Australia Pacific LNG Project

Volume 4: LNG Facility

Chapter 16: Waste

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16.1 Introduction

16.1.1 Purpose

This chapter of the environmental impact statement (EIS) assesses the waste generated from the construction, operation and decommissioning of the liquefied natural gas (LNG) facility for the Australia Pacific LNG Project (the Project).

The Project proposes to utilise ConocoPhillips' Optimized Cascade® process technology for ultimately a four-train LNG plant operating at nominal target capacity of 4.5 million tonnes per annum (Mtpa) for each LNG production train. ConocoPhillips is a joint venture partner of Australia Pacific LNG and will construct and operate the LNG facility.

Throughout the LNG facility's life cycle, including site preparation, construction, operation and decommissioning, it will produce a variety of waste streams and waste products.

Waste management options have been identified and will be employed. These examine alternatives that relate to waste minimisation, re-use and recycling of materials instead of disposal. It is intended that the waste products do not adversely impact upon environmental or human health, as well as amenity.

The purpose of the waste assessment is to:

- Identify, describe and quantify the various waste products and streams to be generated from the construction, operation, decommissioning and rehabilitation of the LNG facility and associated facilities
- Assess the potential impacts to the surround ding environment
- Determine options for waste minimisation and management, with specific reference to the waste hierarchy, as well as other cleaner production techniques
- Develop mitigation measures to minimise any waste impact.

The following waste management goals will be applied across the Project:

- Consider all waste as a resource to minimise disposal
- Design to minimise production of waste from all LNG facility's activities
- Minimise the generation of regulated and radioactive wastes
- Apply the waste management hierarchy of 'avoid, reduce, recycle, recover, treat and dispose', as a final option
- Apply sustainable waste management treatment and disposal methods
- Avoid contamination of soil and water
- Minimise potential risks to workers and the public
- Minimise adverse effects to marine, aquatic and terrestrial vegetation and wildlife.

Australia Pacific LNG has a strong commitment to sustainability and has developed a set of 12 sustainability principles, a subset of which will be used to guide the management of waste (refer to Volume 1 Chapter 3 for more on sustainability). The sustainability principles for waste management 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
- Using resources efficiently, reducing the intensity of materials used and implementing programs for the reduction and re-use of waste
- Identifying, assessing, managing, monitoring and reviewing risks to its workforce, Australia Pacific LNG's property, the environment and the communities affected by its activities
- Working cooperatively with communities, governments and other stakeholders to achieve positive social and environmental outcomes, seeking partnership approaches where appropriate.

In applying the sustainability principles, Australia Pacific LNG will develop and implement waste management plans. The plans will incorporate the waste management hierarchy to avoid, reduce, recycle and dispose of wastes.

16.1.2 Scope of work

This chapter describes the waste assessment for the LNG facility and associated facilities.

Further details regarding the waste streams generated and waste management are discussed in other chapters, as follows:

- Volume 4 Chapter 6 – Land contamination
- Volume 4 Chapter 11 – Stormwater discharges, desalination plant brine discharge, sewage treatment plant wastes and hydrotest water discharge
- Volume 4 Chapter 12 – Coastal modelling of wastewater discharges
- Volume 4 Chapters 13 and 14 – Odour, air emissions and greenhouse gas emissions
- Volume 4 Chapter 24 – Environmental management plan.

Volume 2 Chapter 16 and Volume 3 Chapter 16 describe the waste assessment for the gas fields and gas pipeline components of the Project.

16.1.3 Legislative and policy framework

The regulatory requirements in Queensland for waste management are provided within the Queensland *Environmental Protection Act 1994*, the *Environmental Protection Regulation 2008*, the *Environmental Protection (Waste Management) Policy 2000*, and the *Environmental Protection (Waste Management) Regulation 2000*.

Environmental Protection Act

The intention of the *Environmental Protection Act 1994* is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes from which life depends (ecologically sustainable development).

The Act defines waste as anything, that is:

a) Left over, or an unwanted by-product, from an industrial, commercial, domestic or other activity

b) Surplus to the industrial, commercial, domestic or other activity generating the waste.

Environmental Protection Regulation

The Environmental Protection Regulation 2008 defines general waste as waste other than regulated waste. Regulated waste is defined as waste that is:

a) A commercial or industrial waste, whether or not it has been immobilised or treated.

b) Of a type, or contains a constituent of a type, mentioned in schedule 7 of the regulation.

Environmental Protection (Waste Management) Policy

The aim of the Environmental Protection (Waste Management) Policy 2000 is to achieve the goals of the *Environmental Protection Act 1994* in relation to waste management through:

- Identifying the environmental values to be enhanced or protected
- Providing a framework to:
  - Ensure waste management is consistent with ecologically sustainable development
  - Minimise the impact of waste to the environment
  - Minimise the quantity of waste generated
  - Promote efficient use of resources and maximum use of waste
  - Continuously improve waste management activities.
- Providing for the preparation of waste management programs and industry waste reduction programs.

The policy outlines the waste management hierarchy as an optimal waste management tool, which moves from most preferred to least preferred:

- Waste avoidance
- Waste re-use
- Waste recycling
- Energy recovery
- Waste disposal.

One of the principles highlighted in the policy that applies to the management of wastes associated with the Project is the polluter-pays principle. This principle states that 'all costs associated with the management of waste should, if practicable, be borne by the persons who generated the waste'.

The waste management hierarchy and the polluter-pays principle have important ramifications for the design of a waste management program. The waste hierarchy is specifically designed to reduce the amount of waste that a project produces; while the polluter-pays principle encourages cleaner/greener design by the proponent, by ensuring the proponent is held accountable for any wastes that the Project may produce.

The environmental values that have the potential to be impacted by waste are listed in Table 16.1. The management of waste protects these values during construction, operation and decommissioning of the LNG facility.

Table 16.1 Environmental values

	Environmental values
Air	Qualities of the air environment that are suitable for sustaining life, health and wellbeing of humans
	Local amenity (dust, noise, odour)
	Aesthetic enjoyment
Water	Biological integrity of a modified aquatic ecosystem
	Suitability for recreational use
	Suitability for industrial use
	Wildlife habitat
	Aquaculture
	Human health
	Visual amenity
Noise	Qualities of acoustic environment conducive to the wellbeing of the community or a part of the community including social and economic amenity
Waste management	Life, health and wellbeing of people
	Diversity of ecological processes and associated ecosystems
	Land use capability, having regard to economic considerations
Land	Quality of the land environment to ensure the site is environmentally sustainable for future generations
	Flora and fauna habitat protection

Environmental Protection (Waste Management) Regulation

The purpose of the Environmental Protection (Waste Management) Regulation 2000 is to protect the environment by:

a) Minimising the impact of waste to the environment including, in particular, the impact of waste so far as it directly affects human health

b) Establishing an integrated framework for minimising and managing waste under the principles of ecologically sustainable development.

The regulation also provides for the reporting and tracking requirements of regulated waste.

Central Queensland Waste and Resource Recovery Strategy

The LNG facility's waste management plan will be developed in accordance with relevant principles within the Central Queensland Waste and Resource Recovery Strategy, June 2006 TechSearch Waste and Environment Services. The Strategy aims to contribute to the achievement of regional waste management suitability through:

- The preservation and enhancement of community and environmental health values
- Lower per capita levels of resource consumption
- Lower waste generation rates
- Community and business waste minimisation (re-use and recovery for beneficial use)
- The achievement of regional economic and social development while restricting environmental risks to acceptable levels
- Continuous improvement in environmental performance.

16.2 Australia Pacific LNG corporate standards

The Project's strategic standards are to prioritise the prevention and minimisation of waste generation, and effectively manage wastes in a manner that minimises impact to the environment while also being cost effective. A step-by-step approach will be implemented with the following order of preference:

- Prevention and reduction
- Re-use
- Recycle and recovery
- Treatment
- Disposal.

16.3 Methodology

The waste assessment involved an analysis of each stage of the LNG facility's development to identify potential or likely waste streams and products. The LNG facility will generate atmospheric emissions, wastewater discharges, stormwater discharges and solid and semi-solid wastes. Waste streams have been identified for the construction, operation and decommissioning phases of the facility.

Anticipated volumes and quantities of these wastes were calculated, drawing from information supplied by sub-consultants as well as investigating similar projects throughout Australia and globally.

A matrix was then developed which further investigated the likely impacts associated with these wastes (refer to Table 16.13). Management options were then identified, employing principles such as the previously mentioned waste hierarchy (i.e. focusing firstly on avoidance and minimisation and secondly re-use and recycle and finally considerations for disposal) and cleaner production initiatives.

16.4 Waste generation

There are a variety of sources of waste associated with the each phase of the development of the LNG facility. LNG facilities are typically very low emission facilities compared to other industries in the

Gladstone region, with minimal process wastes associated with the generation of LNG from coal seam gas (CSG). This is attributed to a number of factors, including:

- The use of natural gas to generate energy instead of conventional sources
- Technological innovations, such as ConocoPhillips' Optimized Cascade® process, which increase the efficiency of processes within the plant
- The presence of a number of closed-loop processes, which minimise waste streams and products by reusing or recycling outputs as inputs.

