Australia Pacific LNG Project

Volume 4: LNG Facility

Chapter 17: Traffic and Transport

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17. Traffic and transport

17.1 Introduction

This chapter of the environmental impact statement (EIS) forms the traffic and transport impact assessment of the liquefied natural gas (LNG) facility on Curtis Island, Gladstone element of the Australia Pacific LNG Project (the Project). The assessment addresses the traffic and transport impacts associated with the development, construction and operation of the LNG facility. It identifies the nature, magnitude and significance of the traffic and transport impacts and identifies appropriate measures for impact management and mitigation, which are designed to reduce negative impacts and maximise the positive benefits.

The technical report in Volume 5 Attachment 35 underpins the outcomes summarised in this chapter. It provides a detailed technical assessment of the impact on the whole transport network from all components of the Project. The technical report covers the background, methodology, impacts, impact assessment and mitigation measures for each mode of transport across the whole transport network.

17.1.1 Purpose

Australia Pacific LNG recognises that the construction and operation of the LNG facility could create environmental and community impacts and that successful management of these impacts will be crucial throughout the life of the Project. To this end, the assessment of this project across all disciplines has incorporated 12 recognised sustainability principles.

The sustainability principles applied to the traffic and transport component of the EIS are:

- Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas
- Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities.

17.1.2 Scope of work

The LNG facility will be located in the Curtis Island Industry Precinct of the Gladstone State Development Area (GSDA) at Laird Point. The LNG facility comprises LNG manufacturing and storage facilities and marine export facilities.

The LNG facility will comprise four LNG trains and has an ultimate production capacity of approximately 18 million tonnes per annum (Mtpa). The initial development will be comprised of Trains 1 and 2, with up to 4.5Mtpa capacity each. Trains 1 and 2 will be constructed and both operational by 2015, while Trains 3 and 4 will both be operational by 2022. The timing of commencement of construction of Trains 3 and 4 will depend on the LNG markets and gas development. It is assumed that the construction of Train 3 would commence by 2017 and Train 4 would commence nine months after the commencement of Train 3.

The discussion in this chapter relates to the impacts from the additional traffic generated by the construction and operation of the LNG facility. The discussion relating to the construction and

operation of the gas fields and the gas transmission pipeline is presented within Volume 2 Chapter 17 and Volume 3 Chapter 17 respectively.

The technical report, provided in Volume 5 Attachment 35, assessed the impact of all of the components of the Project across the study area. This included the gas fields study area, the gas pipeline corridor to Gladstone, the greater Gladstone area and an area on Curtis Island allocated to the LNG facility as shown in Figure 17.1. The study area for the potential impacts from the construction and operation of only the LNG facility can be isolated to the greater Gladstone area. Although the LNG facility will generate additional traffic outside of the greater Gladstone area, this traffic will have a negligible impact on the transport network. For example, deliveries of materials to the LNG facility from Brisbane via the Bruce Highway will peak at less than 10 vehicles per day which is less than 1% of the total vehicles on this section of road. The Guidelines for the Assessment of Road Impacts of Developments (GARID) state that "Department of Transport and Main Roads (DTMR) generally considers a development's road impacts to be insignificant if the development generates an increase in traffic on state controlled roads of no more than 5% of existing levels".

Key issues addressed

Concern has been raised by government agencies associated with development in Gladstone regarding to the viability of Auckland Point (or 'Port Central' as commonly referred) as the primary staging post for the distribution of project materials and personnel, both during the construction and operational phases. The two other LNG proponents (Gladstone LNG and Queensland Curtis LNG) have identified Auckland Point for this purpose.

To address these concerns an alternative option to Auckland Point has been developed and forms the basis for assessment in this report.

Fisherman's Landing North Expansion (FLNE) has been identified as the primary embarkation point for the transfer of goods and personnel during the construction and operational phase of the LNG facility. This plan shifts a significant amount of LNG facility's marine traffic into the Western Basin and avoids the congestion around Wiggins Island compared to shipping from Auckland Point. In terms of road traffic this option also avoids the potential capacity and operational constraints at Port Central. Other alternatives are discussed in the Volume 4 Chapter 3.

Figure 17.1 Study area

During construction vacant land off Blain Drive in West Gladstone (commonly referred to as Ash Pond #7) will be used as a construction staff car park. Personnel will drive their private vehicles to this location and then are bussed to Fisherman's Landing. Operational staff will drive directly to Fisherman's Landing, park their vehicles in a staff car park and then be ferried to the LNG facility.

Terms of reference

The Department of Infrastructure and Planning has produced the terms of reference (TOR) for the Project (December 2009). These provided the base assessment criteria for the Project. A series of issues to be addressed were identified for transport, including the need to describe and assess existing transport conditions, the proposed project and the likely impact of this project on the network, and the proposed mitigation measures.

Traffic generated by the Project may result in impacts outside of the scope of works of this chapter but which are addressed in other chapters of the EIS. Table 17.1 identifies other volumes and chapters of the EIS where traffic and transport issues related to the LNG facility and identified in this report are further assessed.

Table 17.1 Cross referencing with other chapters in EIS

Transport related issue	Volume and chapter in EIS where addressed
Likelihood of product spill	Volume 4 Chapter 22
Quarantine management/ spreading of weeds/pests	Volume 4 Chapter 8
Waste management	Volume 4 Chapter 16
Greenhouse gas emissions	Volume 4 Chapter 14
Projected construction and operational workforce	Volume 4 Chapter 20
Impact of project shipping on marine environment	Volume 4 Chapter 10
Measures to reduce the risk of accidents involving Australia Pacific LNG personnel and/or machinery	Volume 4 Chapter 24
Impact on foreshore from shipping	Volume 4 Chapter 12
Heritage and cultural considerations	Volume 4 Chapter 18 and Volume 4 Chapter 19

17.1.3 Legislative and policy framework

Government Acts and regulations

There are numerous pieces of legislation and policy produced by the commonwealth, state and local governments that are relevant to transport operations. Together with the TOR these provide the reference point for undertaking this assessment. Key documents are identified below in Table 17.2, along with the purpose and relevance to the Project.

Table 17.2 Government Acts and regulations

Legislation	Objective or purpose of legislation	Relevance to the Project
Transport Infrastructure Act 1994	To encourage effective integrated planning and efficient management of a system of	Forms the basis for the road impact assessment

Legislation	Objective or purpose of legislation	Relevance to the Project
	transport infrastructure	Road design requirements, policy objectives for the efficient use of the network and identifies the capital roads program (RIP) Statutory requirements for rail safety
AusLink (National Land Transport) Act 2005	The objective of this Act is to assist national and regional economic and social development by the provision of Commonwealth funding aimed at improving the performance of land transport infrastructure	The commonwealth provides funding to a number of state controlled highways used by project traffic and that may require alterations
Transport Operations (Road Use Management) Act 1995	This Act establishes a scheme to allow the management of vehicles, drivers and access to the road network	Establishes compliance procedures
Road Transport - Heavy Vehicle Driver Fatigue Act 2006 (as amended 29 September 2008)	The Act is a national model law that is intended to provide the basis for nationally consistent transport laws. The legislation makes all parties in the supply chain legally responsible for preventing driver fatigue. The new laws apply to both trucks and buses	As identified under the relevant state legislation below mitigation measures identified in this chapter comply with this requirement
Transport Operations (Road Use Management – Fatigue Management) Regulation 2008	Provides for the safe management of fatigue for drivers using fatigue-regulated heavy vehicles	The Project involves travel across long distances by road. Managing of driver hours to ensure road safety may form part of the mitigation measures identified in this chapter
Transport Operations (Road Use Management—Mass, Dimensions and Loading) Regulation 2005	Management of vehicle types on State-controlled roads	Defines the regulations for issuing of permits for oversized vehicles, which will be required for some project traffic
Transport Infrastructure (State Controlled Roads) Regulation 2006	Regulations pertaining to access, road works and ancillary works encroaching on State controlled roads	Establishes regulations to be adhered to for road intersection alterations on State controlled roads
Transport Infrastructure (Ports) Regulation 2005	Defines the port limits and sets out port management guidelines and protection from liabilities	Defines the extent of the port and the legislative requirements applicable for the area within the port and outside of the port limits
Transport Operations (Marine Safety) Act 1994	This Act provides a system that achieves a balance between regulating the maritime industry to ensure marine safety and	Provides a system to assess strategic marine safety and related marine operational issues

Legislation	Objective or purpose of legislation	Relevance to the Project
	enabling the effectiveness and efficiency of the Queensland maritime industry to be further developed	Manages the operation and activities of ships and establishes a marine board as a representative body to advise the Minister Identifies safety obligations to ensure seaworthiness and other aspects of marine safety
Transport Operations (Marine Safety) Regulation 2004	The role of this regulation is to prescribe various matters for the *Transport Operations (Marine Safety) Act 1994*	As noted for the *Transport Operations (Marine Safety) Act 1994*
Transport Operations (Marine Pollution) Act 1995	The overall purpose of this Act is to protect Queensland's marine and coastal environment by minimising deliberate and negligent discharges of ship-sourced pollutants into coastal waters	Defines the requirements for the management of potential ship discharges
Maritime Transport and Offshore Facilities Security Act 2003	This Act establishes a scheme to safeguard against unlawful interference with maritime transport or offshore facilities	The Act establishes an outcomes-based preventive security framework that enables Australia Pacific LNG to develop individual security plans that are relevant to the Project and specific defined risks
Civil Aviation Act 1988	Establishes the Civil Aviation Safety Authority (CASA) and a regulatory framework for maintaining, enhancing and promoting the safety of civil aviation	Defines the legislative requirements for the operation of air services that will be utilised by the Project
Great Barrier Reef Marine Park Act 1975	Established the Great Barrier Reef Marine Park (the Marine Park) Established the Great Barrier Reef Marine Park Authority (GBRMPA), a Commonwealth authority responsible for the management of the Marine Park Provides a framework for planning and management of the Marine Park, including through zoning plans, plans of management and a system of permissions Requires compulsory pilotage for certain ships in prescribed areas of the Great Barrier Reef Region. Provides for regulations, collection of environmental management charge, enforcement, etc	Establishes standards to be adhered to when working within the Marine Park

Policy and network planning documents

Table 17.3 lists the various local and state government planning and policy documents of relevance to the Project.

Table 17.3 Policy and network planning documents

Policy and network planning document	Objective or purpose	Relevance to the Project
The Gladstone Integrated Regional Transport Plan (GIRTP) 2001-2030	The plan sets out a comprehensive framework for the future development of Gladstone's regional transport network for the next 30 years	Matters of particular interest to the Project include: • The need to alter the Mt Larcom Road connection from the Bruce Highway to Gladstone Port and city • Ongoing widening to four lanes of the Dawson Highway from Gladstone all the way to the Landing Road cut-off • Improvements of facilities at Auckland Point and Fisherman's Landing, including improved road and rail access • The promotion of more active transport, in particular the improvement of the limited bus network and subsequently an increase of bus usage which was identified as being very low • Improving air services at Gladstone airport • An integrated transport network incorporating multi-modal infrastructure
The Roads Implementation Program (RIP) [2008/09–2012/13	This details the DTMR projects that have been allocated funds and includes information about the funding allocation and expected timing of the proposed works	Planning for grade separation interchange of the Bruce Highway/Dawson Highway 'T' intersection
Gladstone Regional Council planning scheme(s). There is an overall regional council plan in preparation. Council currently administers the previous Gladstone City, Miriam	The planning scheme provides the regulatory framework for development approval relating to council infrastructure and other developments, as defined	As previously identified, Gladstone will experience a growth in traffic as a result of this project and consultation with Council will play a crucial part in the Project's mitigation measures

Policy and network planning document	Objective or purpose	Relevance to the Project
Vale Shire and Calliope Shire Council schemes		
Gladstone Ports Corporation 50 year Strategic Plan 2008	The plan identifies the potential port developments and provides a plan to assist the ports readiness for accommodating the continuing growth of Gladstone's industry in a sustainable and secure manner	An efficient and safe port operation is crucial for the successful delivery of the Project. Working closely with the Ports Authority will be important when considering mitigation measures
Gladstone airport Development Plan 2008	This updated development plan provides for a range of alterations, including improved passenger terminal facilities and the extension and strengthening of the runway to enhance jet aircraft operations	Gladstone airport will be used by project staff. Potential impacts and mitigation measures have been framed to support the airports development plans. Airport upgrades will enhance resource sourcing, nationally, and competitiveness
Gladstone City Council Walk - Cycle Network Improvement Plan 2006	The plan seeks to expand the existing limited and largely fragmented network and aims to improve the relatively low level of cycle use	Proposed road and intersection alterations seek to include pedestrian and cyclist facilities

17.2 Methodology

This section provides details about the methodology adopted to assess the potential impacts on the transport network (including road, rail, air and shipping) from the construction and operation of the LNG facility.

This assessment of the transport network was undertaken within the following parameters:

- The Project's early works are assumed to commence in late 2010, with the operation of Trains 1 and 2 commencing by 2015. For the purpose of this assessment, it is assumed that construction of Train 3 will commence in 2017 and Train 4 would commence approximately nine months after the commencement of Train 3 with full operation in place by 2022. The dates of construction will be market driven however the timing has been assumed for the purpose of impact assessment on the traffic and transport network
- Movement of material and personnel to site will initially be by road based transport and ferry/barge from Fisherman's Landing north expansion
- Fisherman's Landing north expansion has been assumed as the location of the mainland facility for material, personnel and aggregate material movements from the mainland to Curtis Island
- During construction vacant land off Blain Drive in West Gladstone (commonly referred to as Ash Pond #7) will be used as a construction staff car park. Personnel will drive their private vehicles to this location and then are bussed to the Fisherman's Landing site. Operational staff will drive directly to Fisherman's Landing, park their vehicles in a staff car park and then be ferried to the LNG facility
- The assessment does not include the provision of a bridge from the mainland to Curtis Island.

17.2.1 Road network

Assessment timeframe

The year 2010 has been selected as the starting point for assessment purposes.

The DTMR's GARID indicates that, for staged developments, the planning horizon should be 10 years after the final stage opens. Therefore the timeframe for the assessment of any works continues until 2032, as the Train 4 of the LNG facility is assumed to be fully operational by the year 2022.

Traffic analysis scenarios

In general, the traffic scenarios modelled in the assessment were as follows:

- Background – this assessment was undertaken with the background traffic within the assessment timeframe and factored by the appropriate growth rates
- Background plus development– this assessment was undertaken with background traffic plus the addition of the traffic generated from the Project
- Background plus development and regionally-significant projects – this assessment was undertaken with background traffic, plus the addition of the traffic generated from the Project, and with traffic generated from other regionally-significant projects.

The assessment of intersection performance was undertaken for the following:

- Year 2010 – as detailed above, this is the first year of the Project assessment period
- Year 2013 – this is the first peak traffic generation year of the Project, and is associated with constructing LNG Trains 1 and 2. This coincides with the construction of the gas pipeline
- Year 2019 – this is the second peak traffic generation year of the Project, and is associated with constructing LNG Trains 3 and 4. This coincides with the operation of Trains 1 and 2. While an earlier peak occurs in 2013, 2019 will be critical as it will be combined with a higher background traffic component
- Year 2032 – this is the final year of the Project assessment period.

Assessment triggers

According to the GARID a project's road impacts are considered insignificant if the project generates an increase on State controlled roads of less than five percent of existing levels. In the event the project generates an increase of more than five percent then the impact is deemed to be potentially significant and the impact needs to be assessed.

Growth rates

During the analysis period, there is predicted to be an increase in background traffic volumes due to growth in the region independent of the Project. The growth rates are based upon:

- Years 2008–2020 – applying the historic 10 year average growth rate based on the assumption that this growth rate continues to 2020
- Years 2020–2032 – applying a decaying growth rate based on the assumption that this 10 year growth rate is not realistically expected to continue, and that a more modest growth rate would occur. This was calculated by reducing the 2010 growth rates by 20% in 2032 and interpolating

for the years in between. This reflects general background traffic growth and generally excludes this and other known regionally significant projects currently planned for the study area

There were two other limitations exercised in the growth rate parameters, as follows:

- Where the 10 year historical growth rate was less than 1%, including roads with negative growth, a growth rate of 1% p.a. was adopted
- Where the 10 year historical growth rate was greater than 5%, a rate of 5% was adopted for the first 10 years. The growth rate then decays as detailed above.

Sketch planning model

A sketch planning model was developed to calculate the Project's traffic. A sketch model is a transport model that aims to simplify/streamline the forecasting of traffic volumes. The Project's sketch model has been developed in a series of spreadsheets, with additional coding of traffic distribution and routes in a geographical information system. Full details on the structure, use and capability of this model are found in the technical report in Volume 5 Attachment 35.

Road components analysed

When determining the impact of the Project, four components of the road infrastructure network were analysed. These were road links, intersections, pavement and bridge capacity.

Road link, intersection and pavement capacity were assessed using the sketch planning model, which combined background traffic and growth rates with the Project's generated traffic.

The impact of the Project on bridges was assessed qualitatively, as only limited bridge condition data was made available for this assessment.

The methodology used to determine the Project's impacts are presented below (Section 17.2.1) for each of these components.

Road link capacity analysis

The following methodology was adopted to assess the road links within the LNG facility study area:

- Identify the road links within the study area that could be utilised by the Project's traffic
- Identify planned road alterations within the study area
- Gather all available data on existing traffic volumes on the road links within the study area
- Input traffic data into the sketch model
- Analyse the network over the analysis period of 2010 to 2032, by factoring the average annual daily traffic by the appropriate growth rates to determine background traffic to road links
- Identify and report deficiencies in the existing network (i.e. where road capacity is exceeded)
- Add project traffic to existing background traffic to calculate increased traffic due to the Project
- Identify the road links where the Project's traffic has a significant impact (i.e. where the Project's traffic exceeds five percent of existing traffic)
- For the road links deemed to have been significantly impacted by the Project, determine alteration requirements to maintain road link safety and capacity

- Determine whether alteration needs to be brought forward due to the Project's traffic, and by how many years
- Repeat assessment for traffic generated by regionally significant projects.

The capacity assessment of the road links has been generally based on the approach outlined in Austroads Guide to Traffic Engineering Practice – Part 2.

The capacities identified in Table 17.4 are based on a level of service E.

The level of service is a qualitative measure describing traffic operational conditions on a road and the perception of these conditions by motorists and/or passengers. Six levels are used, from A to F. Level of service A represents free flow conditions in which individual drivers are virtually unaffected by the presence of other drivers. Level of service C is a level where most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre on a road. Level of service F represents congested conditions which experience large delays.

The capacities identified in Table 17.4 are based on level of service E and provides a summary of the adopted capacities for various road links within the study area.

Table 17.4 Roadway link capacities

Roadway type	Capacity (vehicles per day)
Rural, two lanes	16,000
Rural, four lanes with median	40,000
Urban, two lane	18,000
Urban, four lane no median, no access control	30,000
Urban, four lane with median, no access control	36,000

The road link capacity analysis for rural roads has also considered the operating level of service. Extended operation on rural road links at level of service D and E is considered intolerable.

Table 17.5 summarises the maximum average annual daily traffic (AADT) for various levels of service as per the Austroads guidelines for rural roads.

Table 17.5 Adopted maximum AADTs for various levels of service

Road link type	AADT for level of service				
	A	B	C	D	E
Rural, two lane	1,200	3,000	5,500	8,400	16,000
Rural, four lane	13,200	18,000	24,000	30,400	40,000

Intersection capacity analysis

The methodology adopted to undertake the intersection impact assessment was as follows:

- Identify intersections within the study area that could be significantly impacted by project traffic. The intersections were initially identified as those on road links where the Project traffic could be more than five percent of existing background traffic

- Obtain background AM/PM peak hour traffic volumes for the intersections from the sketch model
- Analyse the existing intersection operation over the assessment timeframe
- Identify intersections that reach capacity within the assessment timeframe and the year at which the capacity is reached
- Obtain background plus development AM/PM peak hour traffic volumes for intersections from the sketch model
- Analyse existing intersection operation over the assessment timeframe for background plus Project traffic
- Identify intersections that reach capacity within the assessment timeframe and the year at which capacity is reached for background plus Project traffic
- For intersections that reach capacity within the assessment timeframe, determine intersection alterations required to maintain intersection capacity throughout the assessment timeframe
- Repeat the assessment for traffic generated by regionally significant projects to determine cumulative impacts.

The SIDRA intersection 3.2 analysis program was used to analyse key intersections for each of the analysis scenarios. This program calculates the operation of intersections based upon input parameters including geometry and traffic volumes. Output from the SIDRA intersection analyses provides values for the degree of saturation, queue lengths and delays. The degree of saturation is a volume–to-capacity ratio and is a common variable for assessing intersection performance. The adopted upper limits for an intersection performing satisfactorily were as follows:

- Unsignalised priority intersections: 0.80
- Roundabouts: 0.85
- Signalised intersections: 0.90.

The degree of saturation limits are based upon the GARID limits. A degree of saturation exceeding these values indicates that the intersection is nearing operational capacity. Above these values, users of the intersection are likely to experience unacceptable levels of service and delay.

Pavement capacity analysis

The following methodology was adopted for the impact assessment of the pavements on the State controlled roads:

- Identify the road links within the study area that could be significantly impacted by Project traffic (i.e. where Project traffic exceeded five percent of existing background traffic)
- Obtain all available data about existing traffic volumes, vehicle classification, conditions and roughness on these road links
- Calculate current equivalent standard axles to the road links
- Identify the year that the existing pavement would reach terminal roughness based on background traffic and determine the corresponding equivalent standard axles. This represents the remaining life of the road link pavement in equivalent standard axles and provides the year at which, under normal operating conditions, rehabilitation would be required

- Obtain the Project traffic equivalent standard axles from the sketch model and add these to the background equivalent standard axles to calculate the increases pavement loading due to the Project
- Determine the year at which the existing pavement will reach terminal roughness based on background plus project equivalent standard axles. This year represents the year when pavement rehabilitation would be required due to project traffic.

The pavement analysis comprises two components – the impact on the timing of pavement rehabilitation and the increased maintenance required to the network due to project traffic. The assessment was based on a comparison of the cumulative equivalent standard axle loads, with and without the Project during the analysis period.

The cumulative number of equivalent standard axles loaded onto the roadway segment to the terminal year was calculated based upon the equivalent standard axle loading along the haulage routes. The background volumes were based upon classified AADT volumes with a cumulative heavy vehicle growth rate equivalent to the normal background traffic growth. For this analysis a value of 2.9 equivalent standard axles for each heavy vehicle was applied for the Bruce Highway, while 3.2 equivalent standard axles for each heavy vehicle were used for all other State controlled roads.

Terminal roughness values for the various road links were broadly based on Figure 2.2 of the Queensland Transport's Pavement Rehabilitation Manual 1992. In general, rural roads were assumed to be equivalent to secondary roads with a terminal roughness of 175. With the exception of the Bruce Highway, all other roads were assigned a terminal roughness of 120 which was consistent with assumptions presented in the Gladstone LNG (Santos/Petronas) and Queensland Curtis LNG Project (QGC/BG) environmental impact statements.

Pavement impacts on local roads could not be performed because of the lack of condition data and historic deterioration rates to these roads.

As pavement impact is a cumulative assessment, separate consideration of the other regionally-significant projects was not required. The impact of these projects is to be assessed in isolation, to determine individual project contribution to pavement rehabilitation.

Bridge capacity analysis

Bridges potentially impacted by the Project along roads used by project traffic were identified and assessed. The assessment was based on information sourced from the DTMR database and site inspections of the haul routes. It included considering the potential loads to the bridges due to Project traffic, as well as physical constraints such as the height and width of the bridges. Data was only available for bridges located on the State controlled road network.

17.2.2 Rail network

The analysis methodology for determining the impact on the rail network was based on assessing the capacity of the existing network, and determining what additional infrastructure would be required. This was undertaken in consultation with Queensland Rail.

Investigation of the use of the rail network included assessing the potential transport of pipe segments and the transport of personnel. These are further described in Volume 2 Chapter 17 and Volume 5 Attachment 35. It is currently not envisaged to use the rail network for the construction and operation of LNG facility.

17.2.3 Shipping

The methodology adopted for the assessment of the impact of the LNG facility construction and operation on the shipping infrastructure involved the following:

- Review of the documentation produced by a range of organisations. Sixteen separate specialist reports were reviewed during the course of this assessment, including computer simulation modelling of proposed shipping operations through the Great Barrier Reef Marine Park.
- Consultation with a range of agencies including the Gladstone Ports Corporation (GPC), Maritime Safety Queensland (MSQ), the Great Barrier Reef Marine Park Authority (GBRMPA), the Gladstone Regional Council (GRC), the Australia Quarantine and Inspection Service (AQIS), Queensland Police and the Australian Customs and Border Protection Service (ACBPS).

The impact assessment was primarily concerned with environmental and safety issues arising from the increase in shipping in the marine environment including passage through the Greater Barrier Reef Marine Park, transfer of goods and material from the mainland to and from the proposed LNG facility on Curtis Island and vessel berthing arrangements at the material offloading facility (MOF) servicing the LNG facility.

17.2.4 Air services

The Project's impact on air services was assessed by comparing project traffic to airport capacity and current flight schedules. Discussions have been held with the GRC about current operations and requirements for any future alterations to the airport.

17.2.5 Cumulative analysis

A combination of quantitative and qualitative assessments was used to analyse the cumulative impact of other regionally significant projects on the traffic and transport impact assessment of the LNG facility on Curtis Island, Gladstone element of the Project.

The Department of Infrastructure and Planning's website was reviewed to identify other regionally significant projects that may potentially impact the transport network. Not all projects outlined in the list could be assessed because of the lack of information available within the public domain.

Projects that were included in the analysis were as follows:

- Central Queensland Pipeline (Jemena)
- Gladstone LNG (Santos/Petronas)
- Gladstone LNG Project—Fisherman's Landing
- Queensland Curtis LNG Project (QGC/BG)
- Gladstone Pacific Nickel
- Surat to Gladstone Pipeline (Arrow/Shell)
- Wandoan Coal Mine
- Wiggins Island Coal Terminal
- Surat Basin Railway.

17.3 Existing environment

17.3.1 Existing road network

The key State controlled and Council controlled road links within the study area which service the LNG facility during the construction and operational phases are described in Table 17.6.

Table 17.6 Key State controlled and Council controlled road links

Road name	Description
Gladstone Port Access Road	The Gladstone Port Access Road is a State controlled road that was constructed in 2005 as a link road between Gladstone and the port facilities. It was initially identified as a project in the Gladstone Integrated Regional Transport Plan. The road is a two-lane urban road signposted at 60km/hr and is a designated haulage route for 23m and 25m B-doubles. There are no midblock intersections on this road as the road is grade separated from adjacent streets and railway lines.
Gladstone-Mt Larcom Road	Gladstone-Mt Larcom Road is a State controlled road connecting the Bruce Highway at Mt Larcom (chainage 32.14) to Red Rover Road (chainage 4.625), approximately 4.6km west of the Gladstone Port Access Road. The road is a two lane rural road and is a designated haulage route for 23m and 25m B-doubles. It is signposted between 80km/hr and 100km/hr.
Hanson Road	Hanson Road is a State controlled road that extends from Red Rover Road to the Gladstone Port Access Road. From the Gladstone Port Access Road to Gibson Street the road is a four-lane urban road and is a designated haulage route for 23m and 25m B-doubles. From Gibson Street to Red Rover Road the road is a rural two-lane road. Hanson Road is referred to as Gladstone Mt Larcom Road in DTMR databases and extends approximately from chainage 0.172 to chainage 4.625. The road is signposted at 60km/hr.
Glenlyon Street	Glenlyon Street is a State controlled road extending from the Gladstone Port Access Road to the Dawson Highway. Glenlyon Street is a four- lane urban road and is also referred to as Gladstone-Mt Larcom Road in DTMR databases extending from chainage 0.0 to chainage 0.172. The road is signposted at 60km/hr.
Dawson Highway	The Dawson Highway is a State controlled road connecting Gladstone with the Central Highlands. The portion of the Dawson Highway relevant to the LNG facility extends from Glenlyon Street (chainage 0.0) to the Bruce Highway (chainage 19.05). Between Glenlyon Street and Chapman Drive the Dawson Highway is a four-lane urban road. Between Chapman Drive and the Bruce Highway, the Dawson Highway is a two-lane rural road. The road is a designated Type 1 road train route. The speed limit is generally 100km/hr except in urban areas where the speed limit is posted at 60km/hr.
Blain Drive	Blain Drive is a Council controlled sub-arterial road which connects Hanson Road and the Dawson Highway. It is a two-lane undivided urban road with a 60 to 70km/hr posted speed limit.
Landing Road	Landing Road is a Council controlled road and is a two lane rural road. The speed limit is generally 100km/hr reducing to 80km/hr in sections.

AADT data was obtained from the DTMR for the State controlled road links within the study area. The traffic volume information is summarised in Table 17.7 below. Where available, traffic data on Council controlled roads was also obtained.

Table 17.7 Existing traffic volumes

Road name	DTMR No.	Section	AADT 2009
Gladstone Port Access Road	183	Mark Fenton Drive to Glenlyon Street (chainage 0.0 to 0.858)	2,100
Gladstone Mt Larcom Road	181	Red Rover Road to Landing Road (chainage 4.625 to 12.292)	6,500
		Landing Road to Bruce Highway (chainage 12.292 to 32.14)	3,100
Hanson Road	181	Gladstone Port Access Road to Hildebrand Street (chainage 0.172 to 1.345)	8,400
		Hildebrand Street to Blain Drive (chainage 1.345 to 3.258)	6,700
		Blain Drive to Red Rover Road (chainage 3.258 to 4.625)	9,500
Glenlyon Street	181	Dawson Highway to Gladstone Port Access Road (chainage 0.0 to 0.172)	8,400
Dawson Highway	46A	Glenlyon Street to Breslin Street (chainage 0.0 to 1.5)	13,200
		Breslin Street to Blain Drive (chainage 1.5 to 2.24)	20,500
		Blain Drive to Philip Street (chainage 2.24 to 3.13)	25,000
		Philip Street to Penda Avenue (chainage 3.13 to 4.39)	28,100
		Penda Avenue to Chapman Drive (chainage 4.39 to 5.18)	24,400
		Chapman Drive to Harvey Road (chainage 5.18 to 10.3)	6,500
		Harvey Road to Bruce Highway (chainage 10.3 to 19.05)	5,200
Landing Road	N/A	The approximate daily traffic volume on the Council controlled Landing Road is 1,600 vehicles per day.	1,600

Bridges

There are no bridges of note within Gladstone along routes to be used by traffic associated with the construction and operation of the LNG facility.

However, it is worth noting that at Gladstone there are two bridges that could impact heavy vehicle movements when accessing Auckland Point via the Port Access Road. These are the Goondoon Street overpass on the Gladstone Port Access Road and the rail overpass at Glenlyon Street.

The Gladstone Port Access Road travels under a low, narrow bridge at Goondoon Street which has a 5.1m clearance. The bridge is shown in Figure 17.2 . Any vehicles on the Gladstone Port Access Road exceeding 5.1m in height will need to utilise an alternative route, for example Hopper Road.

Figure 17.2 Goondoon Street low clearance bridge

Glenlyon Street is crossed by a low railway bridge with a 4.7m clearance immediately south of the intersection of Glenlyon Street and the Gladstone Port Access Road. The bridge is shown in Figure 17.3. Vehicles more than 4.7m in height will need to access the port from the north (along Hanson Road).

Figure 17.3 Glenlyon Street railway bridge

Traffic incident history

Information about traffic incidents from April 2003 to March 2008 was obtained from DTMR for the study area. For each State controlled road link within the study area the ratio of the number of crashes per million vehicle kilometres travelled (C/MVKT) was calculated. The links were assigned a level of risk according to C/MVKT ratios as detailed in Table 17.8.

Table 17.8 Crash risk parameters

C/MVKT range	Risk
0 – 0.5	Low risk
0.5 – 1.0	Medium risk
1.0 – 1.5	High risk
> 1.5	Very high risk

The road links within the study area that include a high risk are the Dawson Highway, between Glenlyon Street and Breslin Street and the Glenlyon Street–Hanson Road link. The links have a crash risk ratio of 1.21 and 1.22 respectively. A high percentage of the crashes recorded on both of these

links occur at the Dawson Road/Glenlyon Street/Brampton Street intersection, with the majority of these being rear-end crashes and/or vehicles opposing vehicles turning a right-turn movement.

Public and active transport network

The public transport network includes commercial, school bus services and taxis.

Buslink Queensland operates a ten-route urban passenger service within Gladstone and the surrounding region. At present, scheduled services operate in Gladstone City and between Gladstone and Boyne Island, Tannum Sands, Awoonga Dam, Calliope and Benaraby.

Buslink Queensland provides transport to more than 1,500 primary and secondary students twice daily across Gladstone and surrounding regions. Currently, the service extends to a radius of approximately 50km from the centre of Gladstone to 30 schools along 35 routes.

Blue and White Cabs is the only provider of taxis within the Gladstone region and is the only passenger service operating 24 hours per day. Blue and White Cabs also provide shuttle services during peak demands to the Gladstone airport, Gladstone Port and nightclub precincts.

The active transport network includes pedestrian and cycle infrastructure.

The network comprises a range of formal and informal footpaths and shared pedestrian/cycle paths. The existing Gladstone city cycle network provides direct links to a number of major community and shopping facilities, such as the TAFE college and the airport and a number of major employers such as the Gladstone Power Station and the hospital.

Despite these services generally being more extensive than those found in other regional centres, GRC recognises that bus, walking and cycling patronage rates as being well below the state average. To address this, a series of polices and plans have been prepared. Most notably as part of Council's current planning scheme review issue Paper #7 – Transport and Infrastructure, which seeks to encourage walking, cycling and public transport use.

17.3.2 Existing rail network

The existing rail network in the area is dedicated to freight movement. No local passenger rail network exists in Gladstone.

The rail network in this area is known as the Moura rail system. The Moura system services the coal mines of Dawson, Baralaba, Boundary Hill and Callide. Coal is transported to the Gladstone Power Station, Comalco Aluminium Refinery, Queensland Alumina Limited and the Port of Gladstone at Auckland Point. The route is a single line with passing loops, which has recently been extended to allow 'Blackwater' size trains to operate in this system.

There are a number of major plans for this system, as identified in Queensland Rails Coal Rail Infrastructure Master Plan 2008. This includes adding additional capacity by constructing more passing loops, duplicating the line and extending coverage to industrial areas. No passenger service is planned.

17.3.3 Existing shipping network

Gladstone Port lies within a large natural harbour and is administered by GPC.

The port includes six wharf centres, which together, have 15 wharves located along the coastline. These are Boyne, South Trees, Barney Point, Auckland Point, Clinton and Fisherman's Landing. The

port's maximum capacity (Clinton Wharf) is 220,000 dead weight tonnage (DWT). These are shown in Figure 17.4.

The Port of Gladstone is a major commodities' export port which had a throughput in 2007/08 of 75.5 million tonnes of cargo, of which 54.1 million tonnes were coal (GPC 2008a). This generated 1,368 ship visits during the financial year.

The ships comprised bulk carriers, multi-purpose vessels, tankers, break bulk vessels and liquefied petroleum gas (LPG) carriers. The major cargos imported into the port include bauxite, caustic soda, LPG, petroleum coke, liquid ammonia, bunker oil, magnetite, gypsum and copper slag. Additionally, major cargoes exported from the port included coal, alumina, magnesia, cement, limestone, scrap metal and ammonium nitrate. The largest ship to use the port was a 231,850DWT vessel.

Outside of the port, ships pass through the Marine Park. Shipping in the Marine Park is managed by several government agencies including the Australian Maritime Safety Authority, MSQ, GBRMPA, and the Department of Infrastructure, Transport, Regional Development and Local Government. The GBRMPA is the principal adviser to the Australian Government in relation to the management and development of the Marine Park. GBRMPA's role includes regulating the entry and use of the Marine Park by ships and other vessels through the Great Barrier Reef Marine Park Zoning Plan 2003.

In addition to commercial shipping described above, there are approximately 13,000 marine licenses and 7,000 recreational vessels registered in Gladstone. The Gladstone Sailing Club has approximately 200 sailing members and between 6,000 and 7,000 social members. The Harbour, Auckland Creek, The Narrows and Graham Creek are popular areas for boating, sailing and fishing, with The Narrows and Graham Creek traditionally popular safe harbours for smaller private sailing vessels during storms and cyclones.

17.3.4 Existing air services

The Gladstone airport is the only airport that is impacted by the construction and operation of the LNG facility.

The airport is currently operated by the GRC. The airport caters primarily for business travellers and freight activities associated with the region's developed and emerging industrial complexes. Regular public transport services are currently provided by QantasLink primarily utilising Dash 8 Series Q400 aircraft that can accommodate 74 passengers.

Figure 17.4 Gladstone Port wharves

Eight flights per day operate out of the Gladstone airport from Monday to Friday with reduced services at the weekends. Approximately 50 people are employed at the airport.

Since 1998 the airport expansion has been guided by a development plan which the Aerodrome Board updated in 2004 to take particular account of current and likely future aircraft types and stronger growth in passenger numbers than previously forecast.

The 2004 plan was based upon the airport continuing to cater for up to Code 3 aircraft such as the Q400, E170 and similar 70-seat capacity aircraft. While operations by larger Code 4C aircraft such as the E190, B717, B737 and A320 were considered, the 2004 plan concluded that catering for larger aircraft was not justified by forecast activity if the existing service frequency was maintained and that significant pavement strengthening would be required to allow unrestricted operations by these aircraft.

The plan was updated again in 2008. At this time, it was identified that the runway required strengthening because of deterioration resulting from the introduction of regular Q400 services. Additionally, it was recognised that the runway profile was not compliant with CASA regulations and would require re-profiling or a modified taxiway to cater for larger aircraft.

Plans to cater for larger aircraft have been considered and the runway has been lengthened to allow for larger Code 4C aircraft. Pavement strength remains a constraint to catering for regular Code 4C aircraft services, however this may be overcome by a further asphalt strengthening course.

The plan concludes that the altered and/or new facilities, the current airport site will cater for projected long-term air travel growth in the Gladstone region at an appropriate level of service and continued convenience to the travelling public beyond the 2027/28 planning horizon.

17.4 Project traffic

17.4.1 Description and location of LNG facility

The LNG facility will be located in the Curtis Island Industry Precinct of the GSDA near Laird Point. The LNG facility comprises LNG manufacturing and storage facilities and marine export facilities.

The LNG facility will be constructed in four stages (or trains) and has a production capacity of approximately 18Mtpa. The initial development will be comprised of Trains 1 and 2, with a nominal 4.5Mtpa capacity each. Trains 1 and 2 will be constructed and operational by 2015, while Trains 3 and 4 will be operational by 2022. The dates of construction will be market driven however the timing as been assumed for the purpose of impact assessment on the traffic and transport network.

In addition to the construction of Trains 1 and 2 of the LNG facility, construction will include wharf and jetty structures for the loading of LNG vessels. Construction will also involve the establishment of temporary rock dock and a MOF for the transfer of building materials and heavy equipment to the site. The construction of the marine infrastructure will also involve dredging at the wharf and MOF and the subsequent management of the dredged material. It is likely any capital dredging required for shipping access will be provided under separate approvals sought by the GPC.

17.4.2 Description and location of proposed mainland facility

The planned 153ha reclamation area on the north side of the existing Fisherman's Landing will act as the primary embarkation point for personnel and materials to be transported to and from Curtis Island.

The proposed location and indicative layout of the mainland facility at Fisherman's Landing north expansion is shown in Figure 17.5. This will consist of administration buildings, staff car park, ferry terminal, barge wharf and stockpiling/lay down area for material to be transferred to Curtis Island.

The proposed location of a secure temporary construction staff car park on vacant land off Blain Drive in West Gladstone (commonly referred to as Ash Pond #7). Construction personnel will drive their private vehicles to this location and then be bussed (20 person capacity) to the embarkation point at Fisherman's Landing northern expansion, and then back to the car park at completion of their shift period on the Island. This is shown in Figure 17.6.

17.4.3 Road traffic

A description of the road-based transport generated by the LNG facility within Gladstone and operations at Fisherman's Landing northern expansion is given below.

Construction staff

Construction of the LNG facility will commence in early 2011 with the establishment of a temporary accommodation facility (TAF) on the island. The construction of these facilities will take approximately six months and be used to accommodate up to 1,800 workers.

It is estimated the construction workforce requirements will peak at approximately 2100 workers during the construction of stage 1 (Trains 1 and 2) and stage 2 (Trains 3 and 4).

It has been assumed that up to 80 percent of the total workforce will be accommodated on Curtis Island in a TAF and will work four weeks on and one week off. These workers living in the TAF will be non-residents and will either fly in/fly out (FIFO) from Gladstone airport or drive in/drive out (DIDO) from outside the local area (local area being defined as within 60km of the Gladstone Post Office). The FIFO workers will be shuttled to/from the airport on busses. DIDO workers will park their cars in the designated secure car park (Ash Pond #7 off Blain Drive) area during their rotation in the construction camp.

The remaining 20 percent or more of the workforce are assumed to be residents of the Gladstone area and will commute by private vehicle to a secure car-park at Ash Pond #7 off Blain Drive, park their vehicles and then will be bussed to the Fisherman's Landing north expansion ferry terminal. From here these workers will be transported by ferry to Curtis Island.

It has been assumed that on average 1.2 workers will occupy each vehicle.

Operation staff

Staff will commute daily from the Gladstone area to the LNG facility on Curtis Island. It is assumed, for this study that these workers will drive by private vehicle (1.2 persons per car) to Fisherman's Landing northern expansion before boarding a barge/ferry for the journey to Curtis Island. The following staff numbers have been assumed during the operational phase of each train:

- Train 1 - 100 staff per shift; two shifts working 24hrs/day, seven days per week
- Trains 2 to 4 - additional 75 staff per train; two shifts working 24hr/day, seven days per week.

Figure 17.5 Fisherman's Landing northern expansion facility

Figure 17.6 Ash Pond No#7 construction staff car park

Construction traffic

An estimate of the total number of deliveries of construction materials and equipment for each LNG train is provided in Table 17.9. This is an estimate based on the current construction plan which is yet to be finalised, however the total number of truck loads is approximately 14,000.

Table 17.9 Number of deliveries

Item	Quantity of truck loads per LNG train
Equipment	3,250
Electrical	200
Insulation	500
Fuel	100
Concrete/grout	2,000
Steel	4,250
Aggregate/stone	3,000
Miscellaneous	500
Water	Assumed desalination plant to be constructed on Curtis Island
Oversized and pipe	To be delivered by barge to MOF on Curtis Island

There will be some initial water deliveries from the mainland until the temporary construction phase desalination plant is constructed.

It has been assumed for this assessment all deliveries will be trucked to Fisherman's Landing northern expansion and barged to Curtis Island.

Oversized/pre-assembled items and pipe material will be shipped directly to the MOF on Curtis Island.

It has been assumed deliveries will be made at a constant rate throughout the four-year construction period and approximately 10 percent of the daily delivery movements will occur during each of the morning and afternoon peak hour periods. This assumption is consistent with the expected loading capacity of the barge/ferry to Curtis Island.

During the construction of the LNG trains, it has been assumed 25 percent of the daily construction personnel traffic will commute during each of the morning and afternoon peak hour periods. The model assumes that arrival and departure of personnel will extend across a two hour period.

Operations traffic

Deliveries of materials and equipment during the operation of each LNG train are provided in Table 17.10.

Table 17.10 Delivery of materials during operation of the LNG train

Item	Quantity of trucks per month
Refrigerants	2
Fuel	1
Chemicals	1

Miscellaneous	10

It has been assumed 10 percent of the deliveries will occur during each of the morning and afternoon peak hour periods and 25 percent of the daily operational personnel traffic will commute at the same time.

Traffic generation

Figure 17.7 below provides details of the estimated number of vehicles per day (VPD) generated by the construction and operation of the LNG facility.

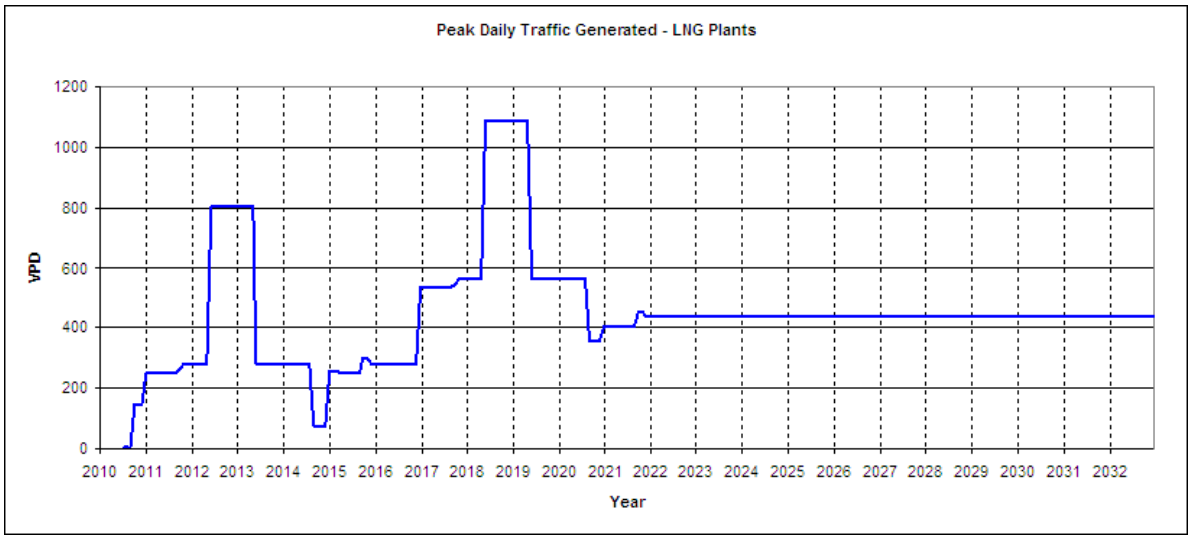

Figure 17.7 Peak daily traffic generated by LNG facility

Table 17.11 provides a summary of the estimated peak hour, peak daily and average daily road-based traffic generation from the construction and operation of the LNG facility.

Table 17.11 Summary of estimated peak hour, road based traffic

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Peak hour	Heavy vehicles	15	7	11	11	7	4	0	7	11	11	7	3	0
	Light vehicles	0	52	174	174	52	65	70	122	244	244	122	106	109
	All vehicles	15	59	185	185	59	69	70	130	255	255	130	109	109
Peak daily traffic	Heavy vehicles	149	74	109	109	74	39	1	74	109	109	74	31	1
	Light vehicles	0	208	696	696	208	261	281	489	977	977	489	425	436
	All vehicles	149	282	806	806	282	300	281	562	1086	1086	562	456	437
Average daily	Heavy vehicles	0	7	29	29	29	22	0	7	29	29	29	22	1
	Light vehicles	49	252	568	453	174	241	281	533	848	734	455	394	437
	All vehicles	49	260	598	482	203	263	281	540	877	763	484	416	437

Traffic distribution

Traffic routes adopted for the construction of the LNG facility are given in Table 17.12.

Table 17.12 LNG facility traffic distribution

Traffic type	Origin	Route
Construction staff	Up to a maximum of 20% local residents	Assumed local residents from throughout the Gladstone Region, drive to Ash Pond #7 car park off Blain Drive and bussed to Fisherman's Landing northern expansion via Gladstone–Mt Larcom Road / Landing Road. Approximately 90% will approach Ash Pond #7 car park from the Dawson Highway and 10% from Gladstone Mt Larcom Road
Construction material	Local and regional	Assumed local deliveries from throughout the Gladstone Region are delivered to Fisherman's Landing northern expansion via Mt Larcom Road / Landing Road Regional deliveries from various locations outside the Gladstone Region including Brisbane. Northern deliveries along Gladstone–Mt Larcom Road/Landing Road to Fisherman's Landing northern expansion. Southern deliveries along Bruce Highway, then Calliope River Targinie Road to Gladstone–Mt Larcom Road / Landing Road to Fisherman's Landing Northern Expansion
Operations staff	Local residents	Assumed local residents from throughout the Gladstone Region, to Fisherman's Landing northern expansion via Blain Drive - Gladstone–Mt Larcom Road / Landing Road
Operational deliveries	Local	Assumed local deliveries from throughout the Gladstone Region to Fisherman's Landing northern expansion via Mt Larcom Road / Landing Road

17.4.4 Shipping traffic

Construction material transport – LNG facility

Shipping activities associated with construction of the LNG facility relate to:

- Transfer of personnel and equipment between Gladstone and the LNG facility site; staging to occur from ferry embarkation point (Fisherman's Landing northern expansion) by barge and ferry
- Delivery of plant, materials and equipment to the LNG facility site on Curtis Island directly via the MOF and temporary rock dock on Curtis Island.

The MOF will have the following functions:

- Offloading of modules for LNG trains
- Offloading general construction materials from barges
- Support to load-out jetty construction.

A permanent facility on the mainland may be established to provide for barge and ferry transport. For the purpose of this study FLNE was assumed.

A ferry dock will be constructed on Curtis Island to receive construction and operational personnel.

A materials staging area on the western side of the harbour at Gladstone would also need to be established to facilitate the transport of materials and personnel. Such a wharf facility should include car parking and waiting areas. Fisherman's Landing northern expansion has been assumed as the site for this facility.

The transport of heavy loads of construction equipment and consumables to the site will be undertaken by barge. It is estimated 15-20 barges per day will be required during a period of two to four years.

For the main construction phase, the non-local workforce will be accommodated in a TAF on Curtis Island. Transportation of the majority of the workforce from Gladstone to Curtis Island will be by ferry. It is estimated there will be two ferry trips in the morning and evening. The transportation of any remaining personnel will be undertaken using smaller water taxis, for fast transit of small numbers of personnel, throughout the day.

Large ferries will allow for embarkation and debarkation of personnel, and also be used for vehicular transport when personnel are not in transit.

The assumed average movement of vessels expected during the construction phase is as follows:

- Large deck barges with coarse aggregate - six per month
- Typical deck barges with sand - two per month
- Bulk cement vessels - two per month
- Roll-on/Roll-off ships - two and a half per month
- Passenger ferries, two trips in the morning and evening with potential weekday evening trips from the island for TAF residents
- Jetty tenders - daily round trips from the wharf to the jetty with piling and beams, armour rock, modules and topside commodities
- Jetty tenders - daily round trips with armour rock, modules, topsides commodities
- Jetty multicast - pushing tenders and running personnel daily
- Crew boats and food supplies for site camp: one every two days
- Patrol boats – as required, up to three daily
- Pilot boats - as required
- Diesel fuel barges - four per month
- Subcontractors' deliveries - four per month.

For the very early part of the construction phase, clean treated water will be brought to the site in tankers from Gladstone on barges. Approximately 800,000m^3 of fresh water will be needed on Curtis Island. A temporary seawater desalination plant will be installed as soon as practical to meet ongoing fresh water needs during construction.

Operations phase transport

A seawater desalination plant will be constructed and operational in time for the start of the permanent operations. This will provide the primary water source for the Project with supplementary water provided through the capture of site run-off. As a result, there will not be the need for any barging of water during operations.

Logistics vessels used during normal operations will include a water taxi at shift start and end, plus additional movement of personnel, as required throughout the day, including ferries carrying waste and supplies and waste to and from site.

Water taxis and ferries used for the Project's operations phase will be high speed, have a low draught and be highly manoeuvrable. These vessels, despite the anticipated number of daily movements, are anticipated to be able to operate without appreciable impact on bulk shipping operations or recreational users of the waterways.

