$5 billion as of June 2008 makes it Queensland's third-largest company and a top 100 company on the Australian Stock Exchange. QGC will enter the National Electricity Market in early 2009, having sold 66% of the first three years' output of its gas-fired Condamine Power Station currently under construction. QGC's contingent gas reserves are estimated to be significantly more than the remaining reserves of the Bass Strait and Cooper Basin combined.



1.3.3 BG-QGC Alliance

On 1 February 2008, BG and QGC announced an alliance (the Alliance) to develop QGC’s world-class CSG resource in the Surat Basin for further domestic gas and electricity markets, and to supply an LNG export terminal on the Queensland coast. The Alliance combines BG’s significant global development and production expertise, LNG technical, sales and marketing capabilities with QGC’s world-class resource holdings in Australia and expertise in CSG exploration and production.

Within the Alliance, BG has acquired a 20% interest in QGC’s coal seam gas assets in the Surat Basin, interests in the Condamine Power Station, and also a 9.9% equity stake in QGC. BG will also acquire a further 10% interest in QGC’s coal seam gas and other assets upon the parties meeting certain other commercial conditions.

On 13 March 2008, BG received approval from the Foreign Investment Review Board (FIRB) for the acquisition of the specified assets of QGC.

1.4 Project Rationale

The primary objective of the Project is to further develop Queensland’s vast CSG resources by opening up new markets for this gas through conversion to LNG and export to international markets, whilst enhancing and creating new supply options to domestic markets.

The estimated capital value of the development of the first LNG train of the Project is approximately A\$8 billion. Subsequent development of the second and third LNG trains would involve substantial additional investments. A Project of this magnitude will contribute significant positive local, State and Commonwealth economic benefits which are described in *Section 1.4.2*.

1.4.1 Project Timeframe and Sequencing

The anticipated Project milestones are shown below in *Table 2*.

Table 2 Project Milestones for Train 1

Train 1 Project Milestone	Timing
IAS and EPBC referrals submitted	Q2 2008
TOR for EIS	Q2 2008
Front End Engineering Design (FEED)	Q3 2008
Continued gas field exploration drilling and production well development (under current Environmental Authorities for existing operations)	On-going
Project EIS submitted	Q2 2009
EIS Approval (State and Commonwealth)	Q4 2009
Construction commences	Q1/Q2 2010
First LNG Production	Q3 2013



1.4.2 Economic Benefits

The Project will be one of Australia's largest capital projects and will have significant economic benefits for Australia and in particular for Queensland. For instance, the capital expenditure associated with the development of the first LNG train alone (sized for approximately 3-4 mtpa) is estimated to involve a capital expenditure of A\$8 billion, including necessary gas field and pipeline infrastructure.

The key benefits of the Project are:

- Provision of a clean and efficient energy source that has lower CO₂ emissions than coal;
- Substantial growth for the Queensland CSG industry by creating a new LNG supply for world markets and by supporting expanded domestic gas sales;
- Immediate and future jobs for Queensland with approximately 3,600 jobs during construction and approximately 820 jobs during operation. Subsequent development of further LNG trains (and required Pipeline and Upstream Component expansions) would contribute ongoing and additional construction and operations jobs;
- Direct and indirect benefits for communities in the Surat Basin and the Gladstone region associated with employment opportunities and the demand for goods and services;
- The potential for the beneficial use of water produced as a by-product of CSG gas production;
- An increased international focus on Queensland as an area for future international investment;
- Clean, environmentally safe and economical extraction of CSG, leaving the coal seams intact for potential future use; and
- Generation of significant royalties and tax revenues for Queensland and the Commonwealth over the life of the Project.

1.5 Regulatory Approvals Processes

The Project will require environmental, construction and operational regulatory approvals from within three tiers of Australian Government, Commonwealth, State of Queensland, and several Local Government authorities.

1.5.1 Environmental Impact Assessment and Approvals

Environmental impact assessment and approvals will be required by the following levels of government and principal legislation:

- **Commonwealth Government** – *Environment Protection & Biodiversity Conservation Act 1999* (Cth) (*EPBC Act*);
- **Queensland State Government** – *State Development & Public Works Organisation Act 1971* (Qld) (*SDPWO Act*); *Petroleum and Gas (Production and Safety) Act 2004* (Qld) (*P&G Act*); and *Environmental Protection Act 1994* (Qld) (*EP Act*); and



- **Local Government** (e.g., Gladstone Regional Council) - *Integrated Planning Act 1997* (Qld) (*IP Act*).

1.5.2 Other Relevant Approvals

Within the overall regulatory approvals framework, the Proponents will secure all necessary permits and approvals under various other legislation and statutory instruments. Legislation applicable to the development of the varying project components is summarised in *Table 3*.

Table 3 Relevant Regulation by Project Activity / Component

Project Activity / Component	Relevant Legislation / Regulations
Development of CSG fields	<ul style="list-style-type: none"> • <i>State Development & Public Works Organisation Act 1971</i> (Qld) • <i>Environmental Protection Act 1994</i> (Qld) • <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) • <i>Water Act 2000</i> (Qld) • <i>Land Act 1994</i> (Qld) • <i>Native Title (Queensland) Act 1993</i> (Qld) • <i>Nature Conservation Act 1992</i> (Qld) • <i>Queensland Heritage Act 1992</i> (Qld) • <i>Aboriginal Cultural Heritage Act 2003</i> (Qld) • <i>Soil Conservation Act 1986</i> (Qld) • <i>Environment Protection & Biodiversity Conservation Act 1999</i> (Cth)
Construction of the pipeline network from the Surat Basin (CSG field) to Gladstone	<ul style="list-style-type: none"> • <i>State Development & Public Works Organisation Act 1971</i> (Qld) • <i>Integrated Planning Act 1997</i> (Qld) • <i>Environmental Protection Act 1994</i> (Qld) • <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) • <i>Land Act 1994</i> (Qld) • <i>Native Title (Queensland) Act 1993</i> (Qld) • <i>Aboriginal Cultural Heritage Act 2003</i> (Qld) • <i>Nature Conservation Act 1992</i> (Qld) • <i>Queensland Heritage Act 1992</i> (Qld) • <i>Soil Conservation Act 1986</i> (Qld) • <i>Fisheries Act 1994</i> (Qld) • <i>Water Act 2000</i> (Qld) • <i>Coastal Protection and Management Act 1995</i> (Qld) • <i>Marine Parks Act 2004</i> (Qld) • <i>Great Barrier Reef Marine Park Act 1975</i> (Cth) • <i>Environment Protection & Biodiversity Conservation Act 1999</i> (Cth)
Construction of the LNG Component, including marine facilities on Curtis Island and the mainland	<ul style="list-style-type: none"> • <i>Environment Protection & Biodiversity Conservation Act 1999</i> (Cth) • <i>State Development & Public Works Organisation Act 1971</i> (Qld) • <i>Petroleum and Gas (Production and Safety) Act 2004</i> (Qld) • <i>Marine Parks Act 2004</i> (Qld) • <i>Coastal Protection and Management Act 1995</i> (Qld) • <i>Fisheries Act 1994</i> (Qld) • <i>Integrated Planning Act 1997</i> (Qld) • <i>Transport Infrastructure Act 1994</i> (Qld)



Queensland Curtis LNG Project



Project Activity / Component	Relevant Legislation / Regulations
	<ul style="list-style-type: none">• <i>Transport Operations (Marine Pollution) Act 1995 (Qld)</i>• <i>Great Barrier Reef Marine Park Act 1975 (Cth)</i>
Construction of the bridge and road from Gladstone to the LNG Component on Curtis Island (this may not be undertaken by the Proponents)	<ul style="list-style-type: none">• <i>Environment Protection & Biodiversity Conservation Act 1999 (Cth)</i>• <i>State Development & Public Works Organisation Act 1971 (Qld)</i>• <i>Marine Parks Act 2004 (Qld)</i>• <i>Integrated Planning Act 1997 (Qld)</i>• <i>Fisheries Act 1994 (Qld)</i>• <i>Coastal Protection and Management Act 1995 (Qld)</i>• <i>Transport Infrastructure Act 1994 (Qld)</i>• <i>Transport Operations (Marine Pollution) Act 1995 (Qld)</i>• <i>Great Barrier Reef Marine Park Act 1975 (Cth)</i>
Construction and maintenance dredging for shipping channel and turning basin to support marine construction components (this may not be undertaken by the Proponents)	<ul style="list-style-type: none">• <i>Environment Protection & Biodiversity Conservation Act 1999 (Cth)</i>• <i>State Development & Public Works Organisation Act 1971 (Qld)</i>• <i>Environment Protection (Sea Dumping) Act 1981 (Cth)</i>• <i>Marine Parks Act 2004 (Qld)</i>• <i>Roads Act 2000 (Qld)</i>• <i>Transport Infrastructure Act 1994 (Qld)</i>• <i>Transport Operations (Marine Pollution) Act 1995 (Qld)</i>• <i>Great Barrier Reef Marine Park Act 1975 (Cth)</i>• <i>Coastal Protection and Management Act 1995 (Qld)</i>• <i>Fisheries Act 1994 (Qld)</i>
Operation of the LNG Component	<ul style="list-style-type: none">• <i>Integrated Planning Act 1997 (Qld)</i>• <i>State Development & Public Works Organisation Act 1971 (Qld)</i>• <i>Environmental Protection Act 1994 (Qld)</i>• <i>Petroleum and Gas (Production and Safety) Act 2004 (Qld)</i>• <i>Land Act 1994 (Qld)</i>• <i>Foreign Investment Review Board Act 1975 (Cth)</i>• <i>National Greenhouse and Energy Reporting Act 2007 (Cth)</i>
Production and disposal and/or beneficial use of associated water	<ul style="list-style-type: none">• <i>Water Act 2000 (Qld)</i>• <i>State Development & Public Works Organisation Act 1971 (Qld)</i>• <i>Petroleum and Gas (Production and Safety) Act 2004 (Qld)</i>• <i>Mineral Resources Act 1989 (Qld)</i>• <i>Environmental Protection Act 1994 (Qld)</i>

The final engineering configuration for the LNG Component will determine whether further additional licences/approvals will be required.



2 PROJECT DESCRIPTION

This section provides a description of the overall Project and the individual Project Components.

The Project will be one of Australia's largest capital projects and will have significant economic benefits for Australia and Queensland in particular. The Project proposes to ultimately supply up to 12 million tonnes per annum (mtpa) of LNG through the development of three LNG trains. The first LNG train and associated gas fields and pipeline infrastructure is estimated to involve a capital expenditure of A\$8 billion. Subsequent development of the second and third LNG trains would involve substantial additional investments. The first LNG train is expected to be producing LNG in Q3 2013, with the second train in operation six to twelve months later, with the third train commissioned in subsequent years depending on the identification of additional gas supplies.

2.1 Project Overview

The overall Project comprises three principal Components described below. For the purpose of the EIS, they will be treated as a single integrated project where the assessment of each Component will include design, construction and operational phases.

- **Gas Field Component** - the expansion of QGC's existing CSG operations in the Surat Basin, to provide gas for the two of the three LNG trains and for domestic gas markets. Over the minimum 20-year life of the Project, this expansion will comprise the development of:
 - An initial 1,500 commercial gas production wells for the first LNG train (approximately 600 wells to be available at start-up), with an additional 1,500 wells for the second LNG train;
 - Associated surface equipment, gas and water gathering systems and gas processing and compression infrastructure; and
 - Management, storage and potential beneficial use of associated water.
- **Pipeline Component** – the development, construction and operation of gas pipelines including:
 - A 380 km main pipeline to link the QGC gas fields to the LNG plant, sized to ultimately supply gas for three LNG trains but with an initial capability of transporting 600 TJ/day of gas to supply the first LNG train. The design for the full three-train capacity in the Main Pipeline will be provided by a larger diameter pipeline, looping (doubling sections of the line in constricted areas) or the addition of intermediate compressor stations;
 - A 200 km lateral pipeline to link other nearby CSG resources to the main pipeline; and
 - Approximately 220 km of gas and water pipeline networks connecting all of QGC's gas fields.
- **LNG Component** – the development, construction and operation of an LNG Facility and associated infrastructure, with an ultimate capacity of up to 12 mtpa, on a site of 200 to 300 hectares located in the Gladstone area, consisting of:



- An LNG Plant comprised initially of one LNG train (with a capacity of 3-4 mtpa), followed by a second and third train, which would result in an ultimate capacity of up to 12 mtpa;
- Two LNG storage tanks up to 200,000 cubic metres each (for the first two trains) and a similar third tank (required for the third train); and
- Marine facilities consisting of barge/ferry terminals and a jetty containing specialised LNG loading and berthing facilities.

In addition, a range of ancillary facilities will be required which may be developed by others. These include:

- Associated water treatment and distribution facilities;
- A possible bridge crossing to Curtis Island and access roads; and
- Dredging of Gladstone harbour.

Figure 1 (located at the end of this document) provides an overview of the location of the Project Components.

2.2 Gas Field Component

2.2.1 Overview

At present, QGC operates an exploration and production programme to fulfil domestic supply contracts. For these existing activities, well development is expected to comprise more than 250 commercial gas production wells by 2010, with production of up to 200 TJ of gas per day. The existing QGC gas field exploration and development areas in the Walloon Fairway of the Surat Basin cover some 7,500 square kilometres (km²).

Current exploration and production activities include:

- The development of exploration and commercial production well sites for existing contracted gas sales;
- The construction and maintenance of gas and associated water gathering infrastructure;
- Support infrastructure including camp and administration facilities;
- Access tracks; and
- Management of associated water, generally through evaporation ponds.



The gas fields have been developed over an 8 year exploration and development programme by QGC. The Walloon CSG deposits generally occur between depths of 250m and 1000m below the surface.

The typical composition of CSG from QGC wells is approximately 97% methane with traces of nitrogen, carbon dioxide and ethane, providing a clean and easily processed gas source for the LNG Plant.

To accommodate the gas demand of the LNG plant, existing gas field activities will require significant expansion of well development, in-field compression, processing plant, associated water management, land access and ancillary infrastructure.

The acceleration of commercial well development within existing tenures will see the following magnitude of expansion:

- Resource certification to supply up to 1.2 PJ/day (1,200 TJ/day) for the first two LNG trains, including the conversion of existing exploration tenure to production tenure;
- The requirement for approximately 600 production wells by the end of 2013 and up to 1,500 wells over the minimum 20-year life of the Project for the first LNG train. The second LNG train will require an additional 1,500 wells to be added over the life of the Project;
- Expedited review and planning for beneficial use of associated water;
- Land access arrangements for commercial development fields;
- Additional compressor and processing plants; and
- Investigation of options for in-ground storage of gas.

2.2.2 Location

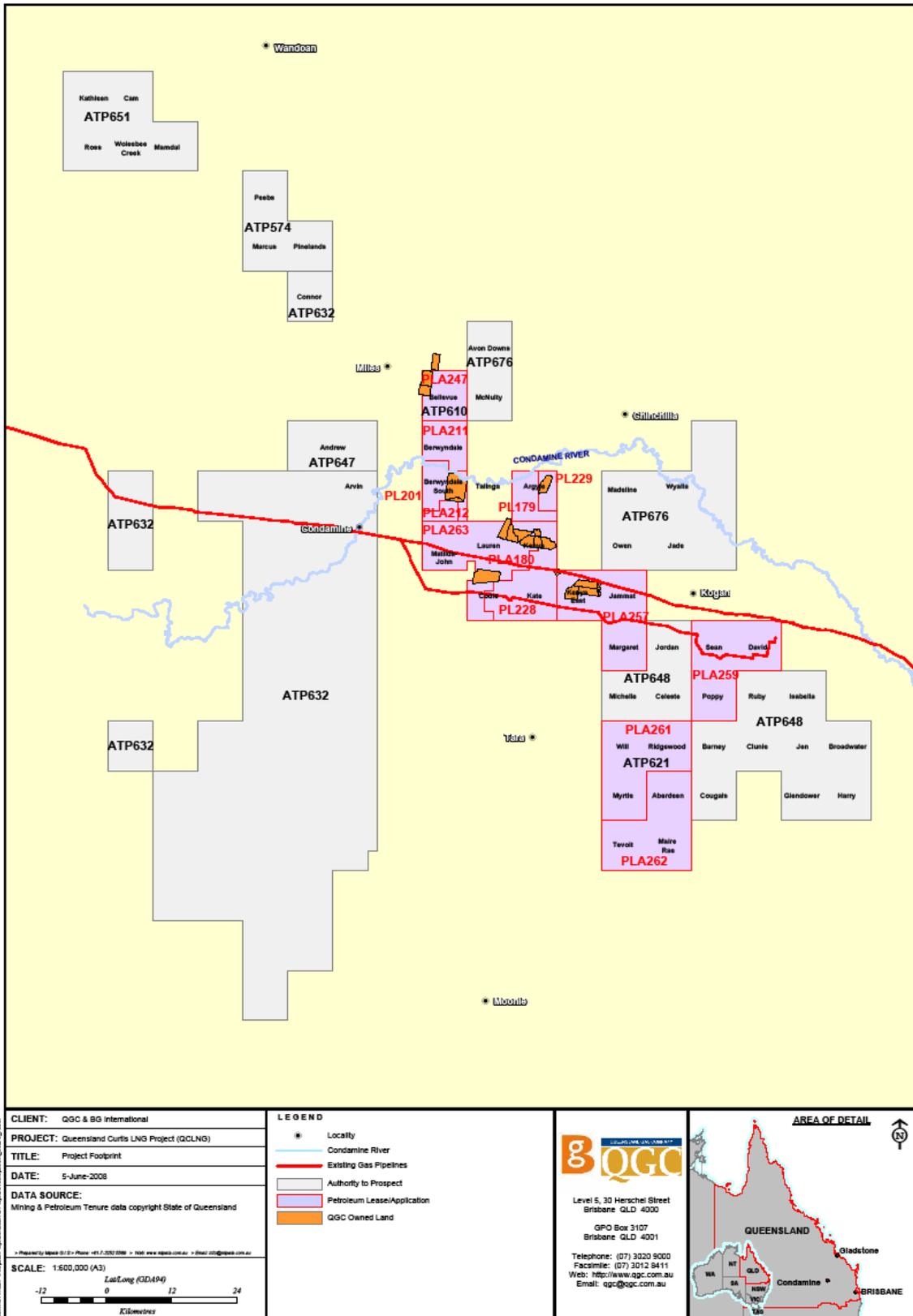
QGC currently holds nine Authorities to Prospect (ATP) covering 7,500 km² in the Surat Basin. Thirteen Petroleum Leases (PL) (including current applications) and four pipeline licences are held within the QGC acreage. These tenures are subject to one Project Environmental Authority under the *Environmental Protection Act 1994* (Qld) for activities in the Walloon Fairway area (excluding PL 201 and PLA 180).

The QGC tenures are all located within the Surat Basin, a resource region in southern Queensland. The tenures are within the Dalby Regional Council and in the vicinity of Miles, Chinchilla, Condamine and Tara townships. The Condamine River bisects the tenure areas and the predominant land use is rural for dry land cropping and grazing.

The tenure area is comprised of blocks initially held under ATPs, which are successively converted to PLs when resources are proven and commercialisation of the gas is imminent. The resultant lease areas are semi-contiguous due to the relinquishment requirements of the petroleum licensing regulations (refer *Figure 2*).



Figure 2 – Location of Gas Field Lease Areas





2.2.3 Gas Field Development

CSG field development is constrained and defined by the physical location of the gas fields. Gathering systems and well placement are negotiated with all stakeholders and are focused on safety requirements and the avoidance of environmentally or culturally sensitive locations. The existing development is currently managed under Development Plans, as approved by the Department of Mines and Energy (DME). A single Project Environmental Authority (EA) and development-specific Environmental Management Plans (EMPs) are approved by the Queensland Environmental Protection Agency (EPA).

The ramp-up phase for the gas fields is planned to generate sufficient gas to supply the initial LNG Plant demand of up to 600 TJ/day for the first LNG train, with expansion up to 1,200 TJ/day for the second LNG train. Options are currently being evaluated for the management of ramp-up gas.

As a result of the increased gas production, associated water volumes will also increase. Future options that are being pursued for beneficial use of associated water, in addition to the existing use of evaporation ponds, include a range of options for both treated and untreated associated water such as:

- Municipal water;
- Agricultural / agribusiness;
- Industrial water (power generation / feedlot);
- Mining wash water;
- Re-injection;
- Irrigation; and
- A wetlands filtration trial as part of a carbon offset programme.

2.2.4 Approvals Process

QGC currently undertakes exploration and production (E&P) activities to supply gas for a number of domestic sales contracts. In order to reduce the effects on current operations and permitting arrangements QGC, in consultation with the EPA and the Coordinator-General's department, has agreed to take the following approaches to ongoing environmental permitting for its existing E&P activities and those activities required for this Project.

QGC current gas field Environmental Approvals

Existing Petroleum Lease (PL) applications (prior to and including 2007) within QGC's gas field have been made to support the domestic supply of gas within existing environmental approvals.

To ensure that the current operation of QGC's gas field exploration and production is not affected by the overall Project approvals assessment, application for amendment to the existing project Environmental Authority (EA150161) will be undertaken through the *Environmental Protection Act 1994* (Qld).



Project Environmental Approvals

Future petroleum lease applications (after and including 2008) made under the *P&G Act* to support the ramp-up to LNG commercial production will be made over land for which a "significant project" declaration is being sought under the *SDPWO Act*. Project gas field development will require impact assessment and environmental approvals to regulate the expanded activities across QGC's lease areas.

Applications for the beneficial use of associated water under *Environmental Protection (Waste Management) Regulation 2000* (Qld) will be required to utilise the associated water generated from the gas field development of the Project. Off-lease use of associated water will also require licensing under the *Water Act 2000* (Qld).

2.2.5 Construction Activities

Gas field development activities will continue over the initial 20-year life of the Project. Processing and compression facilities and supporting infrastructure, such as the camp and evaporation ponds will be constructed in the Project's ramp-up phase (pre-2013).

The gas field development activities will include:

- Commercial well development (access land clearance, well lease development, gathering lines and sumps);
- Construction of in-field screw compressor stations;
- Construction of gas processing and reciprocating compressor plants connecting to the high-pressure gas pipeline network and associated water separating and dehydration facilities;
- Management of associated water (pondage, delivery lines and beneficial use alternatives within the QGC gas fields and in the wider Darling Downs region);
- Construction of required camps and field support facilities (offices and warehouse etc); and
- Water research and development activities (reinjection, crop trials and carbon offset options).

2.2.6 Operational Activities

CSG wells, gas and water pipelines and gas production and processing plants will operate for the life of the Project.

The Proponents will plan for and implement all infrastructure, processes and procedures required for the safe and compliant operation of all associated Project activities.

Operational activities will include:

- Well operation and maintenance;
- Access road maintenance;
- Stakeholder land maintenance;
- Property management;



- Compression and Processing Plant operation and maintenance; and
- Associated water infrastructure operation and maintenance.

2.2.7 Anticipated Workforce

QGC operations currently have a workforce of approximately 300 people (staff and contractors). The construction phase of the Gas Field Component development (including Pipeline Component construction) will require 400-600 people. For the Gas Field Component only, an additional 300 operational field positions will be created over the life of the Project (giving a total of 600 operations personnel for the Gas Field Component).

2.2.8 Additional Support Infrastructure

Gas field development will require additional infrastructure, such as:

- Upgrade of various regional roads / tracks;
- Construction of access tracks to well sites and operational infrastructure;
- Building of temporary accommodation for construction teams;
- Local accommodation for operational staff; and
- Sourcing of local gravel pits for road and site construction.

2.3 Pipeline Component

2.3.1 Overview

The pipeline components of the Project will be sized to transport gas to supply three LNG trains and will comprise the construction and operation of:

- A 380 km main pipeline from QGC's production lease areas in southern Queensland to the LNG Component in Gladstone. The design for the full three-train capacity in the Main Pipeline will be provided by a larger diameter pipeline, looping (doubling sections of the line in constricted areas) or the addition of intermediate compressor stations; (the **Main Pipeline**);
- A 200 km gas collection lateral (the **Collection Lateral**), which will enable the connection of additional CSG fields to the main pipeline;
- A 220 km network of gas and water pipelines (the **Interconnection Network**), linking QGC's various production areas to the Main Pipeline;
- Ancillary facilities including main-line valves, scraper stations, future compressor stations, marker posts, cathodic protection systems and metering facilities (the **Pipeline Ancillary Facilities**).



The pipelines will be licensed under the *P&G Act*, and will be designed, constructed and operated to applicable Australian and industry standards including *AS2885 - 2007 Pipelines - Gas and Liquid Petroleum*. The pipeline diameters and timing of compression needs will be determined as part of the FEED studies.

2.3.2 Location

The Main Pipeline to Gladstone will originate at QGC's production leases in the vicinity of Miles in the Surat Basin. It will traverse a distance of approximately 380 km in a north-easterly direction to terminate at the LNG Plant in Gladstone. The proposed Collection Lateral will extend from adjacent gasfields, to join the Main Pipeline east of Taroom (refer to *Figure 1* located at the end of this document).

The Interconnection Network linking QGC's production areas will generally extend from an area east of Tara to west of Wandoan. There is potential for further laterals to feed into the Interconnection Network from the south and north.

The Pipeline routes on which studies will be progressed were selected to avoid, where practicable, risk areas to the pipeline, environmentally sensitive areas, areas of cultural significance and granted mining leases. *Figure 3* illustrates pipeline corridor options currently under consideration within the Gladstone region.

2.3.3 Alignment Considerations

The strategic objectives in selecting the study areas for the pipelines include:

- Supply of QGC's CSG to the LNG Component;
- Capacity to transport the CSG resources of other producers in the region to the LNG Component via inclusion of the Collection Lateral;
- Interconnection of all of QGC's current and future PLs for efficient treatment, transport and marketing of gas;
- Capacity to transport associated water collected from various outlying sources to major collection points, thereby enhancing capacity to economically achieve beneficial use outcomes;
- Economically feasible construction;
- Minimisation of the clearing of ecologically sensitive areas;
- Access logistics for operations including environmental, stakeholder and economic impacts;
- Acceptable gas transmission costs; and
- Minimal environmental impacts.

The final pipeline alignment has not been agreed with stakeholders at this stage and is dependent upon the results of field surveys, geology, topography, ecology, cultural heritage values and landholder negotiations along the proposed corridor. The EIS will detail pipeline route alternatives considered.



2.3.4 Other Approvals

The gas pipelines will require a Petroleum Survey Licence for investigation of the route and a Pipeline Licence for construction and operation under the *P&G Act*. EAs under the *EP Act* will be required for both licences.

Under Schedule 9 of the *IP Act*, activities under the *P&G Act* are exempt from assessment against Local Government planning schemes. The route selection process would, however, take into account the aims and objectives of Local Government planning schemes to ensure that no conflict arises with respect to existing or planned land use.

Marine Parks Permits will be required for any activities which may affect the Great Barrier Reef Coastal Marine Park (Qld) and/or the Great Barrier Reef Marine Park (Cth).

2.3.5 Construction Activities

Construction of the various pipelines, including the Main Pipeline to Gladstone and the Collection Lateral, is anticipated to take approximately 12-18 months and will follow a typical construction sequence:

- The delivery of pipe;
- Clearing of vegetation along an approved construction corridor;
- Trenching and construction of the pipe in the trench;
- Burial of the pipe in the ground;
- Reinstatement of the land; and
- Testing and commissioning of the pipelines.

The pre-coated pipe will be delivered directly by road to the pipeline easement in 12 to 18 metre sections for stringing along the easement. In some instances, pipe may need to be stored temporarily in lay-down areas in the vicinity of the pipeline corridor.

A wheel trencher, rock-saw or excavator will be used to dig the trench in which the pipe will be placed. In areas of hard rock, small-scale blasting may be required. The length of trench open at any one time will depend on the ground conditions and the rates of construction progress being achieved in given areas. Several work sites may operate at any one time and a variety of excavation methods may be used for areas crossing watercourses, roads and major infrastructure corridors. These will be determined during planning and development phases of the Project, and may include open trenching, boring or directional drilling.

The pipeline lengths will be laid out on the surface, bent to match the horizontal or vertical surface and then welded into "strings" of up to 1 kilometre long. The strings will then be lowered into the trench before it is backfilled, with a typical soil cover of 750 mm.

All disturbed areas will be tidied and reinstated, including pipe lay-down areas, camp sites or other areas impacted by construction. Measures will include removing foreign material (e.g., construction material and waste), ripping compacted soil areas, re-spreading excess soil and vegetation from the excavated trench, contouring if required, and re-spreading topsoil and cleared vegetation.



Marker posts with visible signs will be installed above the pipeline at distances as required under *AS2885 Pipelines - Gas and Liquid Petroleum*.

2.3.6 Anticipated Construction Workforce

Construction of the pipeline network is anticipated to take approximately 12-18 months and will employ approximately 400 people during the peak period of the construction of the Main Pipeline to Gladstone. A further 100 – 200 people will be required at various times to construct the Interconnection Network within the QGC production areas. Pipeline construction will generally involve several work crews (collectively referred to as a “spread”) and it is likely that three spreads will be used. A variety of skill sets would be required from general earthworks through to specialised welding techniques. Only a limited number of companies in Australia can provide the specialised pipeline techniques needed and therefore pipeline construction crews travel around the country from project to project.

Depending on the type of pipeline being constructed, and the terrain encountered, individual construction crews can be expected to progress at a rate of between 500 metres and 3 kilometres per day with crews’ work areas being separated by several days.

Due to the predominantly rural and remote nature of the proposed pipeline network, it is anticipated that the bulk of the construction crews for the Pipeline Component of the Project will be accommodated in dedicated temporary construction camps along the pipeline routes and in QGC camp accommodation. Pipeline operations staff will be housed locally in Gladstone and other towns within the Project area.

2.3.7 Operational Activities

The various pipelines will be buried for their entire length. Operational activities for the pipeline will include regular monitoring to ensure there is no interference from third parties, ensuring cathodic protection mechanisms are functioning correctly and to ensure that revegetation, erosion protection and weed management are being successfully implemented in accordance with EA conditions. The pipeline will be regularly surveyed by aerial and/or ground inspections.

It is anticipated that an operational workforce of approximately 20 people will be employed for direct management and monitoring of the pipeline network.

2.3.8 Infrastructure to Support the Pipeline

Water

Water is required for hydro-testing of the pipeline and dust suppression during construction. The selection of water sources and final disposal locations for hydro-test water will depend on the identification of suitable sources, the hydro-test programme and method of disposal for each section of the pipeline network. These will be determined during subsequent detailed studies during the EIS.

Transportation

The transport of the pipe material to the Project area is likely to comprise both road and rail and, in the case of the Main Pipeline, the pipe is anticipated to be sourced from overseas pipe mills in the event that local mills are unable to produce line pipe of the required diameter. As such, it is anticipated that sea transport and Queensland port facilities will be utilised. Transport and procurement studies will be undertaken to determine the optimum transport solutions.



Electricity

Electricity required for the construction camps will be provided by portable generators. Power will also be needed for mobile and static construction equipment. Permanent grid power will be required for ancillary systems to support compressor station(s) and telemetry systems. Isolated telemetry systems may use solar power.

2.4 LNG Component

2.4.1 Overview

The LNG Component will comprise the development, construction and operation of the following:

- A multi-train LNG Plant (**LNG Plant**) with an ultimate capacity of 12 mtpa, comprised initially of one LNG train (with a capacity of 3-4 mtpa), and associated utilities and common buildings, to be followed by a second and third train;
- Storage tanks (**Storage Tanks**) including:
 - Two LNG storage tanks up to 200,000 cubic metres each (for the first train) and a third tank of a similar size for the third train; (**LNG Storage Tanks**); and
 - One LPG storage tank up to 100,000 cubic metres. (**LPG Storage Tanks**);
- Marine facilities (**Marine Facilities**) consisting of:
 - a marine jetty (**Jetty**) containing:
 - specialised LNG loading facilities and LPG unloading facilities;
 - LNG tanker and LPG ship berths (**Berths**); and
 - A construction dock and barge/ferry terminals for the transportation of construction and operations equipment and personnel between the mainland and Curtis Island (**Construction Dock/Ferry terminals**).
- Dredging works (**Dredging**) associated with:
 - construction and operation of the Marine Facilities; and
 - development and operation of shipping channels in Gladstone Harbour; and
- Construction and operation of a Bridge and Road linking Curtis Island with the mainland (**Bridge and Road**).

The LNG Component of the Project will require construction-related infrastructure (**Construction Facilities**) including:

- Pioneer camp which will be replaced by a temporary construction camp; and



- Lay-down and pre-fabrication/assembly areas.

2.4.2 Location and Siting

The Proponents have undertaken a regional study and a subsequent detailed LNG Facility Site Selection Study to identify the preferred location for the development of an LNG export facility in Queensland. The initial regional study focussed on thirteen different Port locations between Townsville and Brisbane.

Based on the regional review of potential site and the subsequent Site Selection Study, the preferred region for the LNG Component was identified as Gladstone. This region was chosen for the following key reasons:

- Land availability within an industrial development area;
- Protected natural harbour;
- Relative proximity to the CSG field;
- Existing port operations and infrastructure; and
- Relatively low environmental sensitivities.

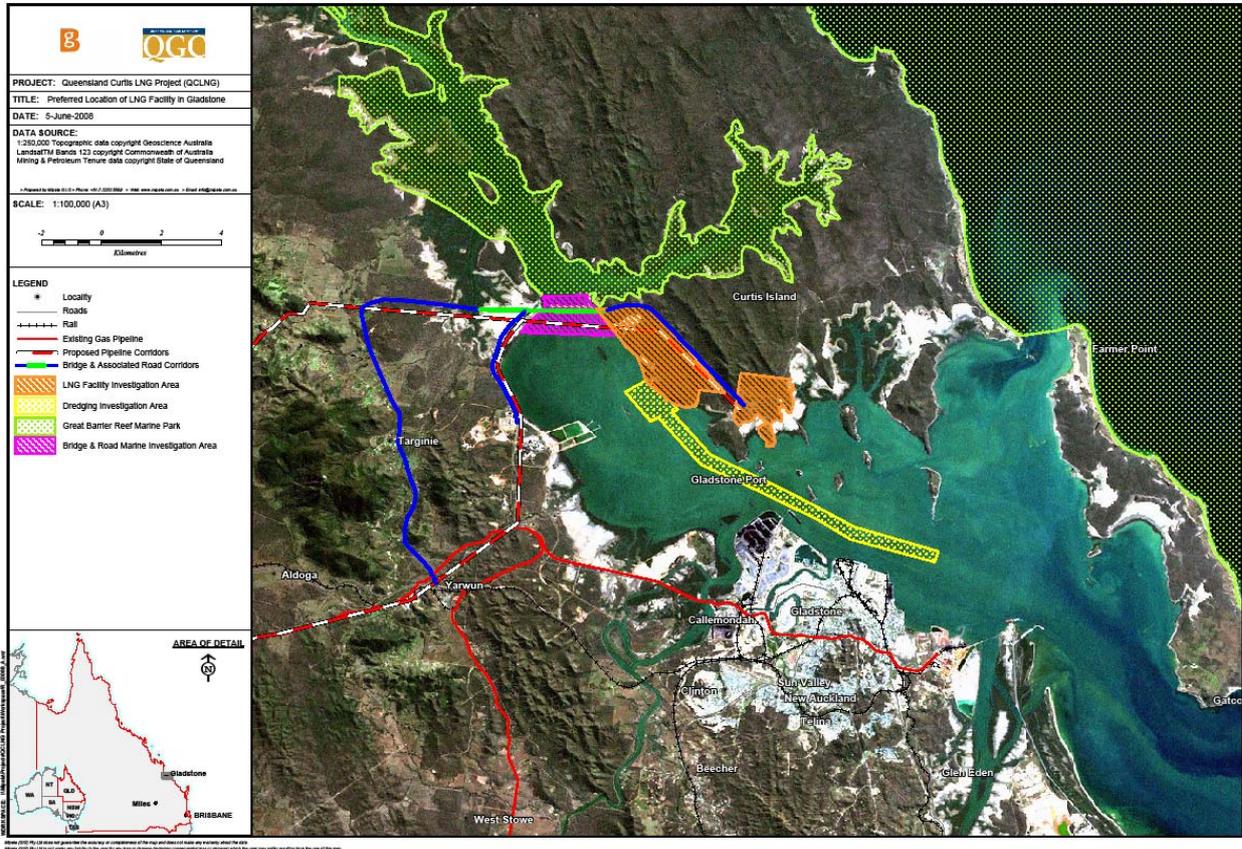
The detailed Site Selection Study examined a number of potential sites within the Port of Gladstone region. These included:

- North China Bay (Curtis Island – northwest of Hamilton Point West site);
- Laird Point (Curtis Island);
- Boatshed Point (Curtis Island);
- South Trees Island (Gladstone); and
- Mainland sites (Gladstone).

Hamilton Point was not included in the Proponents' detailed study as the Gladstone Ports Corporation (GPC) indicated their preference to retain this site for a bulk material handling facility. Furthermore, the Hamilton Point West site, previously known as North China Bay, was not included in this study as land in this area is currently owned by another industrial owner.

The Site Selection Study concluded the preferred site for the proposed LNG Facility to be the North China Bay site (located between the Laird Point and Hamilton Point West sites). The preferred site is situated approximately five kilometres north-west of Gladstone City (Refer *Figure 3. The orange hatched area indicates the proposed LNG Component Investigation Area*). Based on the completion of further studies, consultations and the environmental impact assessment process, a final site will be confirmed.

Figure 3 – Preferred Location of LNG Facility in Gladstone



A full-size copy of Figure 3 is included in the Appendix.

2.4.3 LNG Facility

The LNG Facility consists of the LNG Plant, Storage Tanks and Marine Facilities which are described below.

LNG Plant

The LNG Plant configuration consists of three LNG trains and associated/shared utilities and buildings.

A single LNG train will be developed with a second LNG train planned for commissioning 6 to 12 months after the first train. Dependant on the identification of additional gas resources, a third train will subsequently be constructed and commissioned. Each train is nominally sized for an LNG production capacity of 3 to 4 mtpa.

The major components of each LNG train comprise:

- Initial gas processing facilities (to remove impurities and pre-chill gas); and



- Cryogenic process facilities (to cool and liquefy the natural gas).

The feed gas supplied to the LNG Plant by pipeline will be normally dry, containing no free water or hydrocarbon condensate. The liquid-free gas enters the train where it is metered, filtered to remove entrained pipeline debris, and then sent to the gas treating section.

The gas will be processed in an amine gas treating system (acid gas removal unit) to remove CO₂ and any sulphur components contained in the gas. The gas will be chilled and dried in a three-bed molecular sieve system to remove the final traces of water. The dry gas is further processed through an activated carbon bed system to remove any mercury, if present.

The dry, mercury-free gas is then fed to the refrigeration system, where most of the nitrogen in the feed gas is removed and the resulting gas is liquefied as the LNG product.

Gas turbine drivers will be equipped with dry low-NO_x emission systems and highly-efficient aero-derivative gas turbines will be utilised where possible.

Air fin coolers will be employed for the heat removal requirements of the liquefaction process as an alternative to a cooling tower. As such, cooling water will not be required for the LNG Plant.

In addition, the LNG trains will be supported by a number of shared facilities and services including:

- Utilities including compressed air, water, nitrogen, refrigerant storage and power generation; and
- Buildings, including administration, maintenance, control rooms, and motor control centres.

The utility systems required to support the LNG Plant are detailed below.

Fire Protection and Safety Systems

The plant layout will maximise the use of passive protection in the form of equipment spacing and drainage of possible liquid spillages away from critical equipment to containment sumps. However, active measures such as fire and gas detection, a firewater system and overpressure protection will also be included in the design.

Fuel Gas System

Natural gas will be used as fuel for major equipment during plant operations. However, diesel would be used for firewater pumps and emergency generators.

A fuel gas system will be provided to supply natural gas to high-use components such as refrigerant turbines and power generation turbines, and low-level users such as the heaters and flare systems. A hot oil system or waste heat recovery system may be used as the heating medium for the amine regeneration unit.

Temporary construction power will be supplied by diesel generators or from the local power grid, if available. During operations, electric power will be generated by gas turbine generators. Diesel emergency generator(s) will provide backup power for critical services.

Stormwater and Waste Collection or Disposal

The stormwater and wastewater collection systems will be segregated in the LNG Plant. Wastewater from the LNG Plant will be treated to meet all applicable Queensland Water Quality Objectives and ANZECC environmental guidelines.



An extended aeration-type activated sludge plant will be provided for treating the sanitary wastewater. The treated water will meet all applicable standards and would then be routed to an ocean outfall. The digested sludge would be sent for disposal at an offsite landfill or onsite incinerator.

Solid waste generated during construction activities and operation may consist of regulated (hazardous) wastes and/or inert solid wastes. To the extent possible, waste generated will be minimised and recycled. However, other waste will be disposed of at an approved offsite landfill or waste disposal facility. Another option for waste disposal includes an onsite incinerator.

Flare Systems

The pressure relief and flare system would be separated into three systems:

- A wet flare system;
- A dry flare system for the cold gases and liquids; and
- A flare system for disposal of vapours from the LNG storage tank(s) and for disposal of vapours from the LNG ship if the boil-off gas (BOG) compressors are not operating.

Compressed Air and Nitrogen Systems

Compressed air will be supplied by motor-driven air compressors or emergency diesel-driven compressor(s).

Nitrogen will be provided by standard nitrogen generation package units.

Water

All of the LNG Plant's water needs are anticipated to be provided by a seawater desalination unit. The desalinated water would be further treated to meet specific needs (e.g., process water, potable water). Alternatively, if municipal water or groundwater is available in sufficient quantity, these options may be considered for the Project.

Telecommunications

Construction and operations telecommunications will be provided by satellite based systems. This includes phone, computer, data transmission, etc. Additional systems include cellular telephones, a plant emergency public address/alert system, marine radios (ship-to-shore) and handheld ultra-high frequency/very high frequency (UHF/VHF) radios for field usage.

If available, the existing local phone communications system will be used.

Storage Tanks

LNG will be stored in specialised insulated tanks each sized for a capacity of up to 200,000 cubic metres. The storage system will include product pumps for ship loading and boil-off gas (BOG) compressors for handling the flashing gas, ship return vapours and heat leak.

A 100,000 cubic metre capacity liquefied petroleum gas (LPG) tank will be provided to store imported butane if "spiking" the LNG product to provide a Higher Heating Value (HHV) is required by market demand. Spiking consists of injecting LPG into the LNG stream to raise the HHV to satisfy market / customer requirements. A vapour recovery system will be provided for the LPG tank.



Miscellaneous storage will be provided for several other liquid products such as diesel fuel, lube oil, refrigerants, amine, firewater and potable water.

Marine Facilities

The Marine Facilities development will comprise the construction and operation of the Jetty, Berth(s) and Construction Docks/Ferry terminals.

Jetty and Berths

A dedicated jetty containing specialised LNG loading facilities and LNG tanker berth(s) would be constructed to transfer LNG produced by the LNG Plant to tankers for shipment to markets. The Jetty would consist of a driven-pile trestle structure, connected a Berth(s) with mooring dolphins and breasting dolphins. The Jetty will support loading facilities consisting of piping, utilities and loading arms. In addition, LPG unloading arms located at the Berth, if required, will be used to unload imported LPG for spiking the LNG.

The Jetty and Berth(s) will be designed to accommodate LNG tankers up to "Q Max" size (266,000 cubic metres) and will extend out to the 14 to 15 metre isobath to provide adequate under-keel clearance between the tanker's hull and the sea bottom. Due to the benign wave climate, a breakwater is not required.

Construction Docks/Ferry Terminals

Construction Docks are required to dispatch and receive heavy equipment, including pre-assembled process modules from ships directly or on barge vessels travelling between the mainland and Curtis Island. Construction Dock design may consist of a causeway or a trestle structure and may be temporary, for the period of construction of all three LNG trains.

In addition, permanent Ferry Terminals may be required at both the LNG Facility and on the mainland in order to transport construction and operations personnel. Temporary Construction Docks may remain and be utilised for passenger Ferry Terminal facilities.

Dredging

Dredging is required in order to deepen and widen the access channels and create an appropriate turning basin to access the LNG Berth(s) at the preferred site. Potentially a third party may undertake this dredging work, including the required environmental assessment and approvals, on behalf of the Project.

2.4.4 Additional Infrastructure Requirements

Bridge and Road

A Bridge and Road access to Curtis Island will be required for transportation of some construction equipment, labour and bulk materials to the LNG Facility. In the event that this access is not available in time for the proposed construction schedule, the Proponents will arrange barging and ferrying of materials and construction and operations personnel to and from the Site. The proposed investigation area for the location of the Bridge and Road crossing is shown (as the red hatched area) on Figure 3.

State Development Area

Currently, the Queensland Government is considering the inclusion of parts of Curtis Island under a new section of the Gladstone State Development Area (GSDA). As part of the GSDA, it is anticipated that the State may seek to develop infrastructure such as a Bridge/Road to Curtis Island and other



facilities as 'common user' facilities and infrastructure to be shared by various projects that operate within the GSDA. Under these arrangements, the State may decide in cooperation with existing or new project proponents within the GSDA to jointly develop the facilities/infrastructure.

2.4.5 Alternatives Considered

Alternatives considered include:

- An investigation of LNG site locations (see *Section 2.4.2* for further details);
- Different LNG liquefaction technologies. A final process design will be selected related to schedule, operability and cost;
- Location of Jetty/Berth and turning basin. The location will be developed in consultation with the GPC to minimise the Jetty length and dredging requirements and to maximise safety and Berth availability; and
- LNG Storage Tank size and design. The tank size and design will be selected and optimised during the FEED, in consideration of commercial marketing arrangements, ship size and LNG Plant capacity.

2.4.6 Other Approvals Processes

The LNG facility will require a Petroleum Facility Licence under the *Petroleum & Gas Act 2004 (Qld)* for LNG production and storage and a Level 1 Environmental Authority (Petroleum Activity) under the *Environmental Protection Act 1994 (Qld)*.

Under Schedule 9 of the *IPA*, activities under the *P&G Act* are exempt from assessment against Local Government planning schemes. Notwithstanding the above, other State based approvals will be required. The final site selection process will, however, consider the aims and objectives of Local Government planning schemes to ensure that no conflict arises with respect to existing or planned land use.

The proposed Bridge and Road investigation area is located adjacent to and overlapping the southernmost boundary of the Great Barrier Reef Coast Marine Park (Qld). Under the provisions of the *Marine Parks Act 2004 (Qld)* (MP Act) and the *Great Barrier Reef Marine Park Act 1975 (Cth)* (GBRMP Act), Marine Parks Permits will be required for any activities which may affect the Marine Parks.

2.4.7 Construction Activities

Construction activities to support the LNG Component will include:

- Site clearance and levelling;
- Preparation of laydown and pre-fabrication areas;
- Construction of the Bridge/Road and other access roads;
- Construction of LNG and LPG storage tank(s);



- Construction of LNG Plant and ancillary facilities;
- Construction of Marine Facilities; and
- Dredging and disposal of dredge spoils.

After relevant approvals, site preparation and construction of the LNG Component will occur. Early site access may be required to undertake survey works and prepare pioneer camp facilities. A temporary pioneer construction camp is expected to accommodate 100 to 300 people and would be built within the LNG Plant site area before early site preparation activities for the first LNG train. The pioneer camp will be replaced by a construction camp during the LNG Plant construction. It is anticipated that a construction workforce of approximately 3,000 will be housed in a temporary construction camp on Curtis Island and/or on the mainland. The precise number of workers to be housed on Curtis Island and in Gladstone will be defined during FEED and will be included within the EIS.

The construction camp would include necessary amenities such as a dining hall and kitchen, primary health care facility and recreation centre. Other services and camp infrastructure would include a water treatment plant and storage, sewage treatment plant, temporary power supply, fuel storage facility and fire-fighting equipment.

The final phase of construction is the commissioning and start-up of the LNG Component.

A Construction Environmental Management Plan will be prepared and implemented to comply with the EIS and permit conditions and to avoid any environmental incidents during this phase.

2.4.8 Operational Activities

At commissioning, the LNG Plant will start up in a stepwise process. The first systems started in the LNG Plant will be the utility systems, followed by the refrigeration compression. Natural gas will then be introduced into the system for liquefaction. The LNG Plant will be designed for continuous 24-hour operation. Shutdown of the LNG Plant will only occur during planned routine maintenance on plant equipment or as a result of emergency shut down.

Site operating procedures will be developed to identify personnel responsibilities and to document start-up, normal and abnormal operations, and shutdown situations. Emergency procedures will be prepared for plant control actions required to achieve safe holding and shutdown conditions and to ensure the safety of personnel. The pre-start-up review will be structured to ensure that all construction meets intended specifications and written safety, operating, maintenance and emergency procedures. In addition, the pre-start-up review will ensure that these specifications and procedures are in place and that appropriate training of personnel has been completed.

To ensure the safe start-up and operation of the plant, a comprehensive Operational Safety Management Programme and Emergency Response Plan will be implemented to ensure the overall effectiveness of hazard control through all stages of activity.

An Operations EMP will be prepared and implemented to comply with the EIS and permit conditions and to manage environmental issues during operations.

A Shipping Management Plan will be prepared in consultation with the GPC and other appropriate authorities to manage the safety and associated impacts of shipping traffic.



2.4.9 Anticipated Workforce

The workforce during the construction phase of the first Train of the LNG Component will be approximately 3,000 people. A workforce of approximately 100-200 full-time personnel will operate the LNG Component (Train 1). Subsequent development of further LNG Trains would contribute ongoing and additional construction and operations jobs. The Proponents will provide trained operations personnel to support the operation and maintenance of the LNG Component. Potential impacts on the demand for local services and housing will be assessed as part of the EIS and appropriate plans developed in consultation with Local Government Authorities to manage this issue.



3 EXISTING ENVIRONMENT AND POTENTIAL IMPACTS

This section provides an overview of the existing environment in the Project area and identifies potential impacts related to the proposed Project.

The Project will be developed and permitted as a single integrated Project but, for clarity of presentation, it has been divided into the three principal components for this section.

3.1 Gas Field Component

3.1.1 Environmental Footprint Description

The Gas Field Component of the Project will comprise a production programme within QGC's existing petroleum tenements in the Walloon Fairway area of the Surat Basin. The normal operation of the gas field development has a schedule of progressive clearance of approximately 2,000 hectares for well lease areas, camp and office space, compressor banks and evaporation pondage (up to 800 hectares). This area represents less than 1% of the total area in which QGC has an interest.

The total area of disturbance is likely to peak with cumulative well lease areas of 4,000 hectares (not accounting for shutdown and rehabilitation) over the life of the two trains of gas supplied to the Project. Rehabilitation will be progressive over the life of the Project with the typical well life being 10 to 15 years. Rehabilitation activities will commence sequentially at ramp-down/cessation of commercial production for depleted wells. Studies and pilot projects are ongoing to evaluate options for the beneficial use of associated water.

3.1.2 Land Resources

Topography and Landscape

The area of the QGC gas fields has generally low relief, sloping gently towards the south west. The Condamine River is a regional river which meanders through the QGC gas fields. All rivers flow towards the south west. The Moonie River and Balonne Rivers (two other regional rivers) are located to the south of the QGC gas fields.

Geology and Soils

The QGC gas fields are located near the edge of the Great Artesian Basin, with the Walloon Coal measures outcropping at the north east extent. The surface geology of the QGC gas fields generally comprises Tertiary sediments. Associated water produced in the extraction of CSG is drawn from the coal seams in the Walloon Measures. The Walloon Measures are not connected to the local groundwater source for domestic use and stock watering.

Land resource areas within the QGC gas fields comprise clay alluvial plains, poplar box flat plains, cypress pine sands, brigalow plains, brigalow rises, rolling downs, ironbark/bulloak forests, poplar box rises and light forests.



Land Use and Tenure

The land use is typical of western Queensland with the easternmost extent of the QGC gas fields comprising some cultivated land including intensive farming and feedlots, trending to low intensity grazing in the west as land suitability and mean rainfall declines. QGC has ownership of selective freehold land within the acreage of PLs and ATPs. These properties have been purchased outright for the location of infrastructure such as the compression facilities and evaporation ponds.

Native Title

In late 2007 QGC commenced the Right to Negotiate (RTN) process with the Barunggam peoples as the sole claimant group over QGC's current development areas. QGC has entered into an Ancillary Benefits Agreement with the Barunggam peoples and is negotiating the terms of the section 31 Deed with the State and the Barunggam peoples.

QGC has negotiated exploration Cultural Heritage Management Plans (CHMPs) with the Biggumbal peoples (ATP 621P) and the Imann peoples (ATP 651P).

Further field development for the Project will see a combination of RTNs and Indigenous Land Use Agreements (ILUA) with various Traditional Owners.

Contaminated Land

Given the extensive land titles within the QGC gas fields, absolute data on contaminated land identified under the Environmental Management Register of the *Environmental Protection Act 1994* (Qld) has not been sought to date.

Land Resources – Potential Impacts

Potential impacts associated with the development of the gas fields for the two LNG trains will be related to:

- Commercial well development (access land clearance, well lease development, gathering lines and sumps);
- Construction of in-field screw compressor stations;
- Construction of field processing and reciprocating compressor plants connecting to the high-pressure gas pipeline network, and associated water separating and dehydration facilities);
- Management of associated water (pondage, delivery lines, and beneficial use alternatives within the QGC gas fields and in the wider Darling Downs region);
- Construction of required camps and field support facilities (offices and warehouse etc); and
- Water research and development activities (reinjection, crop trials and carbon offset options).

Additional land may be acquired as part of the gasfield development process.

3.1.3 Cultural Heritage

In 2005, QGC signed cultural heritage agreements with the Barunggam and Western Wakka Wakka peoples. These historic agreements cover most of QGC's tenements in the Surat Basin and the



Projects that QGC may implement within those tenements, including development of the Berwyndale South and Argyle-Kenya gas fields.

These agreements establish a framework for strengthening QGC's relationship with the traditional owners. Key elements of the agreements include:

- Employment of Aboriginal Liaison Officers;
- Protocols to manage cultural heritage;
- Cultural heritage inductions presented by Liaison Officers for all QGC employees and contractors working on QGC projects;
- Indigenous community funding; and
- Wages and working conditions for all indigenous workers on QGC projects.

Cultural Heritage – Potential Impacts

Potential cultural heritage impacts will relate to field development activities and will be managed in the framework of the cultural heritage agreements with the Barunggam and Western Wakka Wakka peoples.

Cultural heritage management plans will be developed and implemented to ensure holistic management of cultural heritage issues.

3.1.4 Traffic and Transport

The gas fields are located in rural areas with minimal transport infrastructure. Site access will use existing tracks and internal property roads wherever possible, but where new access roads are required these will be agreed with the affected stakeholder. Road construction will be undertaken on an "as needed" basis and will usually provide a corridor for water and gas gathering systems.

Traffic and Transport – Potential Impacts

Potential traffic and transport impacts will relate to the construction of additional access roads and increased road traffic movements by heavy vehicles and cars.

3.1.5 Water Resources

Surface Hydrology

The QGC gas fields are located within the Condamine-Balonne catchment. The Condamine Catchment Management Association characterises the hydrology of the Condamine catchment as:

- Highly variable;
- Average rainfall is 726 mm per year;
- Seventy percent of rain falls in the summer months from October to March;
- Rainfall is highly variable in timing and amount in any one year;



- Few streams have permanent flow; and
- 30-35% of the mean natural flow is diverted for agricultural, domestic and industrial use.

Hydrogeology

The area of the QGC gas fields comprises part of the Surat Basin and largely falls within the Great Artesian Basin groundwater management area (GMA) Number 21 (Surat East). A narrow wedge to the west of the Project area belongs to GMA Number 19 (Surat). A small area on the eastern side of the Project area belongs to GMA Number 24 (Eastern Downs).

The Surat Basin, within which the QGC gas fields are located, is one of the major sedimentary basins of the Great Artesian Basin and extends across Queensland and New South Wales. The main aquifers within the QGC gas fields are the Precipice Sandstone aquifer, the Hutton Sandstone aquifer, the Springbok Sandstone aquifer, the Gubberamunda Sandstone aquifer and the Mooga Sandstone aquifer. These aquifers are important aquifers due to their physical characteristics (i.e., thickness and transmissivity), which result in significant water bearing capacities.

The Walloon Coal Measures from which CSG is extracted is an aquifer with low connectivity to the local groundwater source.

Water Quality

Analyses undertaken of historical (2005 – 2007) associated water samples taken from the fields within QGC operations in the Walloon Fairway indicate that the water would require treatment to meet drinking water quality and is not of a quality suitable for release to fresh water bodies, based on the concentration of metals and salts.

Water Management

Associated water is currently managed through surface storage in evaporation ponds centrally located within the current development area.

The Proponents are actively reviewing options for the beneficial use of associated water.

Water Resources – Potential Impacts

A key impact of the development of the gas fields will be the production of associated water.

The rate of associated water production will increase from the current level of approximately 20ML/day to 60ML/day by 2013, with an average of 30ML per day per LNG train over 20 years.

QGC has been pursuing alternatives for the beneficial use of associated water from gas production. Disposal by evaporation pondage is the least preferred option for management of associated water due to the potential for water re-use as a resource in the local area and region for both drinking water and industrial uses.

Potential re-use is dependent on the associated water remaining treatable. If Underground Coal Gasification (UCG) developments are undertaken by others, water quality may vary and beneficial use options may be limited.



3.1.6 Terrestrial Ecology

Areas of Conservation Significance

The QGC gas fields are within the same catchment as two Ramsar sites, but are remote from both sites. The Narran Lake Nature Reserve is approximately 450 km southwest of the QGC gas fields, and the Shoalwater and Corio Bay areas are approximately 460 km to the north. As a result, it is highly unlikely that QGC's gas field development will impact these protected areas. Lake Broadwater lies within the QGC gas fields, 25km southwest of Dalby and is protected under the Lake Broadwater Conservation Park. The Gums Lagoon lies some 26km south of Tara and is protected by a reserve for natural resource management.

Terrestrial Flora

The QGC gas fields lie within the Brigalow Belt Bioregion. The remnant vegetation of the area is typically associated with creek and river banks, property boundaries and road reserves. Four threatened ecological communities, as listed under the *EPBC Act*, were identified as potentially being present from searches of the Commonwealth *EPBC Act* Protected Matters Database. They are:

- Bluegrass dominant grasslands of the Brigalow belt Bioregions;
- Brigalow dominant and co-dominant;
- Semi-evergreen vine thickets of the Brigalow Belt and Nandewar Bioregions; and
- White-box-Yellow-box-Blakely's Red Gum grassy woodland and derived native grassland.

In relation to State protected remnant vegetation, the QGC total acreage includes 2.49% "of concern" and 2.45% "endangered" Regional Ecosystems and these areas will generally be protected from well development activity by a preferred management strategy of avoidance.

The Commonwealth EPBC database search also identified 18 threatened flora species as potentially present within the Project area. This included 1 endangered and 17 vulnerable plant species protected under the *EPBC Act*.

Terrestrial Fauna

A Commonwealth EPBC database search of the pipeline Project area has identified 16 threatened species as potentially occurring within this area. This included 7 birds, 2 mammals, 6 reptiles and 1 fish protected under the *EPBC Act*.

Terrestrial Ecology – Potential Impacts

Potential impacts may include disruption to ecosystems related to:

- Road and pipeline construction and associated site clearance; and
- Well lease site clearance and preparation.



3.1.7 Air Quality

The QGC gas field areas are generally rural in nature and background air quality will be similar to other rural areas in Queensland. Current emissions from existing agricultural land use are related to the burning of grazing land or bush clearing activities, bush fires or blown dust from fields.

The major sources of air emissions from current well development activities are dust generated by well site and access road preparation, gathering line installation and vehicle or equipment movement.

Gas flaring or venting occurs occasionally when testing pilot wells. Emissions from compressor units and other plant equipment have minor additional impacts on local air quality.

Expansion of the number of commercial wells required for the Project will increase the potential dust and other air emissions within the Gas Field Component development area.

Air Quality – Potential Impacts

Air quality impacts relating to well development and operations may include:

- Carbon dioxide (CO₂) and carbon monoxide (CO);
- Nitrogen oxides (NO_x);
- Sulphur oxides (SO_x);
- Volatile organic compounds (VOCs); and
- Dust and particulates.

3.1.8 Noise and Vibration

The QGC gas fields are located in predominantly rural areas. The main sources of noise, above that of the existing background level, are vehicle movements, farming machinery, and QGC compressors and pumps.

Noise and Vibration – Potential Impacts

Noise and vibrations may occur due to site preparation, drilling, compressor stations and transportation.

3.1.9 Socio-Economics

Land use within the QGC gas fields is generally rural in nature. Urban settlements within the area are relatively small (<5,000 people) and include Chinchilla, Miles, Tara and Condamine. Chinchilla is at the heart of extensive infrastructure investment in the energy and power sectors with A\$3.8 billion currently being invested into Chinchilla Shire by different investors across a range of energy and infrastructure projects. The major land uses in the Project area include livestock farming and arable farming.

Socio-Economics – Potential Impacts

Potential impacts may be related to:

- Demand for construction workforce within the Surat Basin region and the impact on skilled and unskilled labour force within this region;
- Ancillary construction workforce pushing up costs of accommodation and rents in the local area (including Chinchilla, Miles, Tara and Condamine);
- Job opportunities, service and supply opportunities and income in the local economy from the construction and operational phases of the Project; and
- Demands from the construction workforce on social services, including schools, leisure and recreation, medical support, hospitals and police.

3.1.10 Visual Amenity

The landscape character is typical of agricultural areas with limited housing and transport infrastructure. The low relief terrain has low visual absorption capacity, however the isolated remnant vegetation associated with roads and property boundaries provides some limited screening.

Figure 4 – Typical Low-Impact Production Well in the Berwyndale Field



Visual Amenity – Potential Impacts

Visual impacts will be related to site preparation, drilling activities, gas wells, pipelines, evaporation ponds and other water management infrastructure. Visual impacts are likely to be most apparent during construction, but long-term infrastructure will also have long-term visual impacts. The visual impact of gas field operations (such as gas wells) is likely to be low, with more significant impacts



related to camps, access roads, compressor stations, evaporation ponds and other long-term infrastructure.

3.1.11 Waste Streams

Associated Water

Associated water is managed according to existing Environmental Authorities that prohibit discharge to surface or groundwater from the operating sites. Management alternatives for the beneficial use of associated water are being actively pursued for current rates of production and will require assessment for the Project volumes. Other liquid wastes are restricted to the effluent from the camp facilities.

Stormwater Drainage

Well lease areas are constructed using a compacted gravel base with collection sumps servicing each pad. Generally stormwater is managed by separation of clean runoff using diversion drains or bunding.

Waste oils and water are generated from compressor units. Compressor stations have an oily-water separator, from which oil will be removed off site to a licensed waste disposal facility and water will be disposed of on site in an evaporation pond (generally 100 m x 100 m in size).

Grease traps from the camp are pumped out approximately once every two or three months by licensed waste transport company for disposal at Dalby Regional Council's wastewater treatment works in Miles.

Effluent Treatment

Sludge from the on-site wastewater treatment facility for the camp is pumped out periodically and transported to the Miles wastewater treatment works by a licensed waste transport company. This material is removed as required, but typically comprises approximately 10,000-15,000L every 3-4 months. Expansions to the field camp facilities will require consultation with the Miles Wastewater treatment works to confirm its continued capacity to process this material.

Solid Waste Management

QGC manages putrescible solid waste under the camp facility contract which is inclusive of disposal. The current facilities generate approximately 4,200L each day which is taken for disposal at a local landfill. A larger camp facility would require consultation with Miles landfill operators to confirm the continued capacity to receive putrescible waste from the Project. Inert waste is removed from site on a regular basis for recycling or disposal depending on waste composition.

Waste – Potential Impacts

Potential waste impacts will include:

- Production, management and potential beneficial use of associated water;
- Generation and disposal of waste oils and other industrial wastes;
- Generation and disposal of waste water treatment sludge; and
- Generation and disposal of domestic and office wastes.



3.1.12 Risk and Safety Assessment

The field exploration and production activities are regulated under the *P&G Act* and its regulations. QGC has established a Safety and Operating Plan, based on a risk and hazard management approach. This applies throughout all QGC operations including exploration, drilling, construction, commissioning, operating and decommissioning.

3.2 Pipeline Component

3.2.1 Environmental Footprint Description

Construction of the Main Pipeline and Interconnection Network will involve the clearing of a construction right of way (ROW) typically between 30 and 40 metres wide along the length of the pipeline. In congested working areas, the ROW may require an additional 50 metres. Pipe and equipment stockpile areas may be required at intervals along the pipeline routes. Additional clearing and work areas will be required at major watercourse crossings, construction camps and in areas of complicated construction such as the crossing of The Narrows in Gladstone Harbour.

3.2.2 Land Resources

Topography and Landscape

Topography of the proposed pipeline routes varies, but includes the features described in the upstream gas field areas, and for the main pipeline to Gladstone the landscape includes flat to undulating terrain associated with the coastal plains around Gladstone and river flats of the Calliope River system. The most significant topographic features of the Main Pipeline route are the Auburn, Callide and Mt Larcom Ranges and associated foothills. Major drainage systems are associated with the Calliope River, Callide Creek and upper catchment of the Dawson River.

Geology and Soils

The Main Pipeline route traverses a broad range of geological units and soil types. Dominant land zones and soils associated with the Main Pipeline route include:

- Exposed or shallowly covered duricrusts formed on a variety of rock types, usually forming mesas or scarps. This land zone is dominant in the first 50km of the route;
- Undulating landscapes on generally horizontally bedded fine grained sedimentary rocks with soils of moderate to high permeability. This land zone is dominant along the southern section of the main pipeline and the lateral;
- Granitic rocks forming ranges, hills and lowlands. This land zone dominates the central section of the pipeline route and a small area in the northern section of the route;
- Metamorphosed sedimentary rocks forming ranges, hills and lowlands. This land zone dominates the northern section of the route;
- Quaternary alluvial systems including floodplains, alluvial plains, levees and swamps. This land zone is present intermittently along the Main Pipeline and Collection Lateral; and



- Tidal flats and beaches of Quaternary estuarine and marine deposits subject to periodic inundation. Acid sulphate soils may also be encountered. This land zone is located along the coastal areas of the mainland and Curtis Island.

Land Use and Tenure

The proposed pipelines traverse predominantly freehold land, with occasional parcels of Leasehold and Crown land.

The proposed route traverses the Dalby, North Burnett and Gladstone Regional Council areas. There will be no displacement of residents for the construction of the Project and disturbance to existing land use will be temporary. Each affected landholder will be consulted regarding the Project to identify site specific issues and discuss specific requirements that may be necessary.

The proposed pipeline route crosses a number of mining and petroleum exploration tenures, including mineral development licences and petroleum production leases. The current route option has been located to avoid all granted mining leases and QGC will liaise with tenure holders to select a final route which avoids, to the extent possible, identified highly prospective resource areas.

Contaminated Land

No detailed contaminated land searches of the proposed pipeline route have been completed to date. However, further investigations would be completed as part of the EIS process. Discussions with landowners along the final preferred route will aid in the identification of potential areas within which notifiable activities may have occurred historically.

Land Resources – Potential Impacts

Potential impacts will relate to:

- Preparation of site access routes and lay down areas;
- Clearing of vegetation along an approved construction corridor; and
- Trenching, pipeline installation and reinstatement.

3.2.3 Native Title

The route is subject to various native title interests and the Proponents will seek to discuss Indigenous Land Use Agreements (ILUAs) with the relevant Traditional Owners.

Native Title – Potential Impacts

Pipeline development for the Project will see a combination of RTN agreements and ILUAs with various Traditional Owners.

3.2.4 Cultural Heritage

Cultural Heritage in Queensland is addressed under the *Aboriginal Cultural Heritage Act 2003* (Qld) and the *Queensland Heritage Act 1992* (Qld). The Proponents will engage with the relevant Traditional Owners to study the proposed pipeline routes with the primary aim of avoiding items of



cultural heritage value. In the event that full avoidance is not practicable the Project will seek to agree management strategies of any values that may be impacted.

European heritage will be studied and the values determined and subsequently managed in accordance with the *Queensland Heritage Act 1992* (Qld).

Cultural Heritage – Potential Impacts

Potential cultural heritage impacts will relate to pipeline construction activities and will be managed in the framework of the cultural heritage agreements with the various Traditional Owner groups.

3.2.5 Traffic and Transport

The pipeline corridors are located in rural areas with variable quality and accessibility to transport. Access to the pipeline work areas will use existing tracks and internal property roads wherever possible, but where new access roads are required these will be agreed with the affected landholder. Temporary access track construction will be undertaken on an “as needed” basis in consultation with affected stakeholders.

Traffic and Transport – Potential Impacts

Potential traffic and transport impacts will be primarily related to the construction phase including delivery of pipe, plant, equipment and construction camps to site.

Pipe is typically supplied in 12m - 18m lengths transported on extended semi-trailers with a capacity to carry 23 tonnes. Due to the linear nature of the development, pipe truck movements will be spread along the proposed route minimising impacts in any one location.

In addition to the pipe haulage, plant and equipment will need to be mobilised and demobilised at the start and end of construction and construction campsites will need to be mobilised, moved from time to time and at the completion of works, demobilised. On a day-to-day basis the workforce will need to travel to and from the work area.

It is unlikely that the large diameter pipe required for the main pipeline will be manufactured within Australia and hence will be transported to Queensland coast via ship. Ground transport will be predominantly by road to the pipeline construction site. However, investigation into the use of rail transport will be undertaken during studies and costing reviews.

3.2.6 Water Resources

Surface Hydrology

A number of watercourse crossings will be required for the construction of the pipeline, with the most significant river systems associated with the Condamine River, Calliope River, Callide Creek and the Dawson River system. The actual location of all crossings will be dependent on the final alignment of the pipeline.

Hydrogeology

The maximum depth of trench for the pipeline will be approximately 3 metres and therefore unlikely to interfere with groundwater resources.



Marine Crossing

The pipeline will require a marine crossing from the mainland to Curtis Island (refer to *Figure 3*), in an area close to Laird Point commonly referred to as “The Narrows”. Initial investigations have determined that the crossing will need to be buried and a range of construction/installation methods will be considered including both excavation and trenchless techniques (such as directional drilling).

Water Resources – Potential Impacts

Potential water resources impacts will primarily relate to the construction phase and will include:

- Disturbance to surface watercourses; and
- Disturbance to marine areas at the marine crossing area.

The construction of the pipeline will not permanently modify any watercourses, although there is the potential for temporary disruption during actual crossings. The construction method for watercourse crossings will be dependent on site factors (e.g. hydrology, stream substrate and geology, environmental sensitivities and engineering feasibility), with the aim to minimise environmental impacts during construction and the requirement for remedial work during the operation of the pipeline.

Assessment of pipeline route watercourse crossings will be included as part of the EIS with particular emphasis on selecting stable crossing locations to assist in minimising potential environmental impacts. Relevant permits will be sought from the Department of Natural Resources and Water.

Relevant permits for Marine Parks works will be sought where necessary from the Environmental Protection Agency (Qld) and the Great Barrier Reef Marine Park Authority (Cth).

3.2.7 Terrestrial Ecology

Areas of Conservation Significance

A number of protected areas including National Parks and Conservation Reserves have been identified within the Pipeline Component area. The proposed route has been located to avoid all these protected areas. Detailed field investigations and engineering design works will ensure that the construction and operation of the pipeline will not significantly impact on these areas.

Terrestrial Flora

The Project lies predominantly within the Brigalow Belt Bioregion and extends into the South East Queensland Bioregion for its easternmost 4km at Curtis Island. The remnant vegetation located along the pipeline route is largely associated with creek and river banks, property boundaries, road reserves and protected areas. The pipeline route has been located to minimise disturbance to areas of regional ecosystems mapped by the Queensland Herbarium as being ‘endangered’ or ‘of concern’.

A Commonwealth EPBC database search of the pipeline Project area has identified 24 threatened flora species as potentially present within the Project area. This includes 3 endangered and 20 vulnerable plant species protected under the *EPBC Act*. The majority of the threatened species are associated with the southern section of the route.

Five threatened ecological communities listed under the *EPBC Act* are identified as potentially present within the Project area:



- Bluegrass (*Dichanthium spp.*) dominant grasslands of the Brigalow Belt Bioregions (North and South);
- Brigalow (*Acacia harpophylla*) dominant and co-dominant;
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions;
- The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin; and
- White Box, Yellow Box, Blakely's Red Gum, Grassy Woodland and Derived Native Grassland.

The pipeline route has been located to minimise disturbance to mapped areas of these threatened ecological communities.

Terrestrial Fauna

A Commonwealth EPBC database search of the pipeline Project area has identified 27 threatened fauna species as potentially occurring within this area. This includes 9 bird, 6 mammals and 12 reptiles protected under the *EPBC Act*.

Terrestrial Ecology – Potential Impacts

Potential impacts will include disruption to ecosystems and habitat fragmentation related to:

- Access road construction and lay down area site clearance; and
- Pipeline construction and associated right of way (ROW) clearance.

The potential impacts on flora will be minimised through the refinement of the proposed route to avoid areas of significant flora, including remnant native vegetation and fauna habitat. Comprehensive ecological surveys are proposed as part of the environmental assessment process for the pipeline. It is proposed that these will be completed and documented in the EIS via a staged process involving:

- Background research to identify potential flora and fauna species and communities associated with the proposed route;
- Identification of preferred habitats;
- Completion of targeted surveys along the route to determine whether any of the listed species are present or are likely to be present;
- Assessment of the potential impacts of the proposed route on identified species;
- Consideration of route refinements to reduce impacts where possible; and
- Development of comprehensive management measures to further reduce potential impacts.

3.2.8 Marine Ecology

The proposed pipeline crossing between the mainland and Curtis Island is located within the limits of the Gladstone Port. The area has been identified in the Curtis Coast Regional Coastal Management



Plan as containing significant coastal resources and areas of conservation significance. While the pipeline crossing area lies outside the Great Barrier Reef Coast Marine Park (Qld) and the Great Barrier Reef Marine Park, all areas below the mean low water mark are within the Great Barrier Reef World Heritage Area.

The area of the proposed crossing comprises:

- Intertidal mudflats;
- Mangrove swamp areas;
- Seagrass beds.

Areas of Conservation Significance

Areas of conservation significance adjacent to or associated with the pipeline marine crossing location include:

- the Great Barrier Reef Marine Park, and Great Barrier Reef Coast Marine Park;
- the Rodds Bay Dugong Sanctuary; and
- “The Narrows”, which is listed in the Directory of Important Wetlands in Australia.

Marine Flora

The upper reaches of the Gladstone harbour supports a range of coastal marine habitats including:

- Intertidal and sub-tidal Seagrass beds;
- Coastal wetlands listed in the Directory of Important Wetlands; and
- Mangroves and claypans.

Marine Fauna

The upper reaches of the Gladstone harbour support an extensive range of marine fauna including Dugongs, seabirds, fish species, reptiles and mammals. The proposed crossing point is located on the northern boundary of the Rodds Bay Dugong Sanctuary and is adjacent to areas on the mainland known to be feed sites for shorebirds. Several threatened and significant species covered by the *Nature Conservation Act 1993* (Qld) (NC Act) and *EPBC Act* have been identified as potentially occurring in the Gladstone region.

Marine studies of the crossing location will be completed to identify the specific values of the area and ensure that the crossing is designed and constructed in a manner that minimises the impact to the marine fauna species. Under the provisions of the *MP Act* and the *GBRMP Act*, Marine Parks Permits will be required for any activities which may affect the Marine Parks.

Marine Ecology – Potential Impacts

Potential impacts may include disruption to ecosystems and habitat fragmentation related to:

- Disturbance of mudflats and intertidal areas;



- Disturbance to mangrove swamps; and
- Disturbance to seagrass areas and fisheries.

The Project will seek to minimise the loss of mangroves and a replacement planting program will be investigated during the EIS.

3.2.9 Air Quality

The pipeline corridor passes through predominantly rural areas and local background air quality is considered likely to be good. No air quality baseline data is currently available.

Air Quality – Potential Impacts

Potential air quality impacts will occur during the construction period. The key air quality issue would be:

- Dust generation during construction from site clearance and access road construction, pipeline installation and vehicle movements; and
- Exhaust emissions from vehicles, compressor stations and mobile plant and equipment.

3.2.10 Noise and Vibration

The pipeline corridor passes through predominantly rural areas and local ambient noise is considered likely to be low. No ambient noise baseline data is currently available.

Noise and Vibration – Potential Impacts

Noise impacts associated with the pipeline would only occur during the construction period. These would be associated with construction activities and transport of pipe, plant and equipment. Some limited and controlled blasting may be required in rock areas. As such, the effects would be transient and short term. If compressor stations are used to increase pipeline capacity there may be local noise impacts associated with the operation of the compressor stations.

3.2.11 Socio-Economics

The pipeline corridor passes through a number of Local Government areas and is in the vicinity of a number of towns including Dalby, Tara, Condamine, Chinchilla, Miles, Wandoan, Cracow, Biloela and Gladstone. The proposed gas collection lateral would pass in the vicinity of Taroom to the Fairview gas fields. The majority of the areas through which the pipeline corridor passes are rural with extensive cattle grazing, arable farming and other mining and energy-based land uses.

Socio-Economics – Potential Impacts

From a capital component and timeframe for construction perspective, the pipeline is a smaller component of the overall large Project. The vast majority of the pipeline costs will be incurred in procurement of the major items (pipeline) and the cost of physical installation over a 12 month period. Due to the remote nature of the pipeline corridor, the construction workforce will be accommodated in dedicated construction camps.



Potential socio-economic impacts from pipeline construction will be largely associated with operation of the construction camps and disturbance to landholders and land use during the construction phase. These impacts will generally be temporary and limited to the duration of the construction process.

Potential impacts may be related to:

- Demand for construction workforce over a number of regional centres and the impact on skilled and unskilled labour force within these regions;
- Ancillary construction workforce pushing up costs of accommodation and rents in the smaller townships closest to construction camps;
- Job opportunities, service and supply opportunities and income in the local economy from the construction phases of the Project; and
- Demands from the construction workforce on social services, including recreation, medical, hospitals and police.

3.2.12 Visual Amenity

The pipeline corridors pass through predominantly rural areas, where the landscape character is typical of agricultural areas with limited housing and transport infrastructure. The terrain has low visual absorption capacity, however the isolated remnant vegetation associated with roads and property boundaries provides some limited screening.

Visual Amenity – Potential Impacts

The construction of the pipelines will create cleared corridors of varying width. This area would be highly visible in pasture and grazing land until grasses and or crops are re-established. Depending on the season, this may take up to 6-9 months. In timbered areas the visual affect would be of longer duration but vegetation screening would also serve to minimise visual impacts. However, the indicative routes are being selected to minimise tree clearing and this criteria will remain during the refinement of the final pipeline routes.

3.2.13 Waste Streams

Construction of the pipelines is not expected to generate significant quantities of waste.

Waste – Potential Impacts

The key waste streams will include:

- Grubbed-up vegetation;
- Regulated /hazardous waste such as oils, greases and solvents;
- General waste;
- Recyclables; and
- Hydrostatic test water.



Minimal amounts of waste would be generated by the pipeline during operations. These would typically include wastes associated with pipeline maintenance equipment and products.

3.2.14 Risk and Safety Assessment

The pipeline will be planned, constructed and operated in accordance with *AS2885: Pipelines – Gas and Liquid Petroleum*, which includes a formal risk assessment process of the pipeline route to determine the design features and management measures to ensure that risks are reduced to as low as reasonably practical.

3.3 LNG Component

3.3.1 Environmental Footprint Description

The LNG facility and marine loading facility footprint will incorporate the following:

- Site clearing and bulk earthworks of 200 to 300 hectares;
- Clearing of mangroves and other marine plants for jetty and construction dock access;
- Dredging of shipping channel and turning basin and dredged spoil disposal; and
- Emissions including noise, atmospheric, solid, and water from construction and operation.

3.3.2 Land Resources

Topography and Landscape

Curtis Island inter-tidal zone is characterised by mudflats dominated by mangroves and in some areas by salt pan / salt couch. Beyond this zone, the land is gently undulating around 5-30 metres above sea level and is covered with Eucalypt woodland. A number of small incised drainage lines flow into Gladstone harbour.

Geology and Soils

The underlying geology for the Curtis Island site is dominated by the Wandilla Formation of the Curtis Island Group consisting of mudstone, quartz greywacke, and pale grey chert. The estuary environments associated with Graham Creek and Gladstone harbour consist of Holocene sediments of gravel, silt and clay alluvium and associated mangrove swamps, mud flats and salt pans.

The Queensland University Advanced Centre for Earthquake Studies (QUAKES) Queensland catalogue states that arguably the largest earthquake to strike in or adjacent to eastern Australia struck about 135 km offshore Gladstone in 1918 (with a magnitude of 6 on the Richter scale). The LNG facility engineering design will be in accordance with *Australian Standard AS 1170 Part 4 – Earthquake Loads*.

The southern sections of Curtis Island have not yet been assessed for the presence of Acid Sulphate Soils. However, areas on the mainland directly adjacent to the proposed Curtis Island site have been identified as having Acid Sulphate Soils. The same geological features of mud and sand have been



identified on the estuarine sections of Curtis Island, particularly areas surrounding Graham Creek. It is therefore considered likely that Acid Sulphate Soils are located in areas of Curtis Island.

Land Use and Tenure

The existing land use on the western side of Curtis Island is currently grazing on a homestead grazing perpetual lease. Currently, the Queensland Government is considering the inclusion of parts of Curtis Island under a new section of the Gladstone State Development Area (GSDA) and it is expected that the zoning of this land will change from rural to industrial in 2008/2009.

The proposal is generally consistent with the CQPA (now the GPA) 50-year Strategic Plan which envisages that this part of Curtis Island will accommodate port dependent industries.

Contaminated Land

Searches of the Queensland Environmental Management Register and Contaminated Land Register searches have been conducted covering the proposed site, and no area of the site is registered as being contaminated.

Land Resources – Potential Impacts

Potential land resources impacts include:

- Changes in land use and tenure;
- Disturbance of Acid Sulphate Soils; and
- Potential contamination of soils.

3.3.3 Native Title

The tenure of the proposed LNG Component site is grazing homestead perpetual lease and is not subject to native title. Although native title has been extinguished for this part of Curtis Island, the Proponents intend to undertake a combination of Right to Negotiate agreements and Indigenous Land Use Agreements (ILUAs) with the Traditional Owners, for the LNG Plant Site including the inter-tidal area associated with the Jetty and if required the Bridge/Road to Curtis Island.

3.3.4 Cultural Heritage

Searches of the Department of Natural Resources and Water database of Aboriginal cultural heritage places and the EPA's Cultural Heritage Information Management System have not identified cultural heritage places or historic places in the proposed site location area. A more comprehensive assessment and a Cultural Heritage Management Plan (CHMP) will be completed as part of the EIS.

Cultural Heritage – Potential Impacts

Potential cultural heritage impacts will relate to LNG Component construction activities and will be managed in the framework of the cultural heritage agreements with the Traditional Owner groups.



3.3.5 Traffic and Transport

The LNG facility site area is currently undeveloped and has no direct road access from the mainland. However, there is some infrequent off-road vehicular traffic in the Project area.

There is considerable existing shipping traffic within Gladstone harbour. However, there is limited shipping in the immediate vicinity of the Project area, mainly associated with the RG Tanna coal terminal and the jetty at Fisherman's Landing on the mainland.

Traffic and Transport – Potential Impacts

Potential traffic and transport impacts will include:

- An increase in vehicular and marine traffic to and from Curtis Island, during both the construction and operational phases of the Project;
- An increase of shipping entering and leaving Gladstone harbour and transiting the harbour to the LNG Jetty. Approximately one LNG tanker will be loaded per week per LNG train. Shipping movements of the LNG tankers within the Gladstone port will be coordinated through the GPC. Tankers will be escorted by tugs in the vicinity of the loading facility and will be under the control of a pilot within harbour waters, to ensure compliance with all procedures including separation distances from other vessels. The loading facility will be capable of handling LNG tankers up to “Q Max” ships with a capacity of 266,000m³, however the general anticipated ship size is 180,000m³;
- Construction Docks/Ferry Terminals will be constructed to facilitate transport of construction material, equipment, and workforce between the commercial harbour and Curtis Island. Alternatively, a Bridge/Road across The Narrows may be constructed as an alternative to barge and small vessel movements.

3.3.6 Water Resources

Surface Hydrology

The surface hydrology is characterised by ephemeral streams. No permanent freshwater bodies are known to be present on the proposed site of the LNG Facility.

Hydrogeology

A search of the Queensland Government Groundwater Database indicates two groundwater bores (registration numbers 91325 and 91326) registered within 3 km of the proposed site, with one less than 1 km to the north and one approximately 1 km to the south of the site. These are existing sub-artesian bores registered for water supply.

Details provided from the Groundwater Database indicate relatively poor groundwater quality, with water quality described as brackish or salty.

Marine Sediment Quality

The area proposed to be dredged is largely undisturbed marine sediments with no on-shore development in proximity. The proposed Dredging Investigation Area is indicated as the yellow hatched area on *Figure 3*.



Water Quality – Potential Impacts

Potential marine water quality impacts related to the construction and operation of the LNG Facility include increased turbidity and suspended solids.

It is estimated that approximately 10-14 million cubic metres of material will be required to be dredged and disposed. The sediments to be dredged may be uncontaminated and suitable for land-based reclamation.

3.3.7 Terrestrial Ecology

Areas of Conservation Significance

Curtis Island National Park is located in the north-eastern sections of Curtis Island (north of Graham Creek). The proposed development is not located within Curtis Island National Park.

Terrestrial Flora

The Regional Ecosystem (RE) Mapping for the proposed sites under consideration on Curtis Island contains remnant vegetation communities which have the status of “not of concern”, “of concern” and “endangered” under the provisions of the *Vegetation Management Act 1999* (Qld) (*VM Act*). Semi-evergreen Vine Thicket (SEVT) has not been mapped or identified on Curtis Island.

Database searches have identified five threatened flora species listed on the *NC Act* recorded from Curtis Island. The location and extent of these species is not defined, and the presence of these in some instances is based on a single historic observation.

Terrestrial Fauna

Essential Habitat mapping under the *VM Act* identifies essential habitat for Koalas in the vicinity of the proposed LNG facility, based on vegetation type. The EPBC online database shows 13 threatened fauna species (6 birds, 5 mammals, and 2 reptiles) and 15 migratory bird species that could potentially occur in the Project area.

Terrestrial Ecology – Potential Impacts

Potential impacts to terrestrial ecology related to the construction and operation of the LNG plant include:

- Clearing of vegetation and disturbance of ecosystems and essential habitats;
- Disturbance to, and loss of, fauna habitat; and
- Introduction of weeds and feral animals and impacts to the adjacent Curtis Island National Park.

3.3.8 Marine Ecology

Areas of Conservation Significance

The Great Barrier Reef World Heritage Area encompasses the Port of Gladstone and Curtis Island and is a matter of National Environmental Significance (NES) under the *EPBC Act*. The proposed



LNG Facility location on Curtis Island lies outside the Great Barrier Reef Marine Park (Cth) and the Great Barrier Reef Coast Marine Park (Qld). Refer to *Figure 3*. The proposed Bridge and Road investigation area is located adjacent to and overlapping the southernmost boundary of the Great Barrier Reef Coast Marine Park.

The Directory of Important Wetlands in Australia (Environment Australia, 2001) lists Port Curtis, The Narrows, and Northeast Curtis Island as Nationally Important Wetlands. The Narrows is a narrow estuarine passage between Curtis Island and the mainland in near pristine condition. Impacts on areas of conservation significance will be addressed in the EIS.

Marine Flora

Estuarine environments of Port Curtis include mangroves, saltmarsh and Seagrass communities that are recognised for their value to fisheries production (Danaher *et al.* 2005) and these environments receive a limited supply of fresh water.

Mangroves are marine plants (trees and shrubs) that grow in the marine tidal zone. They serve a wide variety of functions including sediment trapping, protecting the coast from erosion and flooding, and acting as nursery and breeding areas for a range of marine and terrestrial species. Nearly 7,000 hectares of mangroves have been mapped in the Port Curtis area, the majority of which is *Rhizophora* closed forest (Danaher *et al.* 2005).

Seagrass meadows in the Project area are important feeding grounds for Dugongs (*Dugon dugon*), a species listed as “Vulnerable” under Queensland legislation and marine and migratory on Commonwealth legislation. Seagrasses are protected under section 124 of the Queensland *Fisheries Act 1994* as marine plants. Areas that support Dugongs and Seagrass are identified as a Dugong Protection Area (DPA). Extensive Seagrass mapping has been undertaken by DPIF in the Port Curtis and Rodds Bay area.

Marine Fauna

Intertidal mudflats are submerged at high tide and exposed at low tide. They provide important feeding grounds for numerous species of shorebird (wader) many of which are protected under the EPBC as well as international migratory bird agreements such as JAMBA, CAMBA and ROKAMBA. “Major” shorebird feeding and roost sites have been identified in maps within the Curtis Coast Regional Coastal Management Plan. The largest identified feeding area is between the south-eastern most tip of Curtis Island and north western shores of Facing Island. Birds Australia has limited records of migratory waders in the immediate vicinity of the proposed LNG Facility site.

Fish Habitat Areas (FHA) are declared under section 118 of the *Fisheries Act 1994* (Qld) to protect fisheries resources. The closest FHA is east of Curtis Island in the Curtis Channel. The Project is unlikely to impact on any FHA.

The Narrows south of Graham Creek and east to Facing Island, encompassing the majority of Southern Curtis Island waters is a Dugong Protection Area (DPA). DPAs are an agreed State and Commonwealth initiative designated to restrict boat speed and fishing in designated areas that are important Seagrass grazing habitats for Dugongs. Dugongs are listed as “Vulnerable” in the *Nature Conservation Act 1996* (Qld) and as “Marine” and “Migratory” in the *EPBC Act*, and “Vulnerable” globally by the IUCN (IUCN 2006).

There are no known turtle nesting beaches within close proximity to the Project area. Important turtle nesting beaches for the Flatback Turtle (*Natator depressus*) have been identified on the east coast of Curtis Island and Facing Island and further south at Tannum Sands (Limpus *et al.* 2006). The Green Turtle (*Chelonia mydas*) also nests in these locations, but in smaller numbers. Both species are listed as Vulnerable on both the *EPBC Act* and the *NC Act*.



Marine Ecology – Potential Impacts

Potential impacts to marine ecology related to the construction and operation of the LNG Facility include:

- Some clearing of mangroves will be required for construction and operation of the LNG Component and also the Bridge/Road. Mangroves are protected under section 118 of the *Fisheries Act 1994* (Qld) and a permit will be required for any clearing. The area of mangroves to be cleared will be minimised by micro-siting infrastructure so as to avoid the densest areas of mangroves; and
- Disturbance to seagrass habitats and disturbance of Dugongs. Given the extensive areas of seagrass, it is unlikely the Project will result in such a loss of seagrass that would adversely impact Dugong populations.

Under the provisions of the *MP Act* and the *GBRMP Act*, Marine Parks Permits will be required for any activities which may affect the Marine Parks.

3.3.9 Air Quality

Air quality monitoring is currently undertaken in the Gladstone region by the EPA. Currently, monitoring sites are operated at Targinie, Clinton and South Gladstone. A two-year project has recently been initiated by the EPA to:

- Collate a detailed emissions inventory;
- Undertake detailed airshed monitoring; and
- Update the existing Gladstone airshed model.

Queensland Health has also commenced a health study assessing impacts arising from atmospheric emissions in the Gladstone area.

Previous monitoring data indicates that exceedances of air quality guidelines are experienced periodically.

Air Quality – Potential Impacts

Potential air quality impacts related to the construction and operation of the LNG Facility includes:

- Dust and vehicle emissions during construction;
- Venting and flaring of hydrocarbons during normal and emergency operations, including commissioning and start-up;
- Emissions from heaters and gas turbines (NO_x, CO, CO₂, and hydrocarbons);
- Emissions from waste incinerator, if installed; and
- Fugitive emissions.

Emissions of exhaust gases from the LNG plant site may add to cumulative impacts on local air quality despite relatively low absolute emission levels. LNG plants are “clean” compared to many



industrial plants with the only significant emissions being CO₂ and NO_x. However, dry low-NO_x technology will be used for refrigeration and power generation turbines to minimize NO_x emissions.

CSG will be virtually free of sulphur compounds; therefore, SO₂ emissions from the facility will be negligible. Also the treated CSG will be used as a primary fuel for refrigeration and power generation turbines, heaters, etc. that will not produce any significant quantities of particulate matter (PM).

A number of greenhouse gas reduction measures are being considered for the LNG Component of the Project, including emissions reduction and energy efficiency measures.

The emission of greenhouse gases should be balanced against the beneficial uses of gas in terms of the reduction in emissions of particulates and sulphur dioxide when compared to other fossil fuels. Gas generates the smallest quantity of CO₂ per unit of energy produced of any fossil fuel, roughly half the amount of CO₂ produced by coal and 30% less than crude oil or condensate (Office of Energy, 2003).

3.3.10 Noise and Vibration

The LNG facility will be located in an undeveloped area within the industrial region of Gladstone. The nearest noise sensitive receptors currently identified include residences on the mainland and these are currently experiencing a mixed rural and industrial ambient noise climate.

Noise and Vibration – Potential Impacts

Potential noise sources associated with the proposed development include:

- Construction activities associated with bulk earthworks associated with site preparation and access roads, construction of the LNG Plant and associated construction dock and loading wharf;
- Pile driving of the jetty structure and the LNG Tanks constitute a major source of vibration;
- Operational activities from the LNG Facility, primarily cooling fans, generators, and gas pipes;
- Port related activities, such as loading and unloading of ships; and
- General vehicular traffic.

3.3.11 Socio-Economics

The Port of Gladstone is Queensland's largest multi-cargo port and the fifth largest port in Australia. Studies have identified the Gladstone region as Australia's most cost-efficient industrial site, rating it as one of the top 6 to 8 locations in the world for the establishment of major industry. Existing major industries in Gladstone include:

- The world's largest alumina refinery and associated aluminium production;
- A 1,680MW coal-fired power station;
- Cement production;
- Speciality production; and



- An existing 40 mtpa coal export terminal and the development of an additional 84 mtpa coal export terminal at Wiggins Island.

In addition, a range of other industrial projects are either approved or under development. This includes a nickel smelter and a number of other proposed LNG projects. Parts of Gladstone harbour are used for recreational activities including fishing and sailing.

On 15 March 2008, the Gladstone Regional Council was established from the amalgamation of Calliope Shire Council, Gladstone City Council and Miriam Vale Shire Council. The region has a population in excess of 60,000, while the population of Gladstone City is approximately 30,000. Existing public facilities in the Gladstone region include:

- Gladstone General Hospital;
- A range of schools and educational facilities including a campus site for the Central Queensland University; and
- A regional airport with flights to Brisbane and Sydney.

The population of the Gladstone region is increasing based on the increased industrial development in the region, including growth in indirect employment for support services.

Socio-Economics – Potential Impacts

The socio-economic benefits of the Project at the local, regional, State and National levels are significant. Substantial economic and employment opportunities will emerge at these levels both directly from the Project and indirectly from indirect employment (i.e. the multiplier effect).

Potential socio-economic impacts associated with the proposed development include:

- Increased demand for construction workforce impacting local wage levels in Gladstone;
- Influx of construction workforce impacts accommodation and rental costs in Gladstone;
- Increased job opportunities and income in the local economy from the construction and operational phases of the Project;
- Increased demands from the workforce on social services (include hospitals, police, schools, recreational facilities, etc); and
- Impacts on leisure and recreational facilities.

3.3.12 Visual Amenity

The southern end of Curtis Island is currently undeveloped and faces the port of Gladstone, providing a backdrop to Gladstone across Gladstone harbour.

Visual Amenity – Potential Impacts

Potential visual impacts associated with the proposed development include:

- LNG tanks are typically 50-60m high and are generally visible to surrounding areas. The LNG facility on Curtis Island is expected to be only visible from a limited number of locations and



this does not include residential areas, public roads, or publicly accessible view points. However, the LNG facility will be visible from The Narrows and parts of Gladstone harbour when travelling by boat; and

- In response to one of the World Heritage Area listing criteria (i.e. scenic quality) the visual impact of the LNG facility and associated flares from both land and navigable waters will be further investigated as part of the EIS. Flares are a safety feature and are not used on a routine basis.

3.3.13 Waste Streams

Construction related emissions and effluents (including dust generation, light and noise) are expected to be minor, short term, and their effects are unlikely to be significant.

The LNG facility will generate a range of gaseous and liquid discharges and solid wastes during both the construction and operation phase.

Waste – Potential Impacts

Potential waste impacts associated with the proposed development include:

- Construction related effluents being suspended solids in the storm water runoff;
- Construction waste generated from site clearance, site formation, blasting, dredging, reclamation, seawall construction, filling and concreting;
- Solid industrial and domestic waste and wastewater generated during operations; and
- Hazardous waste and waste oils generated during operations.

3.3.14 Risk and Safety Assessment

LNG Facilities

LNG facilities are required by Australian and international design codes to maintain certain separation distances between land-based facilities and communities including other public areas. A safety/security zone is required around LNG ships. The nearest sensitive receptors (residences) to the proposed site are over 5 km away.

There is a very low probability of release of LNG during normal operations due to the passive safety design features and systems that are in place.

A Quantitative Risk Assessment (QRA) in accordance with The Australian National Standard for the Control of Major Hazard Facilities (NOHSC:1014(2002)) and a National Code of Practice for the Control of Major Hazard Facilities (NOHSC:2016(1996)) will be performed during the detailed engineering phase. Risk assessments will be undertaken in conjunction with emergency services.

The potential hazards which could arise from the operation of the LNG Plant will be addressed in the design, operating procedures, and contingency plans developed for the Project. All practicable measures to prevent hazardous incidents and their consequences will be adopted. The safety of the LNG Plant will be reviewed continually during engineering design, construction and commissioning



and the potential hazards to the public and site personnel arising from the operation of the LNG Plant will be maintained at an acceptably low level.

Shipping Activities

Detailed LNG shipping logistics and shipping risk studies will be conducted as part the Project. These studies will include navigational safety, QRA studies and marine simulations of berthing activities.



4 MANAGEMENT OF ENVIRONMENTAL IMPACTS

The Proponents' approaches to the management of potential environmental impacts from the Project are guided by their policies and procedures on:

- Environmental Management and Social Performance; and
- Health and Safety, Security and Environment Management Systems (EMS) including the operation of project-specific Health, Safety, Security and Environment (HSSE) Construction and Operations plans which form part of its Quality Management Systems.

4.1 The Proponents' Commitments

The Proponents are committed to managing operations in a manner that will minimise environmental and social impacts and maximise benefits through the implementation of a robust process of Project planning, impact assessment and mitigation, and management controls.

QGC has successfully developed and operated coal seam gas fields for more than five years and has gained industry-leading experience in the management and mitigation of environmental, health and safety and community impacts.

BG has an extensive operating track record and has successfully built six LNG trains to date in Trinidad and Egypt as part of its LNG business activities.

4.2 The Approach of the Proponents

4.2.1 QGC Operational Management

QGC field development is undertaken in accordance with Level 1 EA for the petroleum activities on its tenements.

The standardisation of environmental management across all QGC operated tenements has progressed under a project Environmental Management Plan which details the potential impacts, environmental protection objectives and environmental mitigation measures/controls for petroleum activities to be undertaken. This has been prepared in consultation with the EPA to meet the all regulatory requirements.

QGC operates the gas exploration and production activities with a view to balance its company growth with landholder, traditional owner and environmental expectations. Initiatives within QGC exist for the beneficial use of associated water to meet the needs of its regional community and develop sustainable use of land and resources under its management.

QGC's objectives for environmental performance are encompassed in the QGC Code of Environmental Practice:

- Comply with or exceed all applicable laws, regulations, advisory and industry standards and, where adequate laws do not exist, adopt and apply standards that reflect the company's commitment to HSEQ and make adequate provision of resources to meet these requirements;



- Provide a suitable working environment and conditions in which employees can work without danger to themselves, the community and the environment;
- Involve all of its employees in the continuous improvement of HSEQ performance;
- Train and hold individual employees accountable for their area of responsibility through continuous education and defined role descriptions;
- Manage risk by implementing systems to identify, report, assess, monitor and control risks and by reviewing performance;
- Ensure that all employees and visitors such as contractors, suppliers and guests are informed of and understand their obligation with respect to this Policy;

4.2.2 BG Business Principles and Standards

BG's commitment to managing to the highest standards environmental and social issues related to its activities are reflected in its Business Principles. These are BG's highest level statements of commitment and are approved by the Board of Directors. BG Group's Business Principles state that BG is committed to:

- Making a positive contribution to the protection of the environment;
- Going beyond compliance with local environmental regulations to meet internationally accepted best practice; and
- Reducing to the minimum practicable and adverse effects of our operations on the environment;
- Meeting internationally accepted good practice in community relations;
- Recognising that human rights are an important aspect of our business practice and respecting the protection of human rights within its areas of influence.

BG implements a series of systems to ensure that activities conform to the principles outlined above and that the environment and communities are safeguarded. These include:

- HSSE and Social Performance Management Systems;
- Environmental Management System (EMS) accreditation;
- Control of significant environmental effects;
- Environmental monitoring and performance indicators;
- Setting quantifiable objectives and targets; and
- Contractor management and procurement.



4.2.3 Environmental Management Plans

Draft Environmental Management Plans (EMPs) covering construction, operation and decommissioning will be included within the EIS and will be finalised prior to the commencement of construction activities.



REFERENCES

Curtis Coast Regional Coastal Management Plan (Qld. Environment Protection Agency September 2003) and associated maps;

Danaher KF, Rasheed MA, and Thomas R (2005). The intertidal Wetlands of Port Curtis. Qld DPI Fisheries.

Environment Australia (2001). A Directory of Important Wetlands in Australia. Third Edition. Environment Australia Canberra.

Limpus CJ, McLaren M, McLaren G and Knuckey B (2006). Queensland Turtle Conservation Project: Curtis Island and Woongarra Coast Flatback Turtle Studies, 2005-2006. Qld Environment Protection Agency.

Rasheed MA, Thomas R, Roelofs AJ, Neil KM and Kerville SP (2003). Port Curtis and Rodds Bay Seagrass and Benthic Macro-invertebrate community baseline survey. Qld DPI Fisheries Marine Ecology Group.

Shaffelke B, Waterhouse J and Christie C (2001). A Review of Water Quality Issues Influencing the Habitat Quality in Dugong Protection Areas. Great Barrier Reef Marine Park Authority. Research Publication 66.

Databases searched (variously across Project Components)

- Queensland Herbarium HERBRECS database for threatened flora (searched February 2008).
- Birds Australia New Atlas database for birds (searched February 2008).
- *EPBC Act* Protected Matters Search Tool (searched February 2008).
- Queensland Environment Protection Agency and Queensland Parks and Wildlife Service Wildlife Online Extract (searched February 2008).
- EPA Regional Ecosystem and Essential Habitat Mapping online

Personal Communications

Dr Ivan Lawler. Dugong researcher. James Cook University. 27 February 2008.



GLOSSARY

µs/cm	microsiemens per centimetre
2P	Proven and Probable
3P	Proved, Probable and Possible
A\$	Australian Dollars
ACGIH	American Conference of Government Industrial Hygienists
ALARP	As Low As Reasonably Practicable
ANZECC	Australian and New Zealand Environmental Conservation Council
ASR	Air Sensitive Receivers
AS	Australian Standard
ASS	Acid Sulphate Soils
AS2885	Australian Standard 2885 Pipelines - Gas and Liquid Petroleum
BG	British Gas Group
BoG	Boil-off Gas
BoP	Balance of Payment
Ca CO₃/L	Calcium Carbonate per Litre
CAF	Compressed Asbestos Fibre
CEMP	Construction Environmental Management Plan
CH₄	Methane
CHMP	Cultural Heritage Management Plan
CFC	Chlorofluorocarbons
CO	Carbon Monoxide
CO₂	Carbon Dioxide
CSG	Coal Seam Gas
Cth	Commonwealth
dBA	decibels
DEWHA	Department of Environment, Water, Heritage and the Arts
DPA	Dugong Protection Area
DPIF	Department of Primary Industries and Fisheries
E	Endangered
EA	Environmental Authority
EHS	Environmental Health and Safety
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth).</i>



ERA	Environmentally Relevant Activity
FHA	Fish Habitat Area
FEED	Front End Engineering Design
GPC	Gladstone Ports Corporation (previously known as the Central Queensland Ports Authority)
GSDA	Gladstone State Development Area
GSP	Gross State Product
H₂S	Hydrogen Sulphide
ha	hectares
HAZOP	Hazard and Operability Study
HCl	Hydrogen chloride
HERBRECS	Queensland Herbarium database
Hg	Mercury
HHV	High heating value
HSE	Health and Safety Essentials
HSSE	Health, Safety, Security and Environment
IAS	Initial Advice Statement as defined by part 4 of the <i>State Development and Public Works Organisation Act 1971</i> (Qld)
ILUA	Indigenous Land Use Agreements
IP Act	<i>Integrated Planning Act 1997</i> (Qld)
IUCN	International Union for Conservation of Nature
JSEA	Job Safety and Environmental Analysis
km	kilometre
km²	kilometre square
km/day	kilometre per day
kW	kilowatt
LNG	Liquefied Natural Gas
L/s	litres per second
m	metres
mg/L	milligrams per litre
ML	mega litres
MLVs	Mainline Valves
mm	millimetres
mtpa	million tonnes per annum
N₂	nitrogen
NC Act	<i>Nature Conservation Act 1993</i> (Qld)
NES	National Environmental Significance as defined by the <i>Environment Protection & Biodiversity Conservation Act 1999</i> (Cth)
NOx	Nitrogen Oxides



NODGDM	National Ocean Disposal Guidelines for Dredged Material
NTRB	Native Title Representative Bodies
OEMP	Operational Environmental Management Plan
pH	Acidity and alkalinity of water
PLA	Petroleum Lease Application
PL	Petroleum Lease
PPL	Petroleum Pipeline License
PJ	Petajoules
PJ/a	Petajoules per annum
Proponents	BG International and Queensland Gas Company
Q1	Quarter 1
Q2	Quarter 2
Q3	Quarter 3
Q4	Quarter 4
QGC	Queensland Gas Company
Qld	Queensland
QUAKES	Queensland University Advanced Centre for Earthquake Studies
R	Rare
RTN	Right to Negotiate
SEVT	Semi-Evergreen Vine thicket
SDPWO Act	<i>State Development and Public Works Organisation Act 1971 (Qld)</i>
SIA	Social Impact Assessment
SO_x	Sulphur Oxides
SWMP	Stormwater Management Plan
TCF	Trillion Cubic Feet
TDS	Total Dissolved Solids
TJ	Terajoules
TJ/day	Terajoules per day
UCG	Underground Coal Gasification
UHF	Ultra High Frequency
V	Vulnerable
VHF	Very High Frequency
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>
VOC	Volatile Organic Compounds
VSR	Visual Sensitive Receivers
WildNet	Environmental Protection Agency WildNet Database



APPENDIX

The following maps are included within this Appendix:

Figure 1 – IAS Project Overview (Location of Project Components)

Figure 3 – Map of Gladstone and Curtis Island area indicating proposed: Location of the LNG Facility Investigation Area; Pipeline Investigation Area; Bridge & Road Investigation Area; and Dredging Investigation Area.



Queensland Curtis LNG Project



Insert Figure 1



Queensland Curtis LNG Project



Insert Figure 3