16.4.1 Construction wastes

A number of wastes have been identified which are likely to be generated from general construction activities. These include:

- Vegetation cleared during site preparation works
- Oils and oily wastes from equipment and machinery maintenance and refuelling activities
- Waste paints and solvent
- Waste adhesives
- Aerosol cans
- Waste antifreeze/radiator coolant
- General domestic waste and recyclables from construction workers
- Office wastes
- Paper, cardboard and timber from packaging
- Scrap metals (ferrous and non-ferrous)
- Surplus concrete
- General inert construction waste
- Greywater and sewage
- Medical and first-aid station waste.

Additional waste streams will be generated from operating the temporary accommodation facility:

- Office wastes
- General domestic waste
- Food waste
- Greywater and sewage
- Medical and first-aid station waste.

Atmospheric emissions

Various types of construction equipment will be used from the inception of site work until commissioning of the LNG facility. While the majority of this equipment will use diesel fuel, some equipment will use petrol.

Expected emissions will include oxides of nitrogen (NO_X), carbon dioxide (CO_2), carbon monoxide (CO), oxides of sulphur (SO_X), particulate matter (PM_{10}) and volatile organic compounds (VOCs). Table 16.2 provides an estimate of expected emissions generated by the use of construction equipment for a construction period of four years and nine months, which is the anticipated time for constructing two LNG production trains.

Table 16.2 also shows the further emissions generated through the addition of trains 3 and 4. During the construction period, it is anticipated that diesel consumption will be some 10.2ML and petrol consumption in the order of 1.6ML.

Table 16.2 Estimated site air emissions, during the construction phase

Emission	Total emissions (tonnes) (Trains 1 and 2)	Total emissions (tonnes) (Trains 3 and 4)
PM_{10}	90	63
SO_X	80	56
NO_X	1,030	720
CO	1,890	1,325
CO_2	42,000	29,400
VOCs	150	105

Notes:

The estimate is based upon a four-year, nine-month construction period to construct trains 1 and 2 and a similar construction period for trains 3 and 4

Emissions regarded are site emissions only – no emissions associated with the transport of materials, equipment or personnel to and from the site are included in these estimates

United States Environmental Protection Agency (USEPA) emission factors have been used to derive emission levels

Wastewater discharges

Wastewater arising from construction phase activities will include hydrotest water, flushing water, vehicle and equipment washdown water, brine from the desalination plant, stormwater and sewage treatment plant effluent.

Estimated water quantities are outlined in Table 16.3. However, where appropriate, it is intended that hydrotest water, flushing water and stormwater will be transferred to impoundment pond(s) for re-use onsite for dust suppression and irrigation, in accordance with regulatory requirements.

Impoundment pond(s) water will be collected and used to pressure test the storage tanks, pipework and other vessels onsite. This water will be recycled for various testing requirements if the quality is suitable.

After all the hydrotesting being completed, any remaining hydrotest water will be discharged offshore at a location with adequate flushing to enable rapid dispersal. The test water may contain traces of biocides and oxygen scavengers used to protect the inner surface of the tanks from risks of fouling and corrosion. This water will be monitored and treated, if necessary, prior to any release.

Table 16.3 Waste streams and estimated quantities for construction activities

Waste stream	Estimated quantity[1]
Hydrotest water and flushing water	160,000m^3 (total for construction of Trains 1 and 2)
Washdown water	200m^3 per year
Sewage and greywater	86,000m^3 per year
Treated sewage effluent	100,000m^3 per year
Stormwater	100,000m^3 per year
Brine	550,000m^3 per year*

[1] Based on an average construction workforce of 1050

It is expected that the discharge of brine from the desalination plant will reach a maximum of 3,000m^3/day (based on a maximum construction workforce of 2,100). Initially, prior to the completion of the jetty, brine will be discharged near to the end of the materials off-loading facility (MOF) but sufficiently offshore to prevent stagnant hyper-saline areas from forming. The expected quality of this wastewater stream is provided in Volume 4 Chapter 11.

Table 16.13 provides more detail upon the anticipated quantities of each of these waste streams, as well as associated management options to minimise wastewater discharges and associated environmental or human harm.

It is expected treated sewage effluent from the onsite sewage treatment plant will reach a maximum of 550m^3/day (based on a maximum workforce of 2,100) during the construction period. Effluent surplus to onsite irrigation needs will be discharged to Port Curtis, in accordance with regulatory requirements.

In addition, wastewaters will be generated by the washing down of construction vehicles and plant, including the concrete batching plant. This water will be used onsite, were practicable.

General waste

Table 16.4 details waste streams that will be generated predominantly from the operation of the temporary accommodation facility expressed as a quantity per year (based on the forecast total against the four year, nine month construction period for the first two LNG trains). The waste streams and quantities are based upon a peak construction workforce of 2,100 people.

Section 16.4.1 provides more detail about the construction waste streams, the anticipated quantities of each of these streams and associated management options to minimise disposal of wastes and potential environmental or human harm.

Waste generated during the construction phase that cannot be recycled will be collected in mobile garbage bins and suitably-sized roll-on-roll-off bins with proper waste identification and labels in a designated waste segregation area. These wastes will be barged from Curtis Island and disposed of on the mainland at licensed landfill sites.

Table 16.4 Key waste streams and estimated volumes for construction activities

Waste stream	Estimated quantity
Sewage treatment plant solids	140m^3 per year
Food waste	70 tonnes per year
Domestic waste	110m^3 per year
Paper and cardboard	40 tonnes per year
Plastic	10 tonnes per year
Glass	6 tonnes per year
Metal	8 tonnes per year
Other	200 tonnes per year

16.4.2 Operating wastes

The types of waste generated from the LNG facility's operating activities will include:

- Atmospheric emissions
- Wastewater discharges
- General and regulated solid and semi-solid wastes
- Dredging operations.

The following sub-sections and Table 16.13 provide information about the anticipated quantities of each of these waste streams, as well as associated management options to minimise disposal of wastes and potential environmental or human harm.

Atmospheric emissions

CSG is processed to produce LNG with primary inputs into the plant being pre-treated (de-watered) CSG from the pipelines, seawater which is desalinated and various supplies and chemicals required for normal plant operation and maintenance. A number of these stages are primarily closed-loop cycles, whereby outputs are re-used as inputs.

Wastes associated with LNG processing are primarily generated as atmospheric emissions, primarily from the combustion of hydrocarbons. During normal operation, the majority of these are produced from the following stationary sources:

- Gas turbines to drive refrigerant compressors
- Gas turbines for power generation
- Acid gas removal unit
- Hot oil heaters
- Nitrogen rejection unit.
- Dry gas flare (pilot light operating)

- Wet gas flare (pilot light operating)
- Marine flare (including loading of LNG vessels and unloading LPG vessels, if required)

Non-routine operations are those outside of the general operating parameters for the facility, and which occur intermittently for a short duration. Emissions from these events will be variable and intermittent. These emission sources include:

- Dry gas flare (maintenance or upset conditions)
- Wet gas flare (maintenance or upset conditions)
- Marine flare (maintenance or upset conditions).

Mobile sources and their emissions include vehicle emissions, ferry and barge movements and transit of LNG and LPG vessels.

The main atmospheric pollutants that are generated during operations from these sources include:

- Carbon dioxide (CO_2) emissions vented from the amine pre-treatment process
- CO_2, NO_X, CO, PM_{10}, sulphur dioxide (SO_2), nitrous oxide (N_2O) and methane (CH_4) emissions from gas turbine stacks, with the primary sources being compressor turbines and power generation turbines
- CO_2, NO_X, CO, PM_{10}, SO_2, N_2O and CH_4 emissions from flaring (wet, dry and marine flares)
- Volatile organic compounds such as CH_4, ethylene (C_2H_4) and propane (C_3H_8) as fugitive emissions (unintended loss through processing)
- Nitrogen (N_2) via the nitrogen rejection unit during liquefaction.

An expected emissions inventory for primary sources is given in Table 16.5.

Table 16.5 Point source emissions inventory

LNG production	4.5Mtpa (1 train) (tonnes)[1]	18Mtpa (4 trains) (tonnes)[1]
Emissions (tonnes/per year)		
PM_{10}	56	215
SO_2	1	2
NO_X	860	3,440
CO	780	3090
CO_2	1,337,000	5,112,000
N_2O	30	100
CH_4	3,130[2]	12,540[2]
VOCs	35	180
Greenhouse gas equivalent		
Tonnes CO_2/year	1,412,000	5,408,000

Notes: [1] Emissions from non-routine flaring are included
[2] CH_4 emissions do not consider oxidiser on the nitrogen removal unit

The expected level of fugitive emissions has been estimated based upon information from ConocoPhillips, from its operating experience at the Darwin LNG facility. The estimates for each train are:

- Methane – 180 tonnes/year
- Ethylene – 140 tonnes/year
- Propane – 190 tonnes/year.

More specific details about the impacts of these atmospheric emissions are discussed in Volume 4 Chapter 13 and Volume 4 Chapter 14.

Wastewater discharges

The LNG facility operations will generate the following wastewater disposal streams:

- Stormwater
- Sewage effluent produced by the sewage treatment plant
- Brine from the seawater desalination plant
- Potentially contaminated wastewater from the facility process areas.

Clean stormwater

Stormwater is generally not considered a waste unless it becomes contaminated in a construction or process area. As such, stormwater will be diverted around the LNG facility's footprint to reduce the quantity of stormwater entering the site.