During major maintenance shutdowns at the LNG facility, additional ferries and water taxis will transfer personnel and equipment from the operational staging facility to Curtis Island. Vessels used will be similar to those used for normal operations and during the construction phase.

Exporting LNG

LNG is transported by specially designed ships. At the LNG facility's ultimate capacity of approximately 18Mtpa, LNG vessels will arrive every one to two days for loading and export. Turnaround time for vessels will be approximately 24 hours, with a product loading duration of approximately 14 hours. The plant will be operating 24 hours per day, seven days per week.

Typical LNG carriers have a minimum draught of 11.5m and are between 285-314m in length, with a typical carrying capacity of 125,000-165,000m^3 of LNG. However, it is possible LNG carriers with a capacity of up to 220,000m^3 may also be used. These vessels have a draught of 12m and with a length of 315m.

LPG shipping activity is nominated as infrequent transit. The number of vessels will vary subject to commercial requirements relating to the high heating value of LNG exported and therefore the amount of LNG spiking required. The number of vessels will also depend upon the size of the vessels used. However, indicatively, there will be one LPG vessel per month once four trains are operational.

17.5 Potential impacts

17.5.1 Road network

The assessment indicates that there are potential impacts from the Project to the road network with the most significant impact to the road intersections as identified below. For further information refer to Volume 5 Attachment 35.

Road link capacity

The LNG facility's traffic does not bring forward the need for alteration of any of the State controlled links within the study area by more than one year and as such there are no alterations required.

The cumulative impact of the other regionally significant projects, particularly other LNG projects, is expected to bring forward the need to alter the following road links within the study area:

- Gladstone-Mt Larcom Road chainage 3.258 to 12.292 (Blain Drive to Reid Road). Alterations are to be brought forward from 2020 to 2018 for Blain Drive to Red Rover Road and from 2029 to 2028 for Red Rover Road to Reid Road
- Dawson Highway chainage 2.24 to 3.13 (Blain Drive to Philip Street). Alterations are to be brought forward from 2028 to 2027.

Intersections

The following intersections have been identified for analysis based upon the potential for the Project to significantly impact the operation:

- Dawson Highway/Dawson Road/Breslin Street
- Dawson Highway/Blain Drive/Herbertson Street
- Dawson Highway/Philip Street/Shopping Centre Access
- Dawson Highway/Penda Avenue
- Dawson Highway/Aerodrome Road
- Dawson Highway/Chapman Road/Harvey Road
- Dawson Highway/Don Young Drive
- Dawson Highway/Kirkwood Road
- Bruce Highway/Dawson Highway
- Hanson Road/Blain Drive/Alf O'Rourke Drive
- Hanson Road/Red Rover Road
- Gladstone-Mt Larcom Road/Landing Road
- Gladstone-Mt Larcom Road/ Calliope River Road/Targinie Road
- Bruce Highway/Gladstone-Mt Larcom Road.

The intersection locations are shown in Figure 17.8 and Figure 17.9.

Figure 17.8 Gladstone-Mt Larcom Road intersections

Figure 17.9 Dawson Highway intersections

Table 17.13 summaries the impacts of the LNG facility project traffic and the cumulative impacts at the intersections within the study area. The intersection impacts, as assessed in the technical report contained in Volume 5 Attachment 35 and have considered the development traffic from all components of the Project, including the traffic associated with the gas pipeline and the gas fields. However at intersections, the traffic associated with the construction of the LNG facility will constitute more than 95 percent of the Project's traffic.

Table 17.13 Intersection impacts

Intersection	Current layout	Impact
Dawson Highway/Dawson Road/Breslin Street	Signalised	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic and cumulative traffic from the regionally-significant projects will have a minor impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon with the LNG facility's traffic
Dawson Highway/Blain Drive/Herbertson Street	Two lane roundabout	The existing intersection will operate within capacity to 2021 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached during the first peak construction year of 2013 The cumulative traffic from the regionally-significant projects will result in the intersection reaching capacity in 2012
Dawson Highway/Philip Street/Shopping Centre	Two lane roundabout	The existing intersection currently fails during the PM peak hour. It is noted that the roundabout would be expected to operate at a higher level as three legs of the roundabout are metered during the peak hour periods The LNG facility's traffic and cumulative traffic from the regionally-significant projects will have a worsening effect on the intersection performance, particularly during the peak construction years of 2013 and 2019
Dawson Highway/Penda Avenue	Two-lane roundabout	The existing intersection will operate within capacity to 2013 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in capacity being reached by 2012. The cumulative traffic from the regionally significant projects will result in the intersection reaching capacity by 2011
Dawson Highway/Aerodrome Road	Signalised	The existing intersection will operate within capacity to 2014 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached during the first peak construction year of 2013. The cumulative traffic from the regionally significant projects will result in the intersection reaching capacity by 2010
Dawson	Two lane	The existing intersection will operate within capacity to 2014 under

Intersection	Current layout	Impact
Highway/Chapman Road/Harvey Road	roundabout	background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached during the first peak construction year of 2013. The cumulative traffic from the regionally significant projects will result in the intersection reaching capacity by 2012
Dawson Highway/Don Young Drive	Priority controlled	The existing intersection will operate within capacity to 2018 under background traffic only The LNG facility's traffic and cumulative traffic from the regionally significant projects will have an impact on the operation of the existing intersection resulting in the capacity being reached by 2017. The cumulative traffic from the regionally significant projects will result in the intersection reaching capacity by 2016
Dawson Highway/Kirkwood Road	Priority controlled	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic and cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon
Dawson Highway/Bruce Highway	Priority controlled	The existing intersection will operate within capacity to 2012 under background traffic only. The LNG facility's traffic and cumulative traffic from the regionally significant projects will have a minor impact on the operation of the existing intersection but will not result in bringing forward the need for the alteration earlier than 2012
Hanson Road/Blain Drive/Alf O'Rourke Drive	Single-lane roundabout	The existing intersection currently fails during the AM peak hour under background traffic only The LNG facility's traffic and cumulative traffic from the regionally significant projects will have a worsening effect on the intersection performance, particularly during the peak construction years of 2013 and 2019
Hanson Road/Red Rover Road	Single-lane roundabout	The existing intersection will operate within capacity to 2016 under background traffic only The LNG facility's traffic will have a minor impact on the operation of the existing intersection but will not result in bringing forward the need for the alteration earlier than 2016. The cumulative traffic from the regionally significant projects will result in the intersection reaching capacity by 2010
Gladstone-Mt Larcom Road/Landing Road	Priority controlled	The existing intersection will operate within capacity to 2020 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection and will result in the intersection reaching capacity at 2015. The cumulative traffic from the regionally significant projects will result in the

Intersection	Current layout	Impact
		intersection reaching capacity by 2015
Gladstone-Mt Larcom Road/Calliope River Targinie Road	Priority controlled	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic and cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon
Bruce Highway/Gladstone-Mt Larcom Road	Priority controlled	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic and cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon

Blain Drive –Ash Pond # 7 Staff car park Intersection

Currently the site is accessed via an unsealed track off Blain Drive. It is acknowledged that a suitable intersection arrangement will need to be constructed to allow the efficient and safe movement of vehicles at this location augmented with traffic management personnel to assist with traffic flow at peak hours. Australia Pacific LNG will work with GRC to identify an appropriate design.

Pavement rehabilitation and maintenance

As the development will contribute to the accelerated deterioration of the road pavement, DTMR requires a contribution to maintain an adequate level of service for the roadway.

Contributions towards pavement rehabilitation and maintenance would only be made where the development would bring forward the need for rehabilitation by more than one year and where the development traffic has an impact of greater than five percent of the existing traffic volume. Roads conforming to these conditions within the study area are as follows:

- Dawson Highway from Penda Avenue to Bruce Highway – rehabilitation required 1.3 to 2.5 years in advance.

Other components of the development (that is the gas fields' infrastructure and gas pipeline) also utilise these roads and contribute to deterioration. This needs to be taken into account when determining the proportion of cost attributed to the LNG facility.

Traffic incident history

As identified in section 17.3.1 of this report, the following road links were identified as falling within a very high risk or high risk category, based upon the number of crashes per million vehicle kilometres travelled.

- Dawson Highway between Glenlyon Street and Breslin Street
- Glenlyon Street and Hanson Road.

No project traffic associated with the construction and operation of the LNG facility are proposed to use these road links.

Oversized vehicles

It is not envisaged to transport any oversized items by road. Any large LNG facility items will be shipped directly to Curtis Island using the MOF. In the event that such were to be required, appropriate permits would be acquired and escorts would be provided. In addition, movements would be orchestrated and planned to minimize impact on the traffic.

Roads prone to flooding

No roads proposed to be used by LNG facility construction and operation traffic have been identified as being prone to flooding as such that they may prevent the movement of vehicles.

Public and active transport network

Project traffic will inevitability travel along roads also used as school bus routes. However, by utilising Fisherman's Landing northern expansion as apposed to Auckland Point a large proportion of the Project traffic is removed from Dawson Road north of Blain Drive along which is located Gladstone High School.

Environmental impacts

Project traffic will utilise existing roads within Gladstone to access the proposed embarkation facility at Fisherman's Landing northern expansion. This may cause the following environmental impacts:

- Dust control – dust generation on roads used by project traffic during construction and operational phases may impact on roadside vegetation, the safety and general comfort of other road users, and adjoining land uses
- Weed, pest and disease control – it is acknowledged that some Project vehicles may pass through a weed and pest control area. The movement of project vehicles throughout the study area increases the risk of spreading weeds and pests.
- Noise – it is acknowledged that the Project will increase road traffic noise levels, particularly during construction, however it is not expected that the Project traffic will result in accepted noise thresholds for adjacent residences being exceeded.
- Product spill – It is acknowledged that the Project may increase the likelihood of product spill (for example fuel, chemicals, waste, and aggregate) due to increased road traffic during the transportation of materials by road.

Any environmental impacts associated with the Project traffic using existing roads and/or the construction of new roads will be documented and mitigations specified in the detailed design phase of the Project.

17.5.2 Rail network

It is currently not anticipated to utilise the rail network to any large degree for the purpose of the construction and operation of the LNG facility. It has been assumed and forecasted that all material and personnel will be transported by road to Fisherman's Landing northern expansion for transfer by barge or ferry or shipped directly to the MOF on the island. Any rail deliveries of materials or

equipment to Gladstone from other locations within Australia would be of minor impact to the existing system.

17.5.3 Shipping network

LNG ships will represent an increase of three percent in current shipping movements for the first operational LNG train. This may increase to 13% once the four trains are operational.

In assessing the impacts of shipping associated with the LNG facility, two primary key areas of concern were addressed as follows:

- Environmental and safety issues arising from:
  - The increase in shipping within the marine environment, including, passage through the Marine Park
  - The transfer of material and personnel to and from the mainland to the proposed facility on Curtis Island and vessel berthing arrangements at the proposed MOF
- Operations at Fisherman's Landing northern expansion.

Environmental and safety issues

Increased shipping

A range of potential risks have been identified as follows:

- Berthing locations and safe operations
- Bunkering (refuelling) of LNG/LPG vessels
- Collision, loss of control of the LNG container ship, grounding
- Impacts to marine ecology - fauna strikes, lighting from shipping/wharf operations, noise
- Oil pollution and spills
- Harmful effects of anti-fouling systems
- Interaction of LNG ships with other small vessels (ferries/ barges)
- Dredging of a new swing basin and shipping channel
- Suitable anchorages
- Discharges of Waste water at sea, sewerage disposal
- Potential foreshore damage arising from transit though the outer harbour up to the Clinton Channel
- Introduction of pests and other harmful organisms
- Air quality
- Erosion and bottom disturbance
- Heritage and cultural considerations.

A detailed assessment of each of these potential risks has been undertaken and is reported in Volume 5, Attachment 35 Traffic and Transport.

In summary, major shipping routes within the GBRMP can be divided into an inner and outer route, with a number of additional channels connecting the routes.

Following consultation with MSQ, it is anticipated that LNG shipping associated with the Project will use the outer route only for westbound cargoes and ships returning from Western Ports. Shipping destined for northern Asia ports will avoid the Torres Strait, transiting the Coral Sea and Western Pacific. Some ships may cross the Pacific Ocean bound for the Americas. It is also recognised that Project ships may use shipping channels which are beyond the eastern boundary of the Marine Park, therefore avoiding potential impacts on the Marine Park.

LNG will be exported by specially-designed ships from the LNG facility on Curtis Island and exit through the GBRMP. LNG ships will represent an approximate increase of three percent in current shipping movements through the GBRMP for the first LNG train. This may increase to 13 percent once the four LNG trains are operational.

All ship movement through the GBRMP will be in accordance with all international and national shipping regulations, namely:

- All vessels employed in marine activity, whether contracted or sub-contracted, will be inspected according to the International Marine Contractors Association (IMCA) ”Common Marine Inspection Document”.
- All vessels and port facilities will comply with the provisions of the International Ship and Port Facility Security Code (ISPS Code) Parts A and B.
- Any vessel contracted by, or on behalf of, the Australia Pacific LNG Project will have a structured and documented safety management system (SMS). All systems shall demonstrate that quality management and quality system elements meet the requirements of the International Maritime Organization (IMO)26 regulations on the International Safety Management Code for the Safe Operation of Ships (ISM Code) and for Pollution Prevention (MARPOL). The ISM Code has been added to Chapter IX of the International Convention for the Safety of Life at Sea (SOLAS) and is now mandatory.

Transfer of material and personnel

Fisherman’s Landing northern expansion will act as the embarkation point for materials to the LNG facility during the initial phases of construction until the MOF is built. The MOF will then allow direct shipment of some facility modules and other materials.

Construction shipping will include up to approximately 140 ferry journeys per month (between Fisherman’s Landing northern expansion and Curtis Island) and approximately 70 barge journeys per month during the peak construction period. In addition, there will be ferry journeys between Fisherman’s Landing northern expansion and Curtis Island for the transport of consumables, equipment and waste removal. Given that in 2008 a total of 1,417 cargo vessels (excluding pleasure craft) transited Gladstone Harbour, this represents a significant increase in the number of vessel movements. However, the overall impact on non-project shipping and boating activities is anticipated to be minimal as the ferries proposed to be used are highly manoeuvrable and can navigate around any large slow moving bulk carriers.

Operations at Fisherman's Landing northern expansion

Fisherman's Landing north expansion will act as the embarkation point for materials to the LNG facility during the initial phases of construction until the MOF is constructed, which will allow for the direct shipment of facility modules and other materials. It should be noted that this plan shifts a significant amount of the LNG facility's marine traffic into the Western Basin and avoids the congestion around Wiggins Island compared to shipping from Auckland Point.

Facilities will need to be constructed to facilitate the import and export of these materials and personnel.

The conceptual layout for the facilities at Fisherman's Landing northern expansion is reproduced in Figure 17.5. However, all concepts developed to date are indicative and discussions with the GPC about the nature of these facilities are ongoing.

Cumulative impacts

Increased shipping

With a probable cumulative LNG capacity of 28Mtpa in the Western Basin, approximately 400 LNG ship visits per year are anticipated (information based on Blueprint for Queensland's LNG Industry, Department of Employment, Economic Development and Innovation, 2009). This equates to slightly more than one LNG ship per day. The GPC's strategic plan envisages an increase in planned port capacity to 300 million tonnes per year within the next 50 years, which is nearly four times the 2008 throughput. The proposed addition of approximately 400 LNG ship visits per year equates to an increase in harbour traffic of approximately 7 percent of the predicted increase in shipping as defined in the GPC's strategic plan.

A model simulating Gladstone's shipping operations was undertaken in 2009. This assessed the traffic flow within the Gladstone Harbour and included a number of LNG cumulative projects. The report concludes that using improved management logic, only a marginal decrease in average port performance (with the introduction of LNG trades), is expected.

There is expected to be an increase in small craft movement, mainly in the Fisherman's Landing northern expansion area. The impact of increased small craft traffic will depend upon the number of projects being constructed at the same time.

An initial appraisal of the marine traffic inside the Port of Gladstone suggests that congestion within the Western Basin/Clinton and Auckland channel areas is likely to be a significant issue for the cumulative case because of the proposed dredging operation. GPC and MSQ have indicated concern if a number of LNG projects are constructed at the same time and use the Auckland Point facility.

17.5.4 Air services

Gladstone airport

The Gladstone airport will be impacted by the construction of the LNG facility on Curtis Island during shift changes when personnel are bussed to and from the airport.

During the peak construction period of the LNG facility, approximately 2,100 people will be working at the LNG facility, up to 80% of who will be FIFO. It has been estimated, based on a rotating shift pattern that between 50 and 80 people per day during the peak construction period will commute through the airport as a result of LNG facility construction activities.

Cumulative impacts

An estimate of the additional passenger movements associated with the construction of the LNG facilities for the Queensland Curtis Island LNG and Gladstone LNG has been made. It is expected that up to an additional 120 personnel associated with these projects may pass through the airport in any one day during the same period.

In order to minimise the potential impacts, Australia Pacific LNG will work with industry to optimise roster timings and reduce daily passenger movement peaks.

17.6 Mitigation and management

The following discusses proposed traffic and transport mitigation measures for potential impacts to the road network, shipping network and air services.

17.6.1 Road network

Road link capacity

The following State controlled road links within the study area have been identified in this assessment as requiring alterations within the planning horizon. However, these are required to cater for background traffic alone and as such the Australia Pacific LNG project is not the driver for the need for the alterations. The following details outline alterations that are required:

- Gladstone-Mt Larcom Road chainage 3.258 to 12.292 for Blain Drive to Reid Road; alteration from two-lane rural road to four lane urban road during the period 2020 to 2029
- Dawson Highway chainage 2.24 to 4.87 for Blain Drive to Aerodrome Road; alteration from four-lane urban road to six lane urban road during the period 2016 to 2028
- Dawson Highway chainage 4.87 to 10.3 for Aerodrome Road to Harvey Road, alteration from two-lane urban road to four lane urban road by 2029.

The cumulative impact of the other regionally significant projects, particularly other LNG projects, results in bringing forward the alteration of the following road links:

- Gladstone-Mt Larcom Road chainage3.258 to 12.292 for Blain Drive to Reid Road, alteration from two- lane rural road to four-lane urban road. Alterations are to be brought forward from 2020 to 2018 for Blain Drive to Red Rover Road and from 2029 to 2028 for Red Rover Road to Reid Road.
- Dawson Highway chainage 2.24 to 3.13 for Blain Drive to Philip Street; alteration from four-lane urban road to six-lane urban road. Alterations are to be brought forward from 2028 to 2027.

Intersection capacity

A number of State controlled intersections within the Gladstone area have been identified as requiring an alteration to mitigate the impacts of the Project's traffic and cumulative traffic from the other regionally significant projects.

Table 17.14 below provides a summary of the proposed alterations to State controlled intersections within the study area and identifies alteration works.

Table 17.14 Results of the intersection assessment

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
Dawson Highway/Dawson Road/Breslin Street	Three-way signalised	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon	The cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon
Dawson Highway/Blain Drive/Herbertson Street	Four-way, two-lane roundabout	The existing intersection will operate within capacity to 2021 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached during the first peak construction year of 2013 Alteration works recommended for the intersection include: • Addition of a free left turn lane on the Dawson Highway (South) approach. • Extension of the short right turn lane on the Blain Drive approach. • Conversion of the through/right lane on the Blain Drive approach to a left/through/right lane Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally-significant projects are mitigated in a satisfactory manner, provided that the roundabout is signalised Australia Pacific LNG will work with state and local government and industry with respect to potential alterations required to meet the increased demands from regionally significant projects It is noted that DTMR has previously conditioned the Gladstone Pacific Nickel development to contribute to the cost of signalisation of the roundabout.
Dawson Highway/Philip Street/Shopping Centre	Four-way, two-lane	The existing intersection currently fails during the PM peak hour. It is noted that the roundabout would be expected to operate at a higher level as three legs of	The alteration works described opposite will ensure that the cumulative impacts of

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
	roundabout	the roundabout are metered during the peak hour periods The LNG facility's traffic will have a worsening effect on the intersection's performance, particularly during the peak construction years of 2013 and 2019 Alteration works recommended for the intersection include: • Signalisation of the intersection • Provision of three stand-up lanes on each of the Dawson Road approaches consistent with the planned mid block alteration to a six-lane road • Free left turn lane on all approaches • Right turn lanes on all approaches Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	all LNG projects and other regionally significant projects are mitigated in a satisfactory manner. Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection
Dawson Highway/Penda Avenue	Two-lane roundabout	The existing intersection will operate within capacity to 2013 under background traffic only The LNG facility's traffic will have a minor impact on the operation of the existing intersection, but will not result in bringing forward the need for the alteration earlier than 2013 The alteration works recommended for the intersection include: • Signalisation of the intersection • Provision of three stand-up lanes on each of the Dawson Highway approaches, consistent with the planned mid block alteration to six lanes.	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally-significant projects are mitigated in a satisfactory manner. Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection.

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
		• Dual right turn lanes into Penda Avenue Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	
Dawson Highway/Aerodrome Road	Four - way signalised	The existing intersection will operate within capacity to 2014 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection, resulting in the capacity being reached during the first peak construction year of 2013, which corresponds to the first peak year of the development associated with the construction of trains one and two Alteration works recommended for the intersection include: • Additional stand-up lanes on both Dawson Highway approaches. This is consistent with the planned mid block alteration between Aerodrome Road and Philip Street to six-lanes Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally significant projects are mitigated in a satisfactory manner Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection
Dawson Highway/Chapman Road/Harvey Road	Two-lane roundabout	The existing intersection will operate within capacity to 2014 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached during the first peak construction year of 2013 Alteration works recommended for the intersection include:	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally significant projects are mitigated in a satisfactory manner Australia Pacific LNG will work with the federal, state, local government and

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
		• Signalisation of the intersection • Provision of two stand-up lanes on each of the Dawson Highway approaches consistent with the planned mid block alteration to a four-lane road • Free left turn lane all approaches • Dual right turn lanes on Dawson Highway into Chapmen Drive and a single right turn lane on Dawson Highway into Harvey Road Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	industry in regard to the potential alterations to meet the increased demands on the intersection
Dawson Highway/Don Young Drive	Priority controlled T-intersection	The existing intersection will operate within capacity to 2018 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached by 2017 The recommended alteration is signalisation of the existing intersection Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally significant projects are mitigated in a satisfactory manner. Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection.
Dawson Highway/Kirkwood Road	Priority controlled T-intersection	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full	The cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
		planning horizon	operate within capacity for the full planning horizon
Dawson Highway/Bruce Highway	Four way priority controlled	The existing intersection will operate within capacity to 2012 under background traffic only The LNG facility's traffic will have a minor impact upon the operation of the existing intersection and will not result in bringing forward the need for the alteration earlier than 2012 DTMR is planning an alteration to a grade separated interchange Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally significant projects are mitigated in a satisfactory manner. Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection
Hanson Road/Blain Drive/Alf O'Rourke Drive	Four-way, single-lane roundabout	The existing intersection currently fails during the AM peak hour under background traffic only The LNG facility's traffic will have a worsening effect on the intersection performance, particularly during the peak construction years of 2013 and 2019 The recommended alteration works include: • Two circulating lanes • Additional approach lane on Blain Drive • Hanson Road approach alteration to four-lanes, consistent with mid block alteration planning Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally-significant projects are mitigated in a satisfactory manner Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
Hanson Road/Red Rover Road	Three-way single-lane roundabout	The existing intersection will operate within capacity to 2016 under background traffic only The LNG facility's traffic will have a minor impact on the operation of the existing intersection but will not result in bringing forward the need for the alteration earlier than 2016 The recommended alteration works include: • Two circulating lanes, additional approach lanes consistent with the planned four-lane alteration of Hanson Road and an additional approach lane on Red Rover Road • An additional approach lane on Red Rover Road Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally significant projects are mitigated in a satisfactory manner Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection
Gladstone-Mt Larcom Road/Landing Road	Priority controlled T-intersection	The existing intersection will operate within capacity to 2020 under background traffic only The LNG facility's traffic will have an impact on the operation of the existing intersection resulting in the capacity being reached by 2015 The recommended alteration to the intersection is to convert to a single lane roundabout Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection	The alteration works described adjacent will ensure that the cumulative impacts of all LNG projects and other regionally-significant projects are mitigated in a satisfactory manner Australia Pacific LNG will work with the federal, state, local government and industry in regard to the potential alterations to meet the increased demands on the intersection
Gladstone-Mt Larcom	Four-way	The existing intersection will operate within capacity for the full planning horizon	The cumulative traffic from the regionally

Intersection	Current layout	Proposed mitigation treatment	
		Australia Pacific LNG Project	Cumulative
Road/Calliope River Targinie Road	priority controlled	under background traffic only The LNG facility's traffic will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon	significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon
Bruce Highway/Gladstone-Mt Larcom Road	Priority controlled T-Intersection	The existing intersection will operate within capacity for the full planning horizon under background traffic only The LNG facility's traffic will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon	The cumulative traffic from the regionally significant projects will have a negligible impact on the operation of the existing intersection and the intersection will operate within capacity for the full planning horizon

Pavement rehabilitation

Table 17.15 identifies significantly impacted roads within the LNG facility's study area that require rehabilitation during the assessment period.

Table 17.15 Pavement rehabilitation impacts

DTMR region	Road name	Chainage	Rehabilitation year (no development)	Rehabilitation year (with development)	Bring forward with development (years)
Fitzroy	46A - Dawson Highway	0 to 1.5	2029	2028	1.44
		10.3 to 19.05	2030	2028	1.82

Australia Pacific LNG will work with the federal, state, local government and industry in regard to potential rehabilitation requirements to meet the increased demands on regional infrastructure.

Road maintenance

The maintenance for the various road links was based on the Project's proportional use (by equivalent standard axles) of the road over the analysis period. Roads that are impacted by more than 5% of the existing traffic volumes are shown in Table 17.16.

Table 17.16 Maintenance impact

DTMR region	Road name	Chainage
Fitzroy	181 - Gladstone-Mt Larcom Road	0 to 1.345
Fitzroy	46A - Dawson Highway	0 to 1.5
		10.3 to 19.05

Australia Pacific LNG will work with the federal, state, local government and industry in regard to potential maintenance requirements to meet the increased demands on regional infrastructure.

Traffic incident history

Two road links in the LNG study area were identified as high risk roads. These were the Dawson Highway between Glenlyon Street and Breslin Street and Glenlyon Street/Hanson Road. As noted within section 17.3.1, a high percentage of the crashes recorded at both of these links occur at the Dawson Road/Glenlyon Street/Brampton Street intersection, with the majority of these being rear end crashes and/or vehicles opposing vehicles turning into right turn movements.

Australia Pacific LNG will only utilise these intersection for the transport of pipe imported into Auckland Point for the construction of the gas pipeline (refer Volume 3 Chapter 17). The Project traffic on this intersection will be limited to an additional six vehicles per hour during the pipe delivery period in 2011/2012. This is considered to be a negligible amount of additional traffic and is not expected to contribute to an increase in traffic incidents at this intersection.

However, Australia Pacific LNG recognises that road safety is a vital part of project operations. A range of operational health and safety measures covering the operation of project vehicles will be in place to reduce the risk of motor vehicle accidents. Further details are provided in Volume 4 Chapter 24.

Driver fatigue

The Project will aim to reduce private vehicle use as much as possible during construction, by providing transport to the Fisherman's Landing northern expansion embarkation point from the designated pick up area at Ash Pond #7, off Blain Drive for local DIDO personnel and from the local airport for FIFO staff. A principle driver for designating the 60km radius for 'local resident' status is to mitigate the risk of driver fatigue on daily commuters.

Journey management plans for vehicle travel will incorporate fatigue management considerations.

Construction and on-going service deliveries to Fisherman's Landing northern expansion will be in accordance with the traffic management plan and relevant transport regulations. This will include strict adherence to driver travel and required rest periods and the adoption of safe driving techniques.

Driver training

In order to minimise the potential for road accidents and mitigate safety impacts to other road users, Australia Pacific LNG will provide driver's training to relevant Australia Pacific LNG staff. Contractors will be required to have health and safety management system which includes measures for safe driving.

Oversized vehicles

No oversized road based trips are envisaged. However, any oversized and/or overweight vehicle movements will be undertaken in accordance with State regulations and the *Transport Infrastructure Act 1994.* Traffic management plans will be in accordance with these regulations.

Road flooding

In the event that a section of the state or council road network becomes impassable during periods of flooding, alternative routes may be used if safe and practicable. Should access not be achievable during prolonged flooding events, then construction activities may need to be shut down and demobilised for a period.

The Project will limit traffic movement during and after flood events, in line with local traffic control measures.

The analysis has not identified any upgrades of any waterway crossings on the State controlled network.

Public and active transport network

As indicated in section 17.5.1, the Project traffic will travel along roads used as school bus routes.

The Project traffic management plan will consider measures to limit this impact during school drop-off and pick up times. Further details can be found in Volume 2 Chapter 22.

Environmental impacts

New roads will need to be constructed to access the LNG facility including intersection alterations. In determining the location of these facilities, consideration has been given to the proximity of existing roads and the local environment.

During all phases (construction, operation and ongoing road maintenance) of the Project, sustainability measures will be implemented that will provide long term community benefits while minimising traffic impacts. The Project will also adopt road construction practices and technologies to reduce environmental impact and energy use, as far as practicable. In addition, the requirements of the *Environmental Protection Act 1994*, Main Roads Design Manual 2004, and other relevant legislation will be adhered to ensure environmental impacts will be are kept to a minimum as far as practicable.

Earthworks, vegetation clearing, erosion, and runoff will be minimised as far as practicable, and sediment control and weed management measures will be put in place.

Dust control

Australia Pacific LNG will implement conventional measures to minimise, as far as practicable, the generation of dust by project vehicles during construction. This may include regular application of water at appropriate locations, following DTMR's standard specification MRS11.02 – Provision for Traffic.

Weed, pest and disease control

Australia Pacific LNG will participate in pro-active weed management and will work closely with regional councils. Further information on weed management can be found in Volume 4 Chapter 8.

Noise control

Australia Pacific LNG will implement a traffic management plan to minimise, as far as practicable, the potential impacts of road traffic noise from Project traffic. This may include speed controls on project vehicles, management of night-time traffic along roads adjacent to residential or other sensitive land uses.

Spill control

Australia Pacific LNG will implement a traffic management plan to minimise, as far as practicable, the potential impacts of product spill during the transportation of product and materials. This may include the use of suitably qualified fuel transport operators giving consideration to vehicle maintenance, specialist driver training, cleanup procedures and spill kits as part of emergency response plans.

Traffic management plan

For all road-based construction activity associated with the Project, a traffic management plan during the front end engineering and design (FEED) stage of the Project will be developed. The plan will be developed in conjunction with the relevant state and local authorities and the local community.

With regard to the movement of heavy vehicles associated with the development throughout the road network the traffic management plan will address:

- Routes to be used by the heavy vehicles, with routes generally restricted to existing heavy haul routes, particularly through the Gladstone region

- Restriction of heavy vehicle movements during certain time of day/week, e.g. on routes which traverse school zones
- Restriction of vehicle speeds near residences
- Possible installation of temporary/permanent signage to warn road users of increased heavy vehicle activity.

This traffic management plan will also address maintaining access for emergency vehicles and measures to be taken to prevent public access to project sites.

The construction of infrastructure works within the road reserve to mitigate the impacts of the development is expected to be undertaken with conventional construction methods under traffic. Traffic management pans prepared in accordance with the DTMR Specification MRS11.02 Provision for Traffic and the Manual of Uniform Traffic Control Devices will be prepared at the FEED stage for implementation by the road construction contractors who will undertake the works.

17.6.2 Rail network

As it is not anticipated to use the rail network to any large degree for the construction and operation of the LNG facility, no mitigation works for the rail network are required. Any rail deliveries of materials or equipment to Gladstone from other locations within Australia would be of minor impact to the existing system.

17.6.3 Shipping network

The proposed LNG ships will operate under contract to Australia Pacific LNG and will be expected to comply with mitigation measures outlined below.

A range of impacts associated with environmental and safety issues inside and outside of Gladstone Port and the proposed operations at Fisherman's Landing northern expansion have been identified (refer to Section 17.5 for further details). Proposed mitigation measures for each of these under the impact categories listed in section 17.5 are discussed below.

Environmental and safety issues

Increased shipping

A range of potential risks were identified in section 17.5.3. Proposed mitigation measures are identified below.

Berthing locations and safe operations

The proposed site for the berth at the LNG facility is within a sheltered location away from other commercial marine traffic. It will be a safe berth for approaches and departures

While the berth is unoccupied, a 50m safety zone will be applied to exclude small boats and uncontrolled ignition sources. It is noted that the size of this safety zone is still subject to finalisation in consultation with the Regional Harbour Master.

Bunkering (refuelling) of LNG/LPG vessels

Bunkering (refuelling) of LNG/LPG vessels will be carried out by the Port's bunkering contractor at berth (i.e. alongside the LNG jetty) or at anchorage. Bunkering will not be carried out while LNG loading or LPG unloading is in progress.

Collision, loss of control of the LNG container ship, grounding

A LNG ship transit risk assessment has been undertaken. The assessment included consideration of the proposed shipping route, environmental conditions and shipping activities for all credible scenarios including accidental events during operations of the Project. The process involved the key steps of hazard identification, consequence analysis, frequency and likelihood analysis and risk analysis and resulted in the development of risk control strategies.

The assessment concluded that the overall operation of Gladstone Port is considered safe, because of navigation features, support systems and redundancy which all contribute to a low risk of an incident during transit. However, a series of mitigation measures were developed. These are listed in the technical report provided in Volume 5 Attachment 35. Key mitigations measures include:

- Navigational aids on the MOF and marine facilities
- Visibility of LNGC/LPGC at all times whilst at berth
- Visibility of marine facilities and berth at all times
- Exclusion zones for marine facilities.

In addition all LNG vessels calling on Australia Pacific LNG will be subject to inspections by accredited inspectors under the ship inspection report programme (SIRE) conducted under the auspices of the Oil Companies International Marine Forum. SIRE is a program that focuses the tanker industry on the importance of meeting satisfactory tanker quality and ship safety standards.

Australia Pacific LNG will require ship officers to have sufficient experience. Masters are expected to have a minimum four years seagoing and two years LNG experience. Chief Officers are expected to have a minimum two years seagoing and one year LNG experience. The minimum LNG combined experience of the Master, Chief Officers and Gas Engineer is expected to be at least four years.

Impacts on marine ecology - fauna strikes, lighting from shipping/wharf operations, introduced species

The Laird Point Gladstone Port LNG ship transit risk assessment report concluded that the frequency of ship strikes with whales in the GBRMP and Torres Strait is very low (estimated 3.16x10-4 per year).

An assessment of the lighting impacts from lights at the LNG facility on a nearby turtle population indicated that the impact would be negligible provided that appropriate lighting management was implemented.

Appropriate precautions will be undertaken (in consultation with State and Commonwealth regulators (particularly AQIS and Bio-security Qld) and the GPC against translocating potential pest species.

Ballast water operations will be undertaken in accordance with approved AQIS arrangements for the management of ballast water.

Further details are provided in Volume 4 Chapter 10 and Volume 4 Chapter 8.

Oil pollution and spills

Australia Pacific LNG will use ships with double hull protection around the forward and aft bunker fuel tanks. Additionally the Australia Pacific LNG carrier ships are most likely to be powered by gas turbines and will carry no or very limited quantities of bunker fuel. Overall, the likelihood of a bunker spill is almost non-existent.

ConocoPhillips as the Australia Pacific LNG operator of the LNG facility will have in place a corporate global marine vetting standard. This is a standard for vessel vetting and marine terminal clearance for vessels that load or unload at a facility operated by ConocoPhillips. This is to ensure prudent management of marine risk.

Harmful effects of anti-fouling systems

The International Maritime organisation has developed a protocol for banning the use of tributyltin (TBT) on all ocean going ships by 2008. No TBT is to be applied or reapplied after 1January 2003 and by 1 January 2008, no ships will have TBT on their hulls, or at the least, any existing TBT must be covered. In Australia, this is within the Antifouling Program as part of Australia's Oceans Policy.

ConocoPhillips, the Australia Pacific LNG joint venture partner that will build and operate the LNG facility has a marine vetting standard that would apply to shipping operations related to the Project. The standard sets out safety and environmental requirements to meet the company's marine transportation needs.

Interaction of LNG ships and other small vessels (ferries/barges)

GPC and MSQ in consultation with Australia Pacific LNG and other stakeholders have developed a list of draft LNG vessel operating parameters. These operating parameters have been developed based upon navigation simulations with LNG carriers up to 220,000m^3 capacity with laden draft up to 12.2m and arrival draft up to 11m. Australia Pacific LNG is committed to adhering to these operating parameters.

For example, in terms of towage and piloting requirements it is proposed that four tugs be used per LNG ship, including:

- Two 62 tonne, or equivalent capacity, tugs sourced from the existing tug fleet or as replaced
- Two 80 tonne bollard pull tugs, required in addition to the existing tug fleet. This requires three 80 tonne tugs to be in place, with one spare tug to allow for downtime/maintenance.

After an initial trial period, the requirement for tugs will be reviewed, and an alternative configuration with three 80 tonne bollard tugs may be utilised.

Training of pilots through shipping simulation, in co-operation with the Harbour Master, will be ongoing and as required throughout the life of the Project. Pilots will be trained on LNG ship handling characteristics and emerging scenarios in the simulation. In addition, harbour transit will be undertaken during daylight hours only for the first six months of operation, to allow tug masters, pilots and LNG vessel captains to gain familiarity with operation of LNG vessels in Gladstone harbour before 24 hour shipping operations commence.

Dredging of a new swing basin and shipping channel

Dredging will be required to enable vessels to access the LNG facility. This dredging work will be undertaken by GPC as part of the Western Basin Dredging and Disposal Project. The Western Basin Dredging and Disposal Project accommodates the long-term dredging and dredged material disposal required to provide safe and efficient access to the existing and proposed Gladstone Western Basin (Port Curtis, from Auckland Point to The Narrows) development areas

The Western Basin Dredging and Disposal Project comprises dredging associated with the deepening and widening of existing channels and swing basins and the creation of new channels, swing basins, berth pockets and approaches for MOFs. It is proposed that dredged material be placed into

reclamation areas north of Fisherman's Landing to create a land reserve to be used to service new port facilities.

GPC is currently in the process of gaining the necessary environmental approvals to undertake these works The reader is referred to the Queensland Department of Infrastructure and Planning website (http://www.dip.qld.gov.au/projects/transport/harbours-and-ports/port-of-gladstone-western-basin-strategic-dredging-and-disposal-project.html) for details on the Western Basin Dredging and Disposal Project. The EIS for this dredging and disposal project examines the environmental effects that may arise from the dredging required to service the needs of the Project.

Suitable anchorages

The GPC proposed LNG anchorages are set out on Figure 17.10. Australia Pacific LNG proposes to use these anchorages and have consulted with GPC and it has been agreed that this is an appropriate approach.

Figure 17.10 Anchorages

Discharges of waste water at sea, sewerage disposal

Removal of solid wastes will be undertaken by unloading directly to a barge by crane off the vessel. Waste is to be disposed of by an appropriately licensed waste management contractor.

LNG and LPG vessels will have secondary sewage treatment facilities on board. No removal or discharge of liquid waste is anticipated while vessels are within Gladstone Harbour.

The AQIS has implemented mandatory ballast water management requirements for vessels engaged in international shipping. For ships arriving from outside of Australian waters, where the potential risk of contaminants is deemed to be high, the three approved options for the management of ballast water are:

- Full ballast water exchange at sea
- Tank to tank transfers
- No discharge of high risk ballast water in Australian waters.

For the Project, LNG vessels will be expected to comply with these requirements through open sea sequential empty/refill of ballast tanks.

Potential foreshore damage arising from transit though the outer harbour up to the Clinton Channel

LNG carrier transits will be programmed for transits through the Clinton Bypass Channel. Transiting through the main Clinton Channel is feasible at reduced speeds. (In the vicinity of about 3 knots). The potential mainland foreshore damage arising from the Project's shipping operations is expected to be minor to negligible.

Further details on the coastal environment are provided in Volume 4 Chapter 12.

Introduction of pests and other harmful organisms

A system of radio pratique (licence to enter a port with an assurance from the captain that the vessel is free from contagious disease) has been adopted for vessels entering Gladstone as a first Australian port.

To facilitate inspections by the AQIS, a quarantine/bonded area will be established on Curtis Island prior to the cargo being moved into the Project site for staging and technical inspection prior to release for installation. In the event that materials or equipment imported from overseas are offloaded at Fisherman's Landing northern expansion, the Project will work with AQIS to ensure that appropriate quarantine inspection facilities are provided

The Project's operators will keep abreast of the national and international legislative requirements, and will ensure suitable marine transportation companies are engaged.

Further details are provided in Volume 4 Chapter 8.

Air quality

Minimising the impact of air pollution is addressed through annexure VI of MARPOL (GBRMPA 2003). The key features of the convention include the prohibition of deliberate emissions of ozone depleting substances, including halons and chlorofluorocarbons, limits on emissions of nitrogen oxides from

diesel engines and prohibition of the incineration on board ship of certain products, such as contaminated packaging materials and polychlorinated biphenyls.

It is expected that operator /charter parties will comply with the requirements specified through MARPOL.

Erosion and bottom disturbance

The GBRMPA is the principal adviser to the Australian Government on the management and development of the Marine Park. GBRMPA's role includes regulating the entry and use of the Marine Park by ships and other vessels through the Great Barrier Reef Marine Park Zoning Plan 2003 (the Zoning Plan)

Australia Pacific LNG will expect charter parties to comply with the requirements of the Great Barrier Reef Marine Park Zoning Plan 2003 (the Zoning Plan) in respect to potential erosion and bottom disturbance impacts from project shipping.

Further details are provided in Volume 4 Chapter 10.

Heritage and cultural considerations

Australia Pacific LNG will expect charter parties to comply with the requirements of the Zoning Plan.

Further details are provided in Volume 4 Chapter 18 and Volume 4 Chapter 19.

Transfer of material and personnel – Curtis Island to Fisherman's Landing northern expansion

Personnel ferries used within the Port of Gladstone will comply with a reasonable marine assurance standard. All vessels employed in marine activity, whether contracted or sub-contracted, will be inspected according to the International Marine Contractors Association common marine inspection document. This inspection will be performed by a suitably qualified inspector from an approved marine contractor.

Any vessel contracted by, or on behalf of, Australia Pacific LNG will have a structured and documented safety management system. All systems shall demonstrate that quality management and quality system elements meet the requirements of the International Maritime Organisation's regulations on the International Safety Management Code for the Safe Operation of Ships (ISM Code) and for Pollution Prevention (MARPOL).

Operations and Fisherman's Landing northern expansion

Fisherman's Landing northern expansion has been assumed as the embarkation point for materials to the LNG facility during the initial phases of construction until a MOF is built on the island to allow direct shipment of facility modules and other materials. Fisherman's Landing northern expansion is also proposed as the permanent location for construction and operations for mainland embarkation of personnel, materials, vehicles, etc, to the LNG facility.

This conceptual layout for the facility at Fisherman's Landing northern expansion is reproduced in Figure 17.5 in Section 17.5.3. However, all concepts developed to date are indicative.

Cumulative Impacts

An initial appraisal of the marine traffic inside the Port of Gladstone indicates that there is likely to be congestion if the Australia Pacific LNG facility and the other proposed LNG projects are constructed at the same time. The congested would occur in the Clinton and Auckland channel areas.

By Australia Pacific LNG using Fisherman's Landing north expansion as the primary embarkation point for the transfer for goods and personnel during the construction and operational phase of the LNG facility, a significant amount of the LNG facility's marine traffic is shifted into the Western Basin and avoids a potential congestion point around Wiggins Island.

Australia Pacific LNG will continue to work with government agencies and the other LNG proponents to ensure safe and efficient operation of the LNG facility.

17.6.4 Air services

Gladstone airport

As stated in Section 17.5.4, up to 50 to 80 personnel associated with the construction of the LNG facility may use the Gladstone airport. The current airport can cater for Dash 8-400 aircraft capable of carrying 70 persons. Therefore, to cater for the impact of the LNG facility construction, an additional one to two Dash-400 aircraft movements may be required. This is not expected to impact the operations of the airport. As passengers will be arriving by bus to the airport, there is not expected to be a significant impact on parking.

As stated in Section 17.5.4, an estimate of the cumulative impacts of a number of projects being constructed during the LNG facility construction period has been made, in particular the movement of personnel associated with the construction of other LNG facilities on Curtis Island. A conservative estimate of the passenger movements under this scenario would indicate a further additional 120 passenger movements per day associated with the construction of the Queensland Curtis Island LNG and Gladstone LNG facilities. Therefore, to cater for the impact of the other LNG facility projects during construction, up to an additional two Dash-400 aircraft movements may be required.

The cumulative growth plans for the Gladstone region are complemented by the current upgrades being completed at the Gladstone airport. Flexibility for larger aircraft including jet service as well as more frequent service will afford advantages and opportunities to source resources more efficiently throughout Australia. This combined with increased competition would benefit the projects as well as the community at large.

Australia Pacific LNG will work with the GRC and relevant government agencies and service providers to determine the most appropriate options for the use of Gladstone airport.

17.7 Conclusions

17.7.1 Assessment outcomes

The study has identified numerous impacts from the Project on road and shipping networks and the surrounding environment.

A risk assessment has been undertaken to identify potential risks, causes and consequences from traffic and transport. Mitigation measures to reduce the risks have been nominated and the residual risk has been calculated. Further details of the Project risk assessment methodology are provided in Volume 1 Chapter 4.

A summary of the environmental values, sustainability principles, potential impacts and mitigation measures for traffic and transport for the LNG facility is presented in Table 17.17. This table also includes the residual risk for traffic and transport.

Table 17.17 Summary of environmental values, sustainability principles, potential impacts and mitigation measures

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
Road					
The wellbeing of the local community and businesses Efficient, sustainable and supportive transport network for all members of the local and business community Flora and fauna habitat protection	Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities	Increased congestion and delay on road network	Additional volumes of oversize, heavy and light vehicle traffic due to quantity of materials required to construct and operate Project components	Work with federal, state, local government and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network which may include intersection and road alterations Aim to reduce light vehicle use as much as possible during construction, by providing transport to site (bus) from designated pick up areas or to and from the local airport for FIFO staff and daily commuters to and from Fisherman's Landing northern expansion Develop traffic management and logistic plans to provide the safe and efficient movement of people and materials, following regulations and requirements of regulatory agencies	Medium
		Damage and increased wear-and-tear on the existing road infrastructure due to heavy vehicles	Additional volumes of oversize, heavy and light vehicle traffic due to quantity of materials required to construct and operate Project components	Work with federal, state, local government and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network which may include pavement rehabilitation and road	Medium

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
				maintenance Develop traffic management and logistic plans to provide the safe and efficient movement of people and materials, following regulations and requirements of regulatory agencies	
		Increased risk of accidents on the road network	Additional volumes of oversize, heavy and light vehicle traffic due to quantity of materials required to construct and operate Project components Increased long distance road travel	Work with federal, state, local government and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network which may include intersection and road alterations, pavement rehabilitation and road maintenance Aim to reduce light vehicle use as much as possible during construction, by providing transport to site (bus) from designated pick up areas or to and from the local airport for fly in/out staff and daily commuters to and from Fisherman's Landing northern expansion Work with federal, state, local government and industry to improve road safety through clear road signage, improve road alignments and intersection geometry Provide driver's training to relevant Australia Pacific LNG staff. Contractors will be	Medium

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
				required to have health and safety management system which includes safe driving To reduce the risk of accidents to employees and other transport network users from projects operations, Australia Pacific LNG will develop and implement detailed traffic management plans and transport and logistics management plans for construction and operating the project infrastructure. These plans will incorporate safety measures to be implemented. A range of operational health and safety measure covering the operation of project vehicles will be in place to reduce the risk of motor vehicles accidents	
		Increased risk of adverse impact on the environment such as air pollution, noise, dust, land take, loss of habitat, runoff, pest and weed spread	Additional volumes of oversize, heavy and light vehicle traffic due to quantity of materials required to construct and operate Project components Need to alter or construct new roads	Work with federal, state, local government and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network which may include intersection and road alterations, pavement rehabilitation and road maintenance Aim to reduce light vehicle use as much as possible during construction, by providing transport to site, from designated pick up areas or to and from the local airport for fly	Medium

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
				in/out staff. Journey management plans for vehicle travel will incorporate fatigue management considerations Develop traffic management and logistic plans to provide the safe and efficient movement of people and materials, following regulations and requirements of regulatory agencies During the construction, operation and ongoing maintenance of existing and new roads, measures will be implemented to ensure environmental impacts are reduced, as far as practicable, and works will also be carried out in accordance with the requirements of the *Environmental Protection Act 1994*, the Main Roads Design Manual 2004, and other relevant legislation Australia Pacific LNG will implement conventional measures to reduce, as far as practicable the generation of dust by project vehicles during construction Australia Pacific LNG will participate in pro-active weed management and will work closely with regional councils During all phases (construction, operation and ongoing road maintenance) of this	

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
				project, sustainability measures will be implemented that will provide long term benefits while limiting traffic impacts, as far as practicable	
Shipping					
The wellbeing of the local community and businesses Efficient, sustainable and supportive transport network for all members of the local and business community Flora and fauna habitat protection	Refer above	Increased congestion particularly within the Port of Gladstone	Increased shipping due to importation of LNG facility construction materials and export of LNG product Increased ferry and barge numbers for transportation to Curtis Island	Development of shipping operations protocols in consultation with regulatory agencies	Low
		Increased risk of collision or accidents for shipping	Increased shipping due to importation of LNG facility construction materials and export of LNG product. Increased ferry and barge numbers for transportation to Curtis Island	Development of shipping operations protocols in consultation with regulatory agencies	Medium
		Increased risk of adverse environmental impacts such as product spill, ballast discharge	Increased shipping due to importation of LNG facility construction materials and export of LNG product Increased ferry and barge	Development of shipping operations protocols in consultation with regulatory agencies	Medium

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
			numbers for transportation to Curtis Island		
Air					
The wellbeing of the local community and businesses Efficient, sustainable and supportive transport network for all members of the local and business community Flora and fauna habitat protection	Refer above	Increased congestion and delay at local airports and aerodromes	Movement of construction staff at breakdown/shift changes Inadequate capacity at Gladstone airport support larger aircraft Infrastructure not available or services reduced due to airport construction works	Work with Gladstone Regional Council, relevant Government agencies and service providers to determine the most appropriate use of the Gladstone airport Develop management and logistic plans to provide the safe and efficient movement of people and materials, following regulations and requirements of regulatory agencies	Low

17.7.2 Commitments

To reduce the risk of accidents to employees and other transport network users from the Project's operations, Australia Pacific LNG will develop and implement detailed traffic management plans and transport and logistics management plans for constructing and operating the LNG facility.

A range of operational health and safety measures covering the operation of project vehicles will be in place to reduce the risk of motor vehicle accidents.

Australia Pacific LNG will:

- Work with national, state, local governments and industry in regard to infrastructure alterations which may be required to meet the increased demands on the regional and local transport network
- Work with GRC and relevant government agencies and service providers to determine the most appropriate options for the use of Gladstone airport
- Continue to support and consult with GPC and relevant regulatory agencies on construction and operational shipping protocols and traffic management
- Continue negotiations with GPC and GRC to determine the most appropriate methodology for managing construction and operational traffic associated with the LNG facility via Fisherman's Landing northern expansion
- Support additional modelling of ship movements within the Port of Gladstone.