PORT of TOWNSVILLE
Nexus North Queensland

Appendix CC
Hazard and Risk Assessment

Townsville Marine Precinct Project
Environmental Impact Statement

GHD

Appendix CC Hazard and Risk Assessment

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ACRONYMS AND ABBREVIATIONS

AS/NZS	Australian/New Zealand Standards
COAG	Council of Australian Government
DGSM Act	Dangerous Goods Safety Management Act, 2001
DGSM Reg	Dangerous Goods Safety Management Regulation, 2001
EPA	Environment Protection Agency
GHD	GHD Pty Ltd
ha	Hectare
HIPAP	Hazardous Industry Planning Advisory Paper
kL	Kilolitre
km/h	Kilometre per hour
kPa	Kilo Pascal
L/s	Litres per second
m	metre
mm	millimetre
m^3	Cubic metre
ML	Mega litres
MSDS	Material Safety Data Sheet
pa	Per annum
PASS	Potential acid sulphate soil
PHA	Preliminary Hazard Analysis
POTL	Port of Townsville Limited
PPE	Personal Protective Equipment
ppm	Parts per million
Mtpa	Million tonnes per annum
NOHSC	National Occupational Health and Safety Commission
NSW	New South Wales

QFRS	Queensland Fire and Rescue Services
SCBA	Self contained breathing apparatus
SEQ	Southeast Queensland
STEL	Short term exposure limit
t	Tonne
tpa	Tonne(s) per annum
TPAR	Townsville Port Access Road
TWA	Time weighted average

Executive Summary

The Port of Townsville Limited (POTL) is planning to construct a Marine Precinct (known as the Townsville Marine Precinct Project or the "Project"). The proposed Project seeks to provide a dedicated Marine Precinct facility for commercial and recreational use at the mouth of the Ross River in the Port of Townsville.

As part of the regulatory requirements for the development, Port of Townsville is required to conduct an Environmental Assessment, incorporating a Hazard and Risk study. This document reports the findings of this study.

The assessment has been carried out in accordance with the NSW Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No 6 (Guidelines for Hazard Analysis) and HIPAP No 4 (Risk Criteria for Land Use Planning). These documents describe the methodology and the criteria to be used in preliminary hazard analysis studies. The scope of this study covers the construction, operations and decommissioning phase of the Marine Precinct. The methodology consists of hazard analysis, consequence assessment, frequency analysis, and risk assessment. Additional controls were identified for risks so as to bring them in the acceptable range as low as reasonably practicable.

The proposed Project seeks to provide a dedicated Marine Precinct facility for commercial and recreational use at the mouth of the Ross River in the Port of Townsville. Port of Townsville will select a Developer who will be responsible for the construction, operation and decommissioning of the Marine Precinct. The construction phase covers the construction of the breakwater, reclamation area and structures required for the operation of the Marine Precinct as well as the capital dredging works to establish the navigation channel, swing basin and to remove potentially unsuitable material from underneath the breakwater structure. The operational phase covers maintenance dredging and the operation of facilities in the Marine Precinct. The decommissioning phase will cover removal of structures and facilities associated with the Marine Precinct project. Breakwater on the eastern side of the mouth of Ross River will be constructed to protect the Marine Precinct from sediment infill and the action of waves thereby reducing the need for dredging the channel in the long term.

The Risk Register is enclosed in Appendix B at the end of this report. Matrix risk assessment of the 35 hazards resulted in 12 high risks, 15 substantial risks, five medium risks and three low risks before mitigation measures. After mitigation measures, the resulting risk profile was one high risk, three substantial risks, 13 medium risks and 18 low risks. A number of risk reduction measures have been made. From a total of thirty two measures; seventeen actions were identified which will be incorporated into the construction phase and twenty seven actions into the operational phase. The risk assessment carried out in this study assumed that the safety assessment process will continue throughout the design, construction, operation and decommissioning of the project to refine and update the outcome of the development approval/ environmental risk process.

1. Hazard and Risk Assessment

1.1 Objective

The Port of Townsville Limited (POTL) is planning to construct a Marine Precinct (known as the Townsville Marine Precinct Project or the "Project"). The proposed Project seeks to provide a dedicated Marine Precinct facility for commercial and recreational use at the mouth of the Ross River in the Port of Townsville.