Clean stormwater will be collected from sections of the LNG facility that has limited potential for contaminating this run-off. This stormwater will be directed by surface drains to hydrotest pond prior to harvesting for use in the LNG facility for irrigation and dust suppression purposes and/or for ocean disposal during wet weather.

Sewage treatment plant effluent

The sewage treatment plant will be an extended aeration, biological treatment plant designed to treat the wastewater to applicable standards for use for site irrigation purposes and/or for discharge to Port Curtis.

It is anticipated that during steady state LNG production (4 trains), effluent disposal will be at an average rate of 3.5m^3/hr and up to a maximum rate of 15m^3/hr. Indicative effluent characteristics from the sewage treatment plant are detailed in Table 16.6.

Treated sewage effluent will be stored in a tank for dechlorination purposes prior to being used for irrigation purposes or discharged to Port Curtis. If it is discharged it is likely that treated sewage effluent will be discharged with the desalination plant brine (refer to below).

Table 16.6 Indicative treated sewage effluent characteristics

Parameter	Concentration
pH	6.5 - 7.5
5 day biochemical oxygen demand (BOD_5)	10 - 20mg/L
Oil	5 - 10mg/L
Total nitrogen	< 4mg/L as N
Total Kjeldahl nitrogen	1 - 4mg/L
Ammonia nitrogen	1 - 4mg/L
Total phosphorus	<1mg/L
Chlorine	1 - 2mg/L
Total dissolved solids (TDS)	250mg/L

Brine disposal

The brine discharge will be piped and discharged into Port Curtis via an outfall and diffuser arrangement. The diffuser design modelled for the EIS included six ports with a diameter of 50mm and spaced 2m apart over the diffuser length of 10m.

The brine discharge point will be at a location sufficiently far offshore to prevent the formation of stagnant hyper-saline areas in harbour waters with the following characteristics:

- Sufficient depth for mixing to occur and an adequate distance from the shoreline and from the seawater intake
- Free flowing current conditions that would disperse the brine discharge
- Available access for maintenance purposes
- Free from vessel contact and within the LNG facility marine lease area.

It is anticipated that during steady state LNG production (four-trains), brine disposal will be at an average rate of 96m^3/hr and up to a maximum rate of 116 m^3/hr.

The indicative characteristics of the brine are detailed in Table 16.7.

Table 16.7 Indicative brine characteristics, desalination plant

Parameter	Concentration
pH	6 – 8
Total dissolved solids	50,000 – 60,000mg/L
Calcium	600 – 750mg/L
Magnesium	2,000 – 2,500mg/L
Potassium	600 – 800mg/L
Sodium	19,000 – 22,000mg/L
Chloride	30,000 – 33,000mg/L
Fluoride	1.5 – 3mg/L
Sulphate	4,000 – 6,000mg/L
Strontium	15 – 25mg/L
Total suspended solids (TSS), average	20 – 30mg/L
Total suspended solids, maximum	40mg/L
Chlorine	<1mg/L
Anti-scalant	8mg/L
Flocculent	5mg/L
Polymer	1mg/L
Silica dioxide	1 – 2mg/L
5 day biochemical oxygen demand	5 – 10mg/L

Both near-field and far-field modelling were undertaken to assess dispersion of the brine discharge using an outfall and diffuser arrangement. In the near-field, it was predicted there would be no discernible impact from the discharge of the brine reject to the water quality in the vicinity of the diffuser as dilutions are adequate.

From the far-field modelling it was predicted maximum salinity increases do not exceed 0.11ppt which is within ambient seawater variation. The potential impact from accumulation of salinity resulting from the Australia Pacific LNG discharge is negligible (refer Volume 4, Chapter 12).

Potentially contaminated wastewater

An integral part of the LNG facility is a dedicated system to collect and treat process and oily wastewater, including oily water from the compressors and various hydrocarbon leaks, and potentially contaminated stormwater prior to re-use or discharge. Such wastewater will be treated by passage through an oil and water separator (corrugated plate interceptor), a dissolved air flotation unit and an effluent filter.

The oily wastewater will be pre-treated in a hydrocarbon sump drum where vapours and condensate will be separated. The condensate will be pumped to the oil and water separator for retrieval of free

oil, and the vapours will be sent to the wet gas flare for disposal. The separator produces three waste streams – sludge, treated effluent, and waste oil.

The sludge will be temporarily stored in a sludge holding tank pending periodical transport by a licensed contractor for disposal at a licensed waste management facility. Waste oil will also be stored and transported off-site for recycling. The treated effluent from the oil and water separator will be sent to the dissolved air flotation unit and effluent filter to remove any remaining oil. It will be stored onsite in a tank with treated sewage effluent and is likely to be discharged into Port Curtis with the desalination plant brine if not used for onsite irrigation purposes.

The indicative characteristics of the treated effluent are detailed in Table 16.8. It is anticipated that during steady state LNG production (four-trains), this water stream will flow at an average rate of 25m^3/hr and up to a maximum rate of 100m^3/hr.

Table 16.8 Indicative treated effluent characteristics

Parameter	Concentration
pH	6 - 7
BOD_5	15 – 30mg/L
Oil	5 - 15mg/L
TSS	10 – 30mg/L[1]
TDS	250 – 350mg/L[1]

[1] Note: quality characteristics are influenced by the water quality of the process water used

Shipping waste

Management of shipping waste such as wastewater discharges from shipping ballast will be regulated by the International Convention of Pollution from Ships (MARPOL) as established by International Maritime Organisation.

Additionally, the Australian Quarantine Inspection Service (AQIS) enforce mandatory ballast water management requirements for vessels engaged in international shipping which will cover vessels associated with the LNG facility. This is to ensure that exotic species and sediments are not introduced into the Gladstone Port ecosystem from ballast water releases. Ballast water will be exchanged in international waters prior to entering the Great Barrier Reef Marine Park.

Management of shipping waste is undertaken by Gladstone Ports Corporation (GPC) under a certified agreement with the AQIS.

The AQIS deems all salt water from ports and coastal waters outside Australia's territorial sea to present a high-risk of introducing exotic marine pests into Australia. The discharge of high-risk ballast water from ships is prohibited anywhere inside Australia's territorial sea. Therefore, the only ballast water management option for LNG exports is:

- Non-discharge of high-risk ballast water in Australian ports or waters
- Vessels coming into the Port of Gladstone must make waste available for collection by an authorised collector vessel. Wastes including animal waste, organic refuse and galley scraps of quarantine waste.

Additionally, 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. See Volume 4 Chapter 10 for more information on potential impacts from ballast water release.

Solid and semi-solid wastes

The solid and semi-solid wastes generated through the operation of the LNG facility will be:

- General wastes including domestic waste garbage and recyclables from onsite workers, office wastes, paper and cardboard as well as timber from packaging
- Medical and First Aid station waste
- Regulated wastes and/or hazardous wastes including waste lubricating oils, sewage treatment plant sludge, molecular sieve waste, oily sludge from the oil and water separator and dissolved air floatation unit and cellulose
- Regulated wastes and/or hazardous wastes comprising spent solvents.

Table 16.9 outlines the anticipated solid waste generation in tonnes per year for the development of the four-train LNG facility.

Table 16.9 Anticipated LNG facility solid waste generation (4 x 4.5Mtpa LNG facility)

Waste product	Waste source	Quantity (Tonnes/year)
Waste lubricating oils	Plant area	220
Spent oils	Plant area	3
Cellulose	Plant area	3
Biological sludge (dry basis)	Sewage treatment plant	15
Oily sludge/float	Oil and water separator/dissolved air floatation unit	28
Spent solvents	Plant area	<1
Ceramic balls*	Molecular sieve dehydrators	16
Molecular sieve waste	Molecular sieve dehydrators	350[1]
Activated carbon (amine filter)	Acid gas removal unit	80[1]
General wastes	Plant area	320
Waste oil from slop oil tank	Plant area	140m^3/year
Mercury adsorbent[2]	Mercury removal unit	100
Cartridge filters	Plant area	12

[1] Tonnes every three years

[2] Adsorbent bed life is expected to be the LNG facility design life.

Waste materials generated during the operational phase that cannot be re-used onsite will be collected in mobile garbage units and suitably sized roll-on roll-off bins with proper waste identification,

colour and labels in a designated staging area and transported by a licensed contractor for re-use, recycling or disposal at licensed waste management facilities on the mainland.

Pre-processing such as compaction onsite will be considered during detailed planning with waste management contractors.

Dredging operations

Dredging of the approach channel, swing basins, berth pockets, MOF footprint will be required to enable safe shipping access to the LNG facility.

All dredging requirements for the LNG facility are being managed by GPC. GPC is seeking approval to dredge the inner harbour, to create new channels swing basins and berth pockets and dispose of the dredged material into the proposed Western Basin Reclamation Area.

Plans for dredging and maintenance dredging material disposal and associated impacts are described and assessed in GPC's EIS for the Western Basin Dredging and Disposal Project and addendum report.

16.4.3 Decommissioning wastes

It is expected that individual items of equipment and the LNG facility as a whole will be decommissioned when its operation is no longer economically viable.

Facility decommissioning activities will be carried out in accordance with a decommissioning plan and will comply with regulatory requirements that are in force at the time of decommissioning and good industry practice.

The overall aim of the decommissioning plan will be to ensure that the site does not pose an ongoing risk to public safety or the quality of the environment and fulfils community expectations. The decommissioning plan will be prepared for the facility before decommissioning work starts, in consultation with regulatory authorities and relevant stakeholders.

In preparing the decommissioning plan, Australia Pacific LNG will aim to demonstrate how it will reduce as far as practicable the amount of waste requiring disposal. This will include consideration of re-use and recycling alternatives where feasible, such as:

- Removal for use by another operator
- Removal for sale to a third party
- Leaving in place facilities or infrastructure of benefit to the community.

The decommissioning plan will also provide the procedures to be followed for the removal or making safe of the LNG plant, equipment, structures and buildings. Table 16.10 outlines estimated wastes streams and quantities.

Table 16.10 Decommissioning waste and quantities

Waste product	Quantity
Structural steel	58,500t
Concrete	110,340m^3
Wire and cabling	2t equivalent
Pipe insulation	121,200m equivalent
Equipment installation	10,940m^2 equivalent

The decommissioning contractor will designate waste management areas for segregation of the waste into re-use, recycle and disposal streams. Plant and equipment and components that are in good working order will be re-used, as appropriate. The decommissioning contractor will engage recycling contractors to collect all recyclable material and recycle and re-use as appropriate.

The hydrocarbon product to be processed will be predominantly gaseous, so soil contamination is not expected to be an issue. However, the decommissioning plan will provide for a soil contamination survey to be conducted to determine if there has been any inadvertent contamination (e.g. diesel fuel). If any contamination is discovered, a soil remediation program will be developed and implemented consistent with regulatory requirements and good industry practice at the time of decommissioning.

16.5 Potential impacts

Environmental impacts from waste will only occur as a result of poor management. The potential impacts include the following:

- Land and water contamination from inappropriate storage, handling and disposal of solid and liquid wastes
- Land and water contamination from spills and releases during handling and transportation
- Increased populations of vermin from inappropriate storage and handling of waste
- Odours due to inappropriate storage and handling of waste
- Water contamination from discharges of contaminated stormwater, sewage treatment effluent, and brine
- Inefficient use of resources
- Adverse effects to marine, aquatic and terrestrial flora and fauna.

Given ConocoPhillips' (the Australia Pacific LNG joint venture partner who will operate the LNG facility on behalf of Australia Pacific LNG) track record in effective waste management and proven control measures, construction, operational and decommissioning wastes are considered to present a low risk to the environment and/or public health.

16.6 Mitigation and management

The main purpose of waste management is to minimise impacts to the environmental values as outlined in Table 16.1 with consideration of the sustainability principles discussed in Section 16.1.1. Several strategies will be used for the LNG facility, principally the implementation of the waste

management hierarchy and cleaner production principles. These are discussed in further detail in Section 16.6.3 and Section 16.6.4 respectively.

The waste management actions proposed for the LNG facility are detailed in Table 16.13 and in the environmental management plan in Volume 4 Chapter 24.

16.6.1 Waste management plan

A detailed waste management plan will be further developed for the LNG facility's construction, operation and decommissioning phases. This plan will include the following components:

- Waste streams and quantities
- Management strategies to be employed for each waste stream
- Roles and responsibilities
- Monitoring of waste streams and management activities
- Auditing requirements against the waste management plan
- Reporting requirements.

This plan will involve development of the high level strategies detailed in this chapter into effective actions that are appropriate to the type and extent of activities occurring on the site and the wastes being generated. As such, it will be a dynamic document to be amended specifically for each phase of the LNG facility and updated subsequent to waste management audits to ensure continual improvement.

16.6.2 Summary of key environmental design features

The following is a summary of the key environmental design features incorporated in the design of the facility to avoid or minimise potential environmental impact.

Liquid waste minimisation

The LNG facility will use a variety of technologies and practices to control and minimise liquid wastes. These measures will include:

- Segregation of waste water streams and their treatment (contaminated stormwater, sanitary wastewater, clean stormwater)
- Re-use of treated sewage effluent and treated stormwater for potential onsite irrigation
- Use of the facility's inlet air chilling system to generate fresh water thereby reducing the need to obtain water from the desalination plant
- Use of air cooling in place of water cooling; this will lessen site water demand for demineralised water and will avoid the discharge of blowdown water
- Use of a waste heat recovery system using heat transfer oil in place of water to avoid the need to dispose of boiler blowdown and to produce demineralised water
- Use of dry gas seals rather than water cooling to avoid potential water blowdown and thermal discharges impacts
- Use of secondary containment structures for diesel tanks.

Solid waste minimisation

The LNG facility will use of a variety of technologies and practices to control, minimise, and re-use solid wastes during construction and operation. These measures will include the:

- Implementation of waste management practices through the supply chain that will minimise the generation of solid wastes and recycle as much as practicable at source
- Disposal of inert wastes to an approved landfill on the mainland
- Re-use of cleared site vegetation as a mulch to aid site landscaping following site earthworks
- Air-drying of solvent-based wastes (waste paint, paint thinner, adhesives, and so on) prior to disposal.

Atmospheric emissions minimisation

The LNG facility will make use of a variety of technologies and practices to control and minimise gaseous wastes. These measures will include the:

- Use of CSG as the fuel source where practicable, in preference to liquid or solid fuels
- Use of power generators equipped with dry low NO_x technology, and aero-derivative gas turbine drivers equipped with dry low emission (DLE) technology
- Use of waste heat recovery to supply process heat
- Capture and re-liquefaction of excess gas generated during ship loading in the LNG process rather than being flared. Which will reduce emissions resulting from the burning of this gas stream, whilst preserving CSG resources
- Use of closed-loop sampling systems to minimise fugitive emissions.

16.6.3 Waste management hierarchy

The waste management hierarchy will be the primary tool used for sustainable waste management.

Waste avoidance

Waste avoidance will be achieved through the consideration of alternative products, implementation of alternative technology, contracts with companies encouraging sustainable waste management practices, procurement of pre-fabricated materials and compliance auditing of these companies.

The use of pre-fabricated materials will play an important part in waste avoidance for the LNG facility. Given the remote location and limited access to the site, a number of pre-fabricated/modular components will be brought onto site for use at the LNG facility. This will substantially reduce the quantities of some waste streams associated with the construction phase of the LNG facility, including scrap steel and surplus concrete.

Waste re-use

Re-use refers to waste that is re-used without substantially changing its form. Re-use will be achieved initially by identifying re-use opportunities onsite and subsequently through identifying market demands for waste items. To maximise re-use opportunities, wastes will be segregated. Waste items that will be generated by the LNG facility and may be re-used include:

- Timber pallets will be mulched and re-used onsite for dust suppression, erosion and sediment control and rehabilitation
- Cleared vegetation will be mulched and re-used onsite for dust suppression, erosion and sediment control and rehabilitation
- Surplus concrete will be crushed and re-used onsite for road base, hardstand areas and erosion and sediment control
- Building materials will be re-used onsite during construction
- Organic wastes will potentially small scale vermiculture and/or composting and the product re-used for rehabilitation
- Wastewaters during operation for dust suppression and irrigation purposes.

Future investigations regarding waste re-use will continue. Additionally, the marketability of wastes will be regularly reviewed to ensure potential new and emerging opportunities for waste re-use are maximised.

Waste recycling

Recycling represents an important component of the waste management strategy used onsite. It involves the treatment of a waste that is no longer usable in its current form and using it to create new products. A large percentage of the LNG facility's wastes streams (remaining after re-use opportunities have been exhausted) will be recycled. Table 16.11 provides an outline of the recyclable product, potential end use and a qualitative assessment of the marketability of the product.

Table 16.11 Recyclables and market potential

Recyclable product	Potential end use	Marketability
Scrap ferrous metal	Scrap metal will be managed via a third-party licensed recycling contractor. The product will be removed from the site, shredded and either re-smelted or used in the smelting process. Any grade of steel can be recycled to top quality new metal	High marketability with continual high demand from local and global market available for scrap metal recycling
Scrap non-ferrous metal	Scrap metal will be managed via a third-party licensed recycling contractor. The product will be removed from the site, shredded and crushed into bales for resale. It is then smeltered to produce a molten product and forged. There is very little property differences between recycled and virgin non-ferrous metal	High marketability with continual high demand from local and global market available for scrap metal recycling
Lead acid batteries	Batteries will be managed via a third-party licensed recycling contractor. The lead acid batteries will be removed from the site and striped with workable components recycled into new batteries	High marketability with Queensland markets available to recycle this waste
Scrap/surplus concrete	Crushed and re-used onsite for road base, hardstand areas and erosion and sediment control	Onsite uses
Paper, cardboard, glass, some plastics,	These recyclable wastes will be managed via a third- party licensed recycling contractor. The products will be removed	Medium marketability as the demand from

Recyclable product	Potential end use	Marketability
tins and cans	from site and taken to a material recovery facility to sort to specifications, baled, shredded, crushed, or otherwise prepared for resale	Australian and global markets for these products are unstable and will fluctuate
Waste oils	Waste oils will be managed via a third-party licensed recycling contractor. The oils will be taken from the site, filtered and demineralised, propane de-asphalted and distilled to produce re-refined base oil suitable for use as a lubricant, hydraulic or transformer oil	High marketability with Queensland markets available to recycle this waste
Activated carbon	Activated carbon will be managed via a third-party licensed recycling contractor. Activated carbon will be taken from the site, impurities removed by either heat (thermal recycling) or steam (steam recycling) and re-used	Medium marketability with limited Queensland markets available to recycle this waste
Decommissioning equipment	A decommissioning plan will be developed that will maximise recycling opportunities. Waste concrete, ferrous metals and non-ferrous metals will be managed as above. Working plant and equipment will be sold as appropriate	Medium to high marketability due to high value recyclable materials generated

Regulated waste that can be recycled will be transported off-site by a licensed contractor to an appropriate recycling facility.

Waste disposal

Waste disposal to landfill will only be used where there is no other viable option available. Subsequent to ConocoPhillips' approval (refer Section 16.6.8), it is expected general waste will be transported to the Benaraby regional landfill for disposal in accordance with regulatory requirements.

The Benaraby landfill is located on the Bruce Highway, Benaraby and is owned and operated by Gladstone Regional Council. It is a licensed facility able to accept general commercial waste, recyclable waste, green waste, construction and demolition waste, sewage sludge and other regulated wastes. The landfill is a single-lined landfill, consisting of 600mm of compact clay, with a leachate collection system. The site is approximately 220ha and has an expected life of 150 years (*Pers. comm.* Scott Prior, Co-ordinator Waste Services, December 2009).

Regulated waste will be transported off-site by a licensed contractor to an appropriate waste facility licensed for regulated waste acceptance. Following discussing with various licensed regulated waste management contractors in the area, it was identified that several waste management contractors were able to remove and have the facilities to dispose and/or recycle regulated wastes generated from the LNG facility on Curtis Island. Contracts will be prepared and executed prior to construction for the safe and environmentally-responsible removal and management, including re-use, recycling and/or disposal of relevant waste streams.

16.6.4 Cleaner production

Cleaner production is a continual improvement process designed to maximise resource usage and operational efficiency in order to minimise waste disposal.

Cleaner production techniques applicable to the Project are:

- Improved operation and maintenance practices to reduce the quantity of resources used and to minimise the amount of waste generated
- Selection and use of the most appropriate technology to reduce the quantity of resources used and to minimise the amount of waste generated
- Segregation of waste to facilitate re-use
- Closed-loop recycling.

16.6.5 Waste sorting and storage

A designated waste management area will be constructed for sorting the wastes into the various waste streams and waste storage prior to transport off-site. The waste management area will be hardstand area and bunded or have a suitable containment system in place for the type of waste to be stored. The area will have appropriate drainage and leachate collection system in place to assist with the drainage and collection and storage of any leachate. Leachate will be collected and pumped to the sewage treatment plant as required. The leachate collection system will ensure wastes and/or leachate are contained and do not contaminate groundwater, surface water or land.

Sewage treatment plant sludge will be stored in a roll-on/roll-off bin, with appropriate leachate collection, adjacent to the sewage treatment plant. Leachate will be collected and pumped to the sewage treatment plant as required.

All other solid and semi-solid wastes will be stored in mobile garbage bins and suitably sized roll-on/roll-off bins with proper waste identification, colour and labels to reduce double handing and increase re-use and recycling.

Liquid wastes will be stored in bulk containers, and smaller containers as required, within bunded areas that will be designed in accordance with Australian Standards and regulatory requirements appropriate to the types of waste being stored. Bunds will be able to contain 110% of the total volume of the largest container. Bunds containing liquid will be pumped out as required and disposed of appropriately. Spill containment material and spill kits will be strategically located throughout the LNG facility and employees will be trained to use the kits.

There will be a dedicated section in the waste management area for regulated and/or hazardous wastes. They will be stored within a bunded area. The following measures will be implemented to prevent environmental harm:

- Bunds will be designed in accordance with AS1940 The storage and handling of flammable and combustible liquids (AS 1940) and *Dangerous Goods Safety Management Regulation 2001*. These will be constructed to contain 110% of the total volume of the largest container
- Bunds containing liquid will be pumped out as required and disposed of off-site at a regulated waste facility
- Where practicable, all loading and unloading will take place within the bunded area
- Containers storing hazardous waste will be securely closed

- All containers will be labelled for clear interpretation of the contents
- Hazardous wastes will not be mixed with non hazardous wastes
- Spill containment material and spill kits will be provided.

A material safety data sheet (MSDS) provides information on specific materials and products including storage and handling requirements. The relevant MSDS for waste products will be kept onsite and made assessable to all personnel working with waste or working within the location of the designated waste storage area.

16.6.6 Spill containment and remediation

Australia Pacific LNG will implement standard procedures for the storage, handling, disposal and spill response for hazardous waste. Combustible and flammable materials will be stored in appropriate bunding in accordance with AS1940. Other Australian standards for the storage and handling of dangerous goods will be applied. Spill containment material and spill kits will be strategically located throughout the LNG facility and employees will be trained to use the kits.

In the event of a LNG spill, the temperature differential between the LNG and ambient air will cause the LNG to vaporise, form a cloud and eventually dissipate. Leaks and spills are mitigated though extensive onsite monitoring for leak detection, emergency shut down if gas is detected, exclusion zones around LNG loading and shipping operations and the implementation of safety procedures. Further details on hydrocarbon spills are discussed in Volume 4 Chapter 22.

16.6.7 Waste tracking

A site register will be developed and maintained for all wastes generated onsite. It will include the following details:

- Type of waste
- Volume
- Origin
- Dates of collection
- Storage location
- Any storage particulars
- Date of disposal/recycling
- Name and details of transporter and facility used to dispose the waste.

The tracking of regulated wastes is a legal requirement under the Environmental Protection (Waste Management) Regulation 2000. Details including waste type, quantity, waste transporter and disposal location must be recorded and provided to Department of Environment and Resource Management. The treatment, storage and transport of a regulated waste require an environmental authority under the EP Act. Where a contractor carries out these activities, the contractor will be required to hold the appropriate approvals.

16.6.8 Waste auditing

As part of the waste management plan, waste streams and quantities will be monitored during the construction phase on a monthly basis and during the operational phase on an annual basis. The purpose of auditing the waste management activities onsite includes:

- Assessment of the actual wastes compared to predicted waste streams and quantities
- Monitor potential impacts from wastes
- Review the waste transportation records
- Recommend future actions to improve waste management practices
- Monitor the implementation of the principles of waste management hierarchy.

Prior to engaging any waste contractor to transport, recycling, treat or dispose of any wastes related to the LNG facility, the contractors will be audited to ensure compliance with the waste management plan. Subsequent to the audit proving compliance with the plant, an approval will be granted for the contractor and/or waste management facility to manage the waste.

16.6.9 Waste reporting

The National Environmental Protection Council has endorsed a national environment protection measure (NEPM) in the form of the national pollutant inventory (NPI). It is a database designed to provide stakeholders and government agencies information about the type and quantity of substances emitted to land, water and air. The purpose of the NPI is to:

- Provide information to industry and government to assist with environmental planning and management
- Provide the community up-to-date information about substance emissions and transfers from industrial facilities
- Promote waste minimisation, cleaner production, and energy and resource efficiency.

Reporting of emissions under the NEPM will be an annual requirement for the Project.

16.6.10 Cumulative impacts

A qualitative cumulative impact assessment was undertaken of the waste management infrastructure and waste management contractors available to manage waste for the LNG facility, as well as proposed and operating industrial facilities in the Gladstone area. This assessment was based on available general, regulated, and recyclable waste generation information. These waste streams were selected because it was considered that they pose a potential impact in relation to available waste management infrastructure for recycling, treatment or disposal. Projects where waste generation data was available included:

- Central Queensland Gas Pipeline
- Fisherman's Landing Port Expansion
- Gladstone LNG – Fisherman's Landing
- Gladstone Pacific Nickel
- Gladstone Steel Project

- Gladstone LNG (Curtis Island)
- Queensland Curtis LNG
- Western Basin Dredging and Disposal Project
- Wiggins Island Coal Terminal.

Overall, the estimated waste quantities for the above projects and Australia Pacific LNG's contribution to these quantities are outlined in Table 16.12.

Table 16.12 Cumulative waste management quantities

Waste stream	Estimated waste quantity other projects and Australia Pacific LNG (t/year)	Australia Pacific LNG's percentage contribution to the cumulative waste quantities
General waste	35,100	0.5%
Recyclable waste	9,050	24%
Regulated waste	2,300	7.6%

It is expected that general waste from these projects would be transported to the Benaraby landfill located within the Gladstone Regional Council. The quantity of general waste generated by all the proposed projects is approximately equivalent to the current throughput of general waste received at this landfill in a year.

Further, to mitigate the potential cumulative impacts on local waste management infrastructure, the following information is provided:

- Informal discussions with waste management contractors Transpacific Industries, JJ Richards and Sons and Cleanaway indicated that there would be sufficient waste management contractors and infrastructure to accommodate solid and liquid waste streams such as recyclable waste, general waste and regulated waste, from the Australia Pacific LNG facility and other existing and future industrial facilities
- Discussions with Gladstone Regional Council officers indicated that Benaraby landfill has sufficient airspace available to cater for general waste from the region for approximately 150 years based on current demand of approximately 35,000 tonnes per year. Although the increased quantities of general waste from this, other existing and future industrial facilities and domestic waste will reduce the expected landfill life, it is expected that with emerging waste management efficiencies this would not impose a significant impact to Council's waste management infrastructure for the foreseeable future (Pers. comms. Scott Prior, Coordinator Waste Services, December 2009).

16.7 Summary of waste descriptions and management

A summary of waste descriptions and management is provided in Table 16.13.

Table 16.13 Summary of wastes and management

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
Site preparation	Overburden, excess onsite material	From earthworks onsite Dredge material from Port Curtis and the Targinie Channel undertaken by GPC	Inert waste Dredge material from Port Curtis and the Targinie Channel	Balanced cut and fill expected	Erosion and sedimentation of waterways Surface water quality degradation due to increased sediment loads Contaminates from overburden material contaminating surface water and subsequent release to the environment namely Port Curtis, thus degrading the marine environment	The construction contractor will undertake all stockpiling efficiently and with proper erosion control The construction contractor will ensure appropriate sediment and erosion control measures are in place. Additionally, all site run-off will be captured in the hydrotest pond or sedimentation ponds for treatment as necessary prior to any release into Port Curtis The construction contractor will grass or cover stockpiles if not in use for more than three months Disposal of dredge material described in the Western Basin Dredging and Disposal Project EIS	Volume 4 Chapter 3 Volume 4 Chapter 5 Volume 4 Chapter 11 Volume 4 Chapter 24 GPC's Western Basin Dredging and Disposal Project EIS.
	Trees, brush, vegetation	Clearing of vegetation within the lease area	Organic material	Approximately 30,000 to 35,000t	Degradation of marine environment through littering of waterways adjacent to site Hazards to ships and other recreational vessels Fire risk	Mulching/chipping of leaves, branches and brush for use, where practicable, onsite for erosion control and rehabilitation Milling of larger merchantable timber if viable and where there is demand	Volume 4 Chapter 3
Construction	Machinery/plant emissions	Construction machinery fuel use Transportation fuel use Stationary energy through electricity use NO_x and SO_x emissions from, ferries, vehicles, machinery and plant All moving parts of machinery and plant for the clearing, earthworks, power generation, pumping, and so on	Greenhouse gas emissions Fugitive emissions NO_x, CO_2, CO, SO_x and VOCs	Variable (for trains 1 and 2 only as it is the worst case) NO_x 1,030t CO_2 42,000t CO 1,890t SO_x 80t VOC 150t Approximately 85,000 tonnes CO2-e (refer Volume 4 Chapter 14)	Contributions to lifecycle greenhouse gas emissions Fugitive emissions released to the Gladstone air shed Reduced air quality for Gladstone	Use of larger trucks fully loaded whenever practicable Use of fully loaded ferries, barges and ships whenever practicable Maintenance of major energy users to ensure efficient operation. Use of competitive local sources of supply, when it is possible, to minimise transport Use of recycled office paper products where the quality is adequate for its usage Switching off or using standby mode for electrical devices (including lights) when not in use during work hours and all off after hours or using motion sensors Use of energy efficient lighting, whenever practicable Consider other initiatives to reduce emissions such as energy efficiency, use of biofuels, use of fuels incorporating off-set programs and use of energy efficient materials Ensure all machinery/plant is appropriately maintained and in good working order	Volume 4 Chapter 13 Volume 4 Chapter 14 Volume 4 Chapter 24
	Surplus concrete	Surplus concrete, over orders and from the wash-out of the concrete trucks	Inert with components such as cement (limestone and gypsum), water, fly ash, slag cement, aggregate	2,100t/yr	Minor contamination to land Loss of amenity due to poor housekeeping	The construction contractor will designate a site/area for concrete wash-outs and surplus concrete Concrete will be crushed or broken for use as hard stand or sediment and erosion control or transported off-site for recycling	Volume 4 Chapter 3 Volume 4 Chapter 24

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
	Scrap metals	Metals from packaging, machinery parts, food containers, drums and tins, cabling, and so on	Inert waste Ferrous metals such as iron, steel and tin Non-ferrous metals such as aluminium, copper, brass and lead	210t/yr	Minor contaminated land Loss of amenity due to poor housekeeping	The construction contractor will segregate scrap metal from all other waste and designate a storage area The construction contractor will engage a scrap steel contractor to supply a roll–on-roll-off bin for the accumulation of scrap metals. The scrap metal contractor will regularly remove the scrap from the site	Volume 4 Chapter 3 Volume 4 Chapter 24
	Oily rags (maintenance)	Oily rags from maintenance of machinery and plant Cleaning rags/cloths from cleaning various components of facilities and structures	Regulated waste Contaminated with hydrocarbons and chemicals	1t/yr	Release of oily rags to the environment causing minor contamination to land and surface waters and subsequent release to the environment (namely Port Curtis) Loss of amenity due to poor housekeeping	The construction contractor will utilise mobile bins for the segregation and storage of oily rags and cleaning rags and cloths The construction contractor will engage a licensed waste contractor	
	General waste (garbage)	Waste from the construction workforce, including packaging, food wastes, paper and cardboard, tins and cans, bottles and jars, and so on	General waste including food wastes, packaging, plastics, glass, metals	180t/yr	Release of waste causing contamination of land and surface water and subsequent release to the environment namely Port Curtis, thus degrading the marine environment Loss of amenity due to poor housekeeping. Increase in vermin.	The construction contractor will designate several areas throughout the site for waste storage. Areas such as offices, lunch rooms, work shops, etc. will be serviced with mobile garbage bins. Several bins will be required for general waste as well as additional bins for co-mingled recycling, such as glass bottles and jars, metal tins and cans, paper and cardboard and plastic bottles. A licensed waste management contractor will be contracted to supply bins, transport waste, recycle recyclable waste and dispose of non-recyclable waste most likely at the Benaraby landfill	Volume 4 Chapter 24
	Paper and cardboard	Paper and cardboard from packaging, office paper, cardboard boxes, newspapers	Inert waste Made from a fibre called cellulose that comes from trees harvested from plantations and forests	40t/yr	Release of waste causing minor contamination of land and surface water and subsequent release to the environment Fire hazard Loss of amenity due to poor housekeeping Increase in vermin	The construction contractor will segregate all recyclable paper and cardboard waste and designate an area for storage until pick-up The construction contractor will engage a paper and cardboard contractor to supply roll-on-roll-off bins for the storage of accumulated paper and cardboard. The paper and cardboard contractor will regularly remove the paper and cardboard from the site	Volume 4 Chapter 24
	Timber	Timber from packaging and very limited vegetation clearing	Inert waste Organic material	25t/yr	Release of waste causing minor contamination of land and surface water and subsequent release to the environment Fire hazard Loss of amenity due to poor housekeeping	The construction contractor will designate an area for the storage of timber. The construction contractor will engage a licensed contractor to remove and transport the timber off-site for recycling or re-use	Volume 4 Chapter 24

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
					Increase in vermin		
	Oils, waste paints and solvents	Oils and solvents from minor maintenance onsite. The oils and solvents will be stored in a bunded area in close proximity to the workshop	Regulated waste Liquid waste, hydrocarbons	2,500L/yr	Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment	The construction contractor will designate an area for the storage of waste oils and solvents The construction contractor will engage a waste oil and solvents contractor to supply a bulk container for the storage of oils and solvents. This container will be sited in a bunded area sized to 110% of the capacity. The waste oils and solvents contractor will regularly remove the waste oils and solvents and dispose or recycle depending on the quality of the waste	Volume 4 Chapter 24
	Greywater and sewage	Greywater and sewage from portable amenities throughout the site, kitchen sinks, showers, etc	Regulated waste Liquid waste, contaminated with pathogens, such as bacteria, viruses, prions and parasitic worms; Non-pathogenic bacteria; Organic particles such as faeces, hairs, food, vomit, paper fibres, plant material, humus, etc Soluble organic material such as urea, fruit sugars, soluble proteins, drugs, pharmaceuticals, etc. Inorganic particles such as sand, grit, metal particles, ceramics, and so on Soluble inorganic material such as ammonia, road-salt, sea-salt, cyanide, hydrogen sulphide, thiocyanates, thiosulfates, and so on Gases such as hydrogen sulphide, carbon dioxide, methane, and so on	86,000m^3/yr	Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment	The construction contractor will develop a sewage treatment plant for the construction phase of the LNG facility. Until the sewage treatment plant is constructed the site will be supplied with portable amenities as required The construction contractor will be responsible for the maintenance of the portable amenities including the regular pump outs and inspections. The pump outs will be undertaken by a licensed liquid waste contractor to remove, transport and dispose of all treated sewage wastes The construction contractor will hire portable amenities, to include shower facilities, for the duration required. The portable amenity vendor will supply and ensure continual maintenance, cleaning and pump outs are being carried out. The construction contractor will also be responsible to ensure that the vendor is fulfilling their obligations A regulated liquid waste licensed contractor required for sewage waste transport and disposal until the sewage treatment plant is operational	Volume 4 Chapter 11 Volume 4 Chapter 24
	Sewage treatment plant solid waste	Semi-solid waste product of the sewage treatment plant	Regulated waste Coarse primary solids and secondary sludge accumulated in the treatment process must be treated and disposed of in	140m^3/yr	Releases causing contamination of land, and surface water	The sewage treatment plant will include contained storage for sewage treatment plant solids and waste A regulated waste licensed contractor will transport waste from the site for disposal	

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
			a safe and effective manner. This material is potentially contaminated with toxic organic and inorganic compounds (e.g. heavy metals)				
	Cleaning/wash down water	Water from washdown. A designated washdown area is required with a minimum distance of 20m from a drainage line	Liquid waste, potential regulated waste Water with potential contaminates of hydrocarbons, silts and cleaning chemicals	200m^3/yr	Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment (i.e. Port Curtis), thus degrading the marine environment	The construction contractor will designate an area for wash down with a minimum distance of 20m from any drainage line. A trench will be constructed to capture and contain all wash down water. The wash down water will be pumped through the interceptor and through the stormwater system subsequent to visual inspection/monitoring for indications of sediments loads and/or hydrocarbon contamination The construction contractor will engage a waste oil and solvents contractor to supply a bulk container for the storage of waste oils and solvents. The waste oils and solvents contractor will regularly remove the waste oils and solvents and dispose or recycle depending on the quality of the waste	Volume 4 Chapter 24
	Hydrotest water	Water used during construction activities for integrity testing of the LNG tanks, other vessels and piping	Liquid waste, potential regulated waste Water with potential contaminates of silts, cleaning chemicals, traces of biocides and oxygen scavengers used to protect the inner surface of the tanks from risks of fouling and corrosion	160,000m^3 (based on the LNG tank volume and re-use of hydrotest water for first two LNG tanks and the LPG tank)	Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment namely Port Curtis, potentially degrading the marine environment	After hydrostatic testing, the hydrotest water will be re-used where practicable and treated if necessary for release	Volume 4 Chapter 11 Volume 4 Chapter 24
	Brine	Reject water from the desalination process	Liquid waste with a high saline concentration	550,000m^3/yr	The release of hyper-saline water into Port Curtis has the potential to degrade the marine environment Loss of biodiversity due to degradation of native flora and fauna	Discharge of brine will be sufficiently far offshore to prevent stagnant hyper-saline areas close inshore. The design of the outfall will include measures for diffusion dispersion. Water quality parameters will be sufficient to be released into the marine environment so as to not cause harm to or degrade the marine environment	Volume 4 Chapter 12 Volume 4 Chapter 24
Operation	General waste (garbage)	Waste from the operational workforce, packaging, food wastes, paper and cardboard, tins and cans, bottles and jars, and so on	General waste including food wastes, packaging, plastics, glass, metals	320t/yr	Release of waste causing contamination of land and surface water and subsequent release to the environment namely Port Curtis, thus degrading the marine environment Loss of amenity due to poor housekeeping	The construction contractor will designate several areas throughout the site for waste storage. Areas such as offices, lunch rooms, work shops, etc. will be serviced with mobile garbage bins. Several bins will be required for general waste as well as additional bins for co-mingled recycling, such as glass bottles and jars, metal tins and cans, paper and cardboard and plastic bottles. A licensed waste management contractor will be contracted to supply bins, transport waste, recycle recyclable waste and dispose of non-recyclable waste most likely at the Benaraby landfill	Volume 4 Chapter 24

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
					Increase in vermin		
	Oily rags (maintenance)	Oily rags from maintenance of machinery and plant Cleaning rags/cloths from cleaning various components of plant and structures	Regulated waste Contaminated with hydrocarbons and chemicals	0.5t/year	Release of oily rags to the environment causing minor contamination to land and surface waters and subsequent release to the environment (namely Port Curtis) Loss of amenity due to poor housekeeping	The construction contractor will utilise mobile bins for the segregation and storage of oily rags and cleaning rags and cloths The construction contractor will engage a licensed waste contractor	
	Paper and cardboard	Paper and cardboard from packaging, office paper, cardboard boxes, newspapers	Inert waste Made from a fibre called cellulose that comes from trees harvested from plantations and forests	2t/yr	Release of waste causing minor contamination of land and surface water and subsequent release to the environment Fire hazard Loss of amenity due to poor housekeeping Increase in vermin	The construction contractor will segregate all recyclable paper and cardboard waste and designate an area for storage The construction contractor will engage a paper and cardboard contractor to supply roll-on-roll-off bins for the storage of accumulated paper and cardboard. The paper and cardboard contractor will regularly remove the paper and cardboard from the site	Volume 4 Chapter 24
	Timber	Timber from packaging and very limited landscape maintenance	Inert waste Organic material	0.5t/yr	Release of waste causing minor contamination of land and surface water and subsequent release to the environment Fire hazard Loss of amenity due to poor housekeeping Increase in vermin	The construction contractor will designate an area for the storage of timber. The construction contractor will engage a licensed contractor to remove and transport the timber off-site for recycling or re-use	
	Ceramic balls	Dehydration process	Inert waste Ceramic is an inorganic, non-metallic solid	16t/yr	Release of waste causing minor contamination of land and surface water and subsequent release to the environment (i.e. Port Curtis) Loss of amenity due to poor housekeeping	Wastes which cannot be recycled will be collected in mobile garbage bins or roll-on-roll-off bins with proper waste identification and labels in a designated staging area. These wastes will be barged from the island and disposed of on the mainland in licensed landfill sites	
	Molecular sieve waste	Dehydration process	Regulated waste	350t/yr	Release of waste causing severe contamination of land and surface water and subsequent release to the environment (i.e. Port Curtis) Loss of amenity due to poor housekeeping	Wastes which cannot be recycled will be collected in mobile garbage bins or roll-on-roll-off bins with proper waste identification and labels in a designated staging area. This waste will be transported and disposed of by a licensed regulated waste management contactor	

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
	Activated carbon	Acid gas removal unit Mercury removal units	Regulated waste It is a form of carbon that has been processed to make it extremely porous and thus to have a very large surface area available for adsorption or chemical reactions	80t/yr	Release of waste causing contamination of land and surface water and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment	Options to recycle the activated carbon will be further investigated Wastes which cannot be recycled will be collected in mobile garbage bins or roll-on-roll-off bins with proper waste identification and labels in a designated staging area. This waste will be transported and disposed of by a licensed regulated waste management contactor	
	Process water containing oils and solvents	Oils and solvents from minor maintenance onsite. The oils and solvents will be stored in a bunded area in close proximity to the workshop Oily water drains from the compressors Hydrocarbon drains from regeneration gas compressor and regenerator reflux pumps	Regulated waste Liquid waste, hydrocarbons: (waste lubricating oils, spent oils, oily sludge/float, spent solvents, waste oil from slop oil tank)	Waste lubricating oils 220t/yr Spent oils 4t/yr Oily sludge/float 28t/yr Spent solvents 0.4t/yr Waste oil from slop oil tank 140m^3/yr	Spills and overflows causing contamination of land, surface water and groundwater Loss of biodiversity due to degradation of native flora and fauna Spillage and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment	Process wastewater will be treated by CPI oil/water separator, a dissolved air flotation unit (DAF) and an effluent sand filter The sludge will be temporarily stored in a sludge holding tank, pending periodical transport by a licensed contract or for disposal at a licensed waste management facility. Waste oil will also be stored and transported off-site for recycling The treated water from the CPI will be sent to the DAF unit and effluent filter to remove any remaining oil. The treated effluent will be used as irrigation water and/or will be discharged into Port Curtis via an outfall Potential recycling or re-use options for waste oils will be investigated in conjunction with the waste management contractor	Volume 4 Chapter 24
	Greywater and sewage	Greywater and sewage from bathrooms, toilets, showers and sink kitchens throughout the site	Regulated waste Liquid waste, contaminated with pathogens, such as bacteria, viruses, prions and parasitic worms Non-pathogenic bacteria; Organic particles such as faeces, hairs, food, vomit, paper fibres, plant material, humus, and so on Soluble organic material such as urea, fruit sugars, soluble proteins, drugs, pharmaceuticals, and so on Inorganic particles such as sand, grit, metal particles,	31,000m^3/yr (based upon an average population of 150 people)	Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment	Sewage produced from the various buildings is fed by gravity in underground lines to sanitary sumps before being pumped into the onsite sewage treatment plant. The sewage will be treated in an extended aeration type activated sludge plant. Treated wastewater is further processed through tertiary treatment and stored before being re-used, where practicable and/or discharged	Volume 4 Chapter 11 Volume 4 Chapter 24

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
			ceramics, and so on Soluble inorganic material such as ammonia, road-salt, sea-salt, cyanide, hydrogen sulphide, thiocyanates, thiosulfates, and so on Gases such as hydrogen sulphide, carbon dioxide, methane, and so on				
	Brine	Reject water from the desalination process	Liquid waste with a high saline concentration	840,000m^3/hr	The release of hyper-saline water into Port Curtis has the potential to degrade the marine environment Loss of biodiversity due to degradation of native flora and fauna	Brine from the desalination process is to discharge into the marine environment while ensuring good mixing and dilution with ambient marine waters. Discharge location will consider vessel and ship traffic, maintenance dredging requirements, and inter-tidal areas that dry at low water. Desalination process options have minimised the discharge quantity of the brine Outfall options will promote good dilution through the design and construction of the diffuser	Volume 4 Chapter 12 Volume 4 Chapter 24
Process venting	Acid gas	Gas from the inlet separator is fed to the acid gas removal unit	GHG emission The acid gas removal unit reduces the CO_2 concentration to <100ppmv and H_2S concentration to <3ppmv	580,000t CO_2/yr 600t CH_4/yr	Contributes to lifecycle greenhouse gas emissions	Evaluate the need for an acid gas incinerator in the FEED phase of the Project	Volume 4 Chapter 13 Volume 4 Chapter 14 Volume 4 Chapter 24
	Hot exhaust gases	Refrigeration compressor/turbines	GHG emissions and hot exhaust gases	PM_{10} 182.7t/yr NOx 2,620t/yr CO 1,590t/yr CO_2 3,529,300t/yr N_2O 80t/yr CH_4 689,00t/yr	Contributes to lifecycle greenhouse gas emissions	Implement greenhouse abatement measures, including: • The use of ConocoPhillips' Optimized Cascade® process • GE LM2500+G4 gas turbines were selected as they are efficient (efficiency approximately 40%) and will use less fuel gas • Both aero-derivative gas turbine drivers and generators are equipped with DLE technology • Waste heat recovery is planned for some of the Refrigeration Gas turbines to supply heat to the hot oil system and the Dehydration system regeneration gas	Volume 4 Chapter 13 Volume 4 Chapter 14 Volume 4 Chapter 24
		Power generation turbines	GHG emissions and hot exhaust gases	PM_{10} 14,390t/yr NOx 620t/yr CO 760t/yr CO_2 699,900t/yr N_2O 16t/yr CH_4 220t/yr			Volume 4 Chapter 13 Volume 4 Chapter 14 Volume 4 Chapter 24
	Flaring	Ground flare and marine flare	GHG emissions and hot exhaust gases	SO_2 1t/yr	Contributes to lifecycle GHG emissions	Implement greenhouse abatement measures.	Volume 4 Chapter 13 Volume 4 Chapter 14

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
				NOx 120t/yr CO 670t/yr CO_2 213,700t/yr N_2O 4t/yr CH_4 4t/yr		There will not be any routine flaring. Flaring will only occur during commissioning, process upsets, maintenance and emergency situations but not during normal operations The ground flare proposed for the LNG facility burns more cleanly than a conventional elevated pipe (stack) flare and this results in fewer emission by-products and less GHG emissions overall In order to minimise emissions, excess gas generated during ship loading will be recovered rather than flaring	Volume 4 Chapter 24
	Fugitive emissions	Losses from LNG facility processing.	GHG emissions. Propane, Ethylene, Methane	Methane 180t/yr Ethylene 140t/yr Propane 190t/yr	Contributes to lifecycle GHG emissions	Implement greenhouse abatement measures The key measures implemented in the design to reduce fugitive emissions are as follows: • Routine maintenance • Vapour recovery for the LNG storage • Vapour return-line for the LNG loading arms	Volume 4 Chapter 13 Volume 4 Chapter 14 Volume 4 Chapter 24
	Treated process and contaminated stormwater	LNG facility	Liquid waste with the following quality: pH = 6 to 7 BOD_5 = 10 to 20mg/L TSS = 5 to10mg/L TDS = 250mg/L Oil = 5 to15mg/L	25-100m^3/hr (based upon dry weather (average) flows and wet weather (stormwater) flows	Excess water to treat Spills and overflows causing contamination of land, surface water and groundwater Spillage and subsequent release to the environment (namely Port Curtis), thus degrading the marine environment Loss of biodiversity due to degradation of native flora and fauna	Process water and contaminated stormwater will be directed to the CPI separator for treatment. CPI effluent will be further treated in a dissolved air flotation unit and an effluent filter and then routed to the irrigation system, where it will be of sufficient quality for irrigation purposes onsite	Volume 4 Chapter 11 Volume 4 Chapter 24
	Spills / washdown	LNG facility	Liquid waste Regulated waste (worst case)	Variable 50,000L/yr	Spills and overflows causing contamination of land, surface water and groundwater Social amenity degradation Spillage and subsequent release to the environment namely Port Curtis, thus degrading the marine environment	Process water and contaminated stormwater will be directed to the CPI separator for treatment. CPI effluent will be further treated in a dissolved air flotation unit and an effluent filter and then routed to the irrigation system, where it will be of sufficient quality for irrigation purposes onsite	Volume 4 Chapter 11 Volume 4 Chapter 24
Ship waste (GPC, AQIS)	Solid, liquid, contaminated, bilge water wastes	From the LNG vessels loading	Regulated wastes Wastewaters Solid wastes General wastes	Variable 80,000t/yr	Contamination of receiving waters (namely Port Curtis), thus degrading the marine environment Introduction of marine pests through ballast water, hull fouling,	Management of harbour traffic is undertaken by GPC under an agreement with the AQIS. Non-discharge of AQIS defined high-risk ballast water in Australian ports or waters Vessels coming into Port of Gladstone must make waste available for	Volume 4 Chapter 24

Phase	Waste	Source	Characteristics/nature	Estimated quantity	Potential impact	Management	Section of the EIS
			Food wastes Recycling wastes		and fouling of seawater intake pipes	collection by an authorised collector vessel. Wastes including organic refuse and galley scraps of quarantine waste	
Decommissioning and rehabilitation	Contaminated fill	LNG facility	Land contaminated with hydrocarbons	None expected	Restricting the land use of the site for future users Contamination of land, surface water and groundwater Social amenity degradation Release to the environment namely Port Curtis, thus degrading the marine environment	The site will be listed on the EMR but it is not expected to be listed on the CLR due to the operational activities onsite. In summary, a decommissioning plan will detail rehabilitation process and will be developed in accordance with regulatory requirements and the land owner contractual agreements	
	Machinery/ plant Scrap steel Cabling Pipework.	Four LNG trains consisting of: • Gas feed station • Amine package • Dehydration plant • Liquefaction module • Vessel loading arms • Flares • Storage tank • Septic systems	Mostly inert waste Recycling wastes Machinery Ferrous and non ferrous metals Plastics Concrete	Structural steel 58,500t Concrete110,340m^3 Wire and cable 2Mt Equipment insulation 10,940m^2 equivalent Pipe insulation 121,200m equivalent	Contaminated land Release to the environment (namely Port Curtis), thus degrading the marine environment Social amenity degradation due to poor housekeeping	The decommissioning contractor will designate areas for segregation of the waste/recycle/re-use streams. Equipment/plant/components that are in good working order will be sold as appropriate The decommissioning contractor will engage recycling contractors to collect all recyclable material for recycling and re-use	Volume 4 Chapter 24

16.8 Conclusion

16.8.1 Assessment outcomes

This study was undertaken to identify potential impacts from the LNG facility in terms of the waste management and develop mitigation measures in accordance with the Australia Pacific LNG sustainability principles.

Table 16.14 summarises the key potential risks, the mitigation actions to reduce the impact of the risk, and the residual risk. The residual risk is categorised as either negligible, low, medium, high, or very high. A full description of the risk assessment methodology is given in Volume 1 Chapter 4.

Table 16.14 Summary of environmental values, sustainability principles, potential impacts and mitigation measures

Environmental values	Sustainability principle	Potential impact	Possible cause	Mitigation and management measures	Residual risk level
Life, health and wellbeing of people Diversity of ecological processes and associated ecosystems Land use capability, having regard to economic considerations	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 Using resources efficiently, reducing the intensity of materials used and implementing programs for the reduction and re-use of waste Identifying, assessing, managing, monitoring and reviewing risks to its workforce, Australia Pacific LNG's property, the environment and the communities affected by its activities Working cooperatively with communities, governments and other stakeholders to achieve positive social and environmental outcomes, seeking partnership approaches where appropriate	Inefficient use of resources Insufficient landfill capacity Release of waste causing contamination of land and surface water Release of waste causing degradation of biodiversity i.e. native flora and fauna Social amenity degradation Increase in vermin Reduced landfill space	Inappropriate waste handling and/or storage and/or disposal	Australia Pacific LNG will maximise the opportunities for re-use and recycling Encourage subcontractors and suppliers to establish sustainable waste management practices Procurement of pre-fabricated materials will be maximised to reduce the quantity of waste All waste will be segregated to maximise re-use and recycling opportunities Waste to be transported by a licensed contractor to a recycling facility or suitable licensed landfill with the appropriate waste management approvals Mobile garbage bins and/or roll-on-roll-off bins will be designated for the storage of wastes Mobile garbage bins and/or roll-on-roll-off bins for regulated wastes will be sealed, labelled and stored appropriately Spill kits will be located at appropriate locations within the LNG facility and employees will be trained to use the kits All wastes will be appropriately stored Sewage treatment plant and stormwater systems will be designed to capture and contain contaminated wastewaters	Low

16.8.2 Commitments

Australia Pacific LNG commits to the following waste management and minimisation actions:

- Develop and implement a waste management plan consistent with the *Environmental Protection (Waste Management) Policy 2000* (including waste management hierarchy) for the LNG facility to reduce the risk of contamination of land or water
- Ensure removal, transport and disposal of all general waste and regulated wastes by an appropriately licensed waste management contractor and facilities.