The objective of this Hazard and Risk assessment is to provide a qualitative investigation of potential hazards and risks associated with the Townsville Marine Precinct project and to identify actions for mitigating or reducing these hazards and risks.

1.2 Scope

The scope of this assessment includes the identification of the major hazards and risks from the construction, operation and decommissioning phases of the Marine Precinct project. The construction phase covers the construction of the breakwater, reclamation area and structures required for the operation of the Marine Precinct as well as the capital dredging works to establish the navigation channel, swing basin and to remove potentially unsuitable material from underneath the breakwater structure. The operational phase covers maintenance dredging and the operation of facilities in the Marine Precinct. The decommissioning phase will cover removal of structures and facilities associated with the Marine Precinct project. Breakwater on the eastern side of the mouth of Ross River will be constructed to protect the Marine Precinct from sediment infill and the action of waves thereby reducing the need for dredging the channel in the long term.

1.3 Background Information

1.3.1 Construction Activity

The construction phase of the project will cover the removal of sediments in the reclamation area prior to reclamation occurring and some temporary works such as upgrade, relocation, realignment of roads and other infrastructure, construction of the breakwater, the reclamation area and the capital dredging works to establish the navigation channel and swing basin.

The source of the aggregate material required for the construction of the reclamation and breakwater is yet to be decided, however, a number of options have been put forward. Of these potential quarry options, the distances from the Marine Precinct site range from approximately 17 km to approximately 120 km. 24-tonne trucks are used to transport rocks required for construction of reclamation bund.

Dredging will be undertaken by a floating excavator with hydraulic clamshell or grab attachment, which will place the dredge material in split hopper barges for disposal. Equipment requirements are floating excavator with hydraulic clamshell or grab dredge, split hopper barges, tug and workboat. The preferred method of dredging to reclaim would be to use a cutter suction dredge discharging through pipes directly into the reclamation area. Further investigations are in progress at the time of writing this report.

The construction phase of the project considering option C for the breakwater is expected to be completed by 30 June 2015, but may be completed in parallel with earlier works by 30 June 2011. Additional works may occur until December 2017.

The facilities proposed at the Marine Precinct include fifty berths, provisioning, sullage and refuelling docks, maritime fabrication activity, barge berthing, access road, utilities, vessel straddle carrier or travel lift with supporting maintenance/ servicing infrastructure and 200-space parking area.

In order to facilitate early commencement of works, POTL will offer the Developer a licence to occupy a temporary hardstand area on reclaimed land to the north east of the proposed Marine Precinct.

Upon expiry of licence the developer will be responsible for the removal of infrastructure and reinstatement and remediation of the temporary hardstand area and hand-back the area to the standard of the baseline condition.

POTL will provide road access and utilities services to the Marine Precinct. The Developer will design, construct, operate and maintain the Marine Precinct at his own cost and risk and ensure that the project complies with all environmental laws and Environmental Approvals and all other laws and approvals at his own cost and risk.

1.3.2 Operation phase

It is not anticipated that the development of a Marine Precinct in the mouth of Ross River will substantially increase vessel numbers in the area. The Ross River channel is already a restricted speed zone. It is anticipated that maintenance dredging for the Marine Precinct will not be significantly greater than current dredging programs deployed by the Port of Townsville.

The Townsville Marine Precinct is expected to house a selection of marine operations that are currently located upstream on the Ross River. The activities proposed at the precinct include maritime infrastructure fabrication, land based vessel construction and maintenance, work berths, chandlery, tourist or scientific vessel berthing, defence force activities including naval vessel maintenance, seafood industry, small scale eateries, marine industry training facilities, heavy vessel slip or lift, floating dock and boat ramps.

The commissioning process will most likely be undertaken by the Developer and he will ensure that all government legislative requirements are complied.

1.3.3 Decommissioning

As this Project is not likely to be decommissioned in the foreseeable future (not less than 20 years), detailed rehabilitation information can not be provided at this time. It would be expected that a decommissioning plan would be required to be developed at a later stage.

It is noted however, that rehabilitation of small components of the project during construction may be required. This may include any proposed vegetation removal and dredging impacts.

1.3.4 Associated infrastructure

Associated infrastructure requirements for the project are as follows:

» The construction work force is currently estimated to be approximately 100 and would be housed in Townsville. The work force is expected to commute in company vehicles from residence to the site.

- Existing access to the Project site is via Benwell Road, South Townville. Both Boundary Street and Benwell Road form part of the 'Principal Road Freight Network' as defined in Townsville City Council's City Plan 2005. A new road and rail link is proposed to be built over the mouth of Ross River.
- Energy, water and telecommunication infrastructure does not currently exist on the site and will be provided at the site as a part of this infrastructure development.
- Stormwater infrastructure does not currently exist on the Project site. Stormwater will be pumped out of the facility as a measure to protect the Great Barrier Reef World Heritage Area.
- Sewerage infrastructure does not currently exist on the Project site, and it is proposed to provide a physical and chemical treatment plant as a part of this infrastructure.

1.3.5 Waste management

Solid, inert waste from POTL activities includes waste metal, timber, packaging materials, office waste and other general solid waste. The majority of solid inert waste is proposed to be land-filled at TCC's municipal facility, although scrap metal associated with pile renewal will be segregated for recycling. Waste transporters will be contracted to remove this material.

A management plan will be developed for the collection and containment of wastes derived from vessels berthed in the Marine Precinct or moored in Ross River. Regulated wastes generated by port users include waste oils, old batteries, oily rags, tyres, chemical containers, obsolete light fittings and sewage sludges. Regulated wastes require special disposal arrangements due to their hazardous or toxic nature. These will be disposed as per applicable regulations and is discussed separately in the EIS.

1.3.6 Dangerous Goods

The project will use a number of substances listed in the Australian Dangerous Goods Codes. Table 1 provides an indicative list of substances by chemical name, dangerous goods classification, raw and storage concentrations, UN number, packaging group and use of this substance.

Table 1 Indicative Lists of Hazardous Substances and Stated Dangerous Goods

Chemical Name (Shipping Name)	Raw conc., %wt	Storage conc., %wt	D.G. Class	Hazchem Code	UN Number	Packaging group	Purpose/ Use
Diesel (Diesel)	N/A	N/A	3 (Class C1)*	3[Z]	1202	III	Fuel for marine and heavy vehicle operations
Unleaded Petrol	N/A	N/A	3	3[Y]E	1203	II	Fuel for spark ignition engines

Chemical Name (Shipping Name)	Raw conc., %wt	Storage conc., %wt	D.G. Class	Hazchem Code	UN Number	Packaging group	Purpose/ Use
Oils (Lubrication/ Hydraulic Oils)	N/A	N/A	3 (Class C2)**	N/A	N/A	N/A	Lubricate plant and equipment and replenish hydraulic systems.
Liquefied Petroleum Gas (LPG)	Propane: 40-100% Propylene: 0-60%	Propane: 40-100% Propylene: 0-60%	2.1	2WE	1075	N/A	Fuel
Acetylene (Acetylene Dissolved)	> 98%	> 98%	2.1	2[S]E	1001	N/A	Fuel
1,1,1,2-Tetrafluoroethane (Refrigerant gas R134a)	>99%	>99%	2.2	2RE	3159	N/A	Refrigeration gas
Liquid Nitrogen (Liquid Nitrogen)	>99%	>99%	2.2	2RE	1977	N/A	Freezing application
Nitrogen gas	>99%	>99%	2.2	2T	1066	N/A	Pneumatic equipment

*: Class C1 – a combustible liquid that has a flashpoint of 150^{o}C or less

**: Class C2 – a combustible liquid that has a flashpoint exceeding 150^{o}C

N/A: None allocated

Construction Phase

Table 2 provides an indicative list of substances to be held at site during the construction phase. The table details rate of usage, indicative maximum storage at site, storage and handling details.

Table 2 Consumption Details of Hazardous Substances and Stated Dangerous Goods – Construction Phase

Chemical Name	Indicative maximum inventory onsite	Storage Details	Handling Details	Storage Location
Diesel (Diesel)	80 kL	80 kL aboveground storage tanks	Road transport by fuel tanker to site storage tanks, one trip per day. Manual transfer to vehicles on-site	Fuel farm

Chemical Name	Indicative maximum inventory onsite	Storage Details	Handling Details	Storage Location
Oils (Lubrication/ Hydraulic Oils)	4 kL	Bulk and drums	Road transport to site	Fuel farm

Operation Phase

Table 3 provides an indicative list of substances to be held at site during the operation phase. The table details rate of usage, indicative maximum storage at site, storage and handling details.

Table 3 Consumption Details of Hazardous Substances and Stated Dangerous Goods – Operation Phase

Chemical Name	Indicative maximum inventory onsite	Storage Details	Handling Details	Storage Location
Diesel (Diesel)	75 kL	3 x 25 kL aboveground storage tanks	Road transport to site by 57 kL fuel tanker 27m B doubles type, 700 trips per year. Manual transfer to vehicles on-site	Fuel farm
Unleaded Petrol	50 kL	2 x 25 KL	Road transport to site by 57 kL fuel tanker 27m B doubles type, 700 trips per year. Manual transfer to vehicles on-site	Fuel farm
Oils (Lubrication/ Hydraulic Oils)	30 kL	Bulk and drums	Road transport to site by 30 kL fuel tanker 27m B doubles type, 6 trips per year. Manual transfer to vehicles on-site	Fuel farm
Liquefied Petroleum Gas (LPG)	1300 kg	45 kg bottles	Road transport to site by trucks. Manual transfer to storage	Store/ Work Shop
Acetylene (Acetylene)	245 m^3	35 x 7 m^3 bottles	Road transport to site by trucks. Manual transfer to storage	Store
1,1,1,2-Tetrafluoroethane (Refrigerant gas R134a)	40 kg	In standard bottles	Road transport to site by trucks. Manual transfer to storage	Store
Liquid Nitrogen (Liquid Nitrogen)	160 L	In standard bottles	Road transport to site by trucks. Manual transfer to storage	Workshop/ Store

Chemical Name	Indicative maximum inventory onsite	Storage Details	Handling Details	Storage Location
Nitrogen gas	20 bottles per annum	190 m^3	6 x 7.2 m^3 bottles 3 x 4.1 m^3 bottles	Road transport to site by trucks. Manual transfer to storage

Dangerous Goods Management

Diesel

Diesel is a combustible liquid and will be used as a fuel for heavy vehicles. Diesel colour is variable – water white through to light brown/ straw colour light to fluorescent green. It has a flash point of > 61.5^{o}C, specific gravity 0.85 at 15^{o}C and vapour pressure < 1 mm Hg @ 25 ^{o}C. Contact with eyes and skin will cause irritation. Inhalation in high concentrations will result in headache, dizziness, nausea, vomiting, drowsiness or narcosis. Time Weighted Average (TWA) National Occupational Health and Safety Commission (NOHSC) exposure standard for oil mist is 5 mg/m^3. Spills can impact flora and fauna.

It is proposed to store diesel in three tanks each with a capacity to hold 25 kL of diesel. Both tanks will be above ground on impervious surfaces and located in the Fuel Farm. Designs including the bund capacities will be as per AS 1940 – The storage and handling of flammable and combustible liquids. All tank transfer operations will be on impervious surfaces with a spill collection system. An external concrete concourse has been proposed at the vehicle servicing workshop area for refuelling trucks.

Diesel is insoluble in water and incompatible with strong oxidising agents. Spillages will be prevented from entering drains or water courses. The drain valves to the bund will be designed to normally operate in a closed position. Inert absorbent material such as vermiculite, sand or dirt will be placed on the spillages. The material will be collected and placed in a labelled container for disposal. Build-up of electrostatic charges will be prevented by bonding. and grounding.

Personal protective equipment (PPE) for exposure control will consist of impervious material gloves for hand protection, safety glasses or face shield for eye protection and suitable personal clothing for body protection. All PPE will conform to relevant Australian Standards.

Suitable fire fighting systems will be provided. In the event of fire, emergency response will include the use of carbon dioxide, dry chemical or foam and personnel who engage in emergency response activities will wear breathing apparatus. Due to the properties of diesel, there is no risk of violent explosion with a diesel fire.

Petrol

Petrol is a flammable liquid and will be used as a fuel for vehicles. Petrol colour is yellow, red or purple. It has a flash point of < - 40^{o}C, specific gravity 0.73 – 0.78 at 15^{o}C, vapour pressure 35-90 kPa, LEL 1.00% v/v and UEL 8.00% v/. Contact with eyes and skin will cause irritation. Inhalation may cause irritation to the respiratory system. Prolonged and repeated skin contact may cause dermatitis. Time

Weighted Average (TWA) National Occupational Health and Safety Commission (NOHSC) exposure standard for petrol is 900 mg/m^3.

It is proposed to store petrol in two tanks each with a capacity to hold 25 kL. Both tanks will be above ground on impervious surfaces and located in the Fuel Farm. Designs including the bund capacities will be as per AS 1940 – The storage and handling of flammable and combustible liquids. All tank transfer operations will be on impervious surfaces with a spill collection system.

Solubility of petrol in water is negligible. Contain the spills with sand or earth. Keep away from heat, naked flames and sparks. Use absorbent in suitable sealed containers. The drain valves to the bund will be designed to normally operate in a closed position. Inert absorbent material such as vermiculite, sand or earth will be placed on the spillages. Build-up of electrostatic charges will be prevented by bonding and grounding.

Personal protective equipment (PPE) for exposure control will consist of PVC gloves for hand protection, eye protection, PVC apron and sleeves and PVC or rubber boots. All PPE will conform to relevant Australian Standards.

Suitable fire fighting systems will be provided. Water sprays will also be provided to keep the tank cool. In the event of fire, emergency response will include the use of carbon dioxide, dry chemical or foam. Petrol is highly flammable with risk of violent explosion in fire.

Oils (Lubrication and hydraulic)

Oils are typically clear green viscous liquids with specific gravity of 1.01 to 1.03 and a boiling point of 100 – 105^{o}C. They are an irritant to eyes and skin after prolonged exposure.

Oils will be stored in bulk tanks and drums. Activities using oils will be conducted on a hard stand area, and drip trays will be provided at appropriate locations. All spillages will be prevented from entering drains or water courses. Absorbent material will be placed on the spillages which will be collected for disposal. Hand gloves and goggles will be used while handling the product.

Liquefied Petroleum Gas

Liquefied Petroleum Gas (LPG) is used mainly in the workshop as a fuel / heat source for miscellaneous equipment items. LPG is a colourless liquid (under pressure), colourless gas, with a pungent odour. It has a vapour pressure of 1,292 to 1,530 kPa at 40^{o}C and flash point of - 100^{o}C. Acetylene has a lower explosion limit of 2.3%. Propane and propylene which are the constituents of LPG are asphyxiant.

LPG is heavier than air and may accumulate in low lying areas such as drains where it can become a serious fire and explosion hazard. LPG is highly flammable and explosive. It will ignite on exposure to heat or an ignition source and may also ignite on exposure to a strong oxidising agent. Flashback may occur. Pressurised containers may result in a Boiling Liquid Expanding Vapour Explosion (BLEVE) situation. Emergency response will include use of water to cool closed containers to prevent pressure build-up and possible auto ignition or explosion, with personnel using full protective clothing. There is a risk of explosion with LPG releases and people will be evacuated from the workplace of the incident.

Acetylene

Acetylene is highly flammable and is used as a fuel. It is a colourless gas with garlic like odour with vapour pressure of 4700 kPa at 25^{o}C and flash point of < 23^{o}C. Acetylene has a lower explosion limit of 2.5%. It is non irritant and an asphyxiant gas with effects proportional to the oxygen displaced.

Bottles will not be stored near sources of ignition, oxidising agents, poisons, flammable liquids or combustible materials. Bottles will be kept upright, in a secure area on firm floor to prevent falling.

PPE will consist of safety boots, cotton or leather gloves and safety glasses. Where an oxygen deficiency risk exists, wear an air-line respirator if the pressurised bottles are exposed to fire, the elevated temperatures may cause cylinders to explode. Emergency response will include use of water fog to cool the bottles with personnel using full protective clothing. For incidents involving acetylene cylinders a 200-metre exclusion zone will be establish and people evacuated from the immediate area.

Refrigerant Gas (R134a)

R134a is used as a refrigerant and is non-flammable. R134a is a clear liquid with slight ethereal odour having a vapour pressure of 665 kPa at 25^{o}C, vapour density of 1.21 and a boiling point of -26.4^{o}C. The Time Weighted Average (TWA) National Occupational Health and Safety Commission (NOHSC) is 1000 ppm. Exposure to eyes and skin will result in cold burns. When heated to decomposition, R134a may evolve toxic gases such as hydrogen fluorides and carbon monoxide. No known ecological damage is caused by this product.

Bottles will be kept upright in a secure area, on a firm floor to prevent falling. Bottles will not be kept near sources of ignition. If the cylinder is leaking, evacuate area of personnel.

PPE will include wearing of safety glasses, safety boots and leather gloves. When an inhalation risk exists, self contained breathing apparatus (SCBA) or air line respirators will be used. If the pressurised bottles are exposed to fire, the elevated temperatures may cause cylinders to explode. Emergency response will include use of water fog to cool the bottles with personnel using full protective clothing.

Liquid Nitrogen

Liquid Nitrogen has freezing applications. It is a non flammable, colourless and odourless liquid with a specific gravity of 0.967 and has a boiling point of – 195.8^{o}C. Exposure to eyes and skin will result in cold burns. Release of liquid to the atmosphere will generate a vapour fog cloud which must be treated as an asphyxiating atmosphere. Nitrogen will quickly disperse to the atmosphere. It is not toxic to plants and animals except at extremely high (asphyxiating) levels.

Liquid Nitrogen will be stored in bottles and kept upright, in a secure area on a firm floor to prevent falling. It is incompatible with oxidising agents, acids, heat and ignition sources and potentially violent with oxygen, halogens and metal halides.

Use of PPE will be specific to the situation and may include splash proof goggles or face shield, air line respirator and self contained breathing apparatus. If the pressurised bottles are exposed to fire, the elevated temperatures may cause cylinders to explode. Emergency response will include use of water fog to cool the bottles with personnel using full protective clothing.

Nitrogen

Nitrogen is a non-flammable, colourless and odourless gas having a vapour density of 0.967 and a boiling point of -195.8^{o}C. It is a non-irritating asphyxiant gas with effects proportional to the oxygen displaced. Nitrogen is a major component of air and is non-toxic to plants.

Compressed nitrogen gas will be stored in gas bottles and kept upright in a secure area on a firm floor to prevent falling. If the cylinder is leaking, personnel will be evacuated from the area. Any person affected by the gas will be removed from the area immediately by a rescuer using an air line respirator or SCBA.

If the pressurised bottles are exposed to fire, the elevated temperatures may cause cylinders to explode. Emergency response will include use of water fog to cool the bottles with personnel using full protective clothing.

1.4 Natural Hazards

A natural hazard is a naturally occurring situation or condition with the potential for loss or harm to the community or environment (SPP 1/03, 2003).

1.4.1 Cyclone

Australia's tropical cyclone season is usually from November to April inclusive and affects most of the Queensland coast. Tropical Cyclone Warning Centre of the Bureau of Meteorology (BOM for Eastern region) at Brisbane issues a tropical cyclone warning when a cyclone or developing cyclone is likely to affect coastal or inland communities. The warnings identify the communities likely to be affected, the name of the cyclone, its position, intensity, severity and movement. Consequences of a cyclone can include a combination of flood, storm tide inundation, strong winds and landslide.

Selections of tropical cyclones occurring since last 100 years Source: www.bom.gov.au (accessed on 3 Feb 09) in the region of Townsville are as follows:

1. On 9 February 1927, a tropical cyclone crossed the coast just to the north of Cairns. Many buildings were unroofed and 16 were totally destroyed. The sea wall at Cairns broke in several places. The tropical cyclone weakened into a disastrous rain depression. Many people drowned including one at Townsville. A total of 47 people lost lives. Several washaways of railway line and bridges occurred.
2. In February 1929, two tropical cyclones crossed the coast at Townsville and Mossman, bringing heavy rain and widespread flooding. Damage in the Monto district very severe and low lying areas of Rockhampton inundated. Considerable damage to roads and bridges at Rockhampton and Mt Morgan. From the 26th to 28th February portions of Cairns were inundated and road and rail traffic severely disrupted.
3. In January 1930, a non-damaging tropical cyclone crossed the coast at Mossman, bringing heavy rains and flooding to many areas of Queensland. Traffic between Townsville and Cairns completely disrupted, low-lying portions of Cairns and Mackay inundated. Other areas affected by flooding included Townsville, Cloncurry, Mt Isa, Hughenden, Winton, Longreach, Aramac, Adavale (3m of water in the streets) and Charleville. Three rail passengers drowned while being ferried across the Burdekin River and there were 3 other drowning. Cattle and sheep were drowned.
4. *Tropical Cyclone Ada* was a 'Category 4' cyclone that severely damaged resorts on the Whitsunday Islands on 17 January 1970. It claimed resorts and boats on the Islands of Daydream, South Molle and Hayman, as well as homes near Proserpine where flooding also occurred. Fourteen people died and total estimated costs were $390 million (in 1970 values).
5. *Tropical Cyclone Althea* was a 'Category 3' cyclone crossed the coast just north of Townsville. Three lives were lost in Townsville and damage costs in the region reached $50 million (1971). Severe winds damaged or destroyed many homes. On Magnetic island 90% of the houses were damaged or destroyed. Tornadoes damaged trees and houses in Bowen. A 2.9 m storm surge was recorded in Townsville Harbour, with a maximum storm surge of 3.66 m recoded at Toolakea, just north of

Townsville. . The storm surge and wind generated waves, although occurring at low tide, caused extensive damage along Strand in Townsville and at Cape Pallarenda.

6. On the night of 10 January 1998 *Cyclone Sid* dumped 549 mm of rain, the highest recording at Townsville airport. Unofficial figures from some suburbs were over 700 mm.
7. In February 1999, Cyclone Rona was caused by severe flooding resulting in serious infrastructure and property damage and heavy crop losses Thousands of hectares of sugar cane and bananas in the Mossman -Townsville region were flattened or flooded. Five hundred homes were damaged injuring five people.
8. *Tropical Cyclone Larry* crossed coast near Innisfall on 20 March 2006. Major damage to homes and other buildings was caused by Larry as well as extensive damage to local crops. Larry reached Category 5 for a time just before landfall. Very large storm surges (debris lines to 5 m above Mean Sea Level) were measured in the Bingil Bay area.
9. *Tropical Cyclone Ellie* crossed the coast at Mission Beach, south of Cairns on 2 February 2009 and as reported till 10 February 2009, it dumped nearly 400 mm of torrential rain on parts, causing flash flooding. Nearly 250 mm of rain fell in Townsville flooding rivers and cutting roads. Ingham was worst affected with water over parts of airport runway and cutting off Bruce Highway both north and south of the town.

The Marine Precinct Project is situated in a location that is historically known for cyclones and flooding. The project proponent will monitor for such warnings and advise internally to clients at the Marine Precinct.

1.4.2 Coastal Water Wind Warning

Coastal water warnings are issued by the Brisbane regional office of the BOM whenever strong winds, gale, storm force or hurricane force winds are expected within one or more coastal waters forecast areas. The warning attempts to provide a lead time of 24 hours and are renewed every 6 hours.

The project proponent will monitor for such warnings and advise internally to clients at the Marine Precinct.

1.4.3 Earthquake

Earthquakes are unpredictable and strike without warning. They range in strength from slight tremors to great shocks lasting from a few seconds to a few minutes. In the last 80 years there have been 17 earthquakes in Australia registering 6 or more on the Richter scale. Australia's rate of earthquakes is about 1 every 5 five years, compared to a world average of about 140 per year. The size of earthquakes is commonly measured using the Richter scale.

The earthquakes with magnitude of 5 or greater recorded in Townsville region since last 100 years (Geoscience Australia, 2009) are summarised as follows:

» Earthquake of magnitude 5.7 was recorded at 13:54 hours on 18 Dec 1913 at Lat -20.0 and Long 147.0 which is approximately 93 km south of the Marine Precinct.

» Earthquake of magnitude 5.0 was recorded at 09:12 hours on 01 Feb 1937 at Lat -16.5 and Long 148.5 which is approximately 333 km north-east of the Marine Precinct in the sea.

» Earthquake of magnitude 5.0 was recorded at 10:35 hours on 01 Dec 1958 at Lat -16.5 and Long 145.5 which is approximately 326 km north-north-west of the Marine Precinct.

Seismic hazards will be considered separately in the Marine Precinct Development Project by the individual project proponents and POTL. Appropriate Australian Standards will be followed.

2. Preliminary Hazard Analysis

This section presents the assessment methodology and results for the hazards and risks associated with the construction, operation and de-commissioning phases of the Marine Precinct Project through the use of Preliminary Hazard Analysis (PHA).

The following regulations, standards and guidelines are applicable:

- Australian Risk Management Standard AS 4360:2004;
- Australian Code for Transport of Dangerous Goods by Road and Rails (ADG Code);
- HB 203 2006: Environmental Risk Management – Principles and processes;
- Dangerous Goods Safety Management Act 2001;
- Transport Infrastructure Act 1994;
- NSW Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) no 6 Guidelines for Hazard Analysis;
- NSW Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No 4 Risk Criteria for Land Use Planning; and
- State Planning Policy 1/03, Mitigating the Adverse Impacts of Floods, Bushfire and Landslide.

The risk assessment carried out in this study assumed that the safety assessment process will continue throughout the life cycle of the project to refine the outcome of the development approval/ environmental risk process.

The PHA includes:

- All relevant hazards, both natural and technological;
- The possible frequency of potential hazards, accidents, spillages and abnormal events occurring;
- Indication of cumulative risk levels to surrounding land uses;
- Life of any identified hazards;
- Effects of hazardous substances to be used, stored, processed, produced or transported;
- The rate of usage of substances; and
- Type of machinery and equipment used.

The key components of PHA are as follows:

Stage 1: Hazard Identification

This stage consists of review of potential hazards associated with activities at Marine Precinct. The hazard identification stage includes a comprehensive identification of possible causes for potential incidents and their consequences to environment and public safety, as well as an outline of the proposed operational and organisational safety controls required to mitigate the likelihood of the hazardous events from occurring.

A desktop review of all relevant data and information was conducted to highlight specific areas of potential concern with focus on health and safety, environmental, damage to property, compliance or reputation. Hazards identified were carried forward for consequence and effect analysis.

Stage 2: Consequence and Effect Analysis

The consequences of identified hazards were assessed using the Port of Townsville Risk Management Guidelines which has been developed using current techniques for risk assessment. Well established and recognised correlations between exposure and effect on people were used to calculate impacts.

Stage 3: Frequency Analysis

The objective of the frequency analysis is to determine the frequency of each of the hazardous events. Where a potential hazard is identified as having consequences that extend beyond the site boundary, a frequency analysis is conducted to determine the magnitude of the risk associated with the potential hazard. In this step, the roles of passive controls in reducing the likelihood of the hazards are considered qualitatively. The risk is the combination of the consequence and frequency assessment of the potential hazard.

Stage 4: Risk Reduction

Where possible the risk reduction measures are identified throughout the course of the study in the form of recommendations/ mitigation measures.

Schematically, the Risk Management Process is depicted as Figure 1.

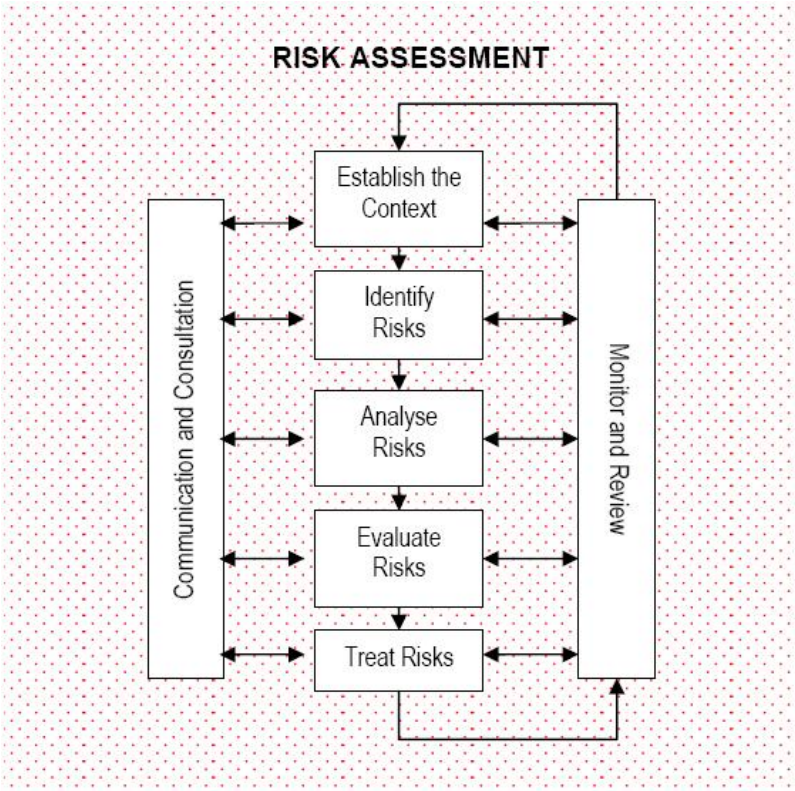

Figure 1 Risk Assessment Process

The Port of Townsville Risk Matrix used to rank each of the hazards and the definitions of each frequency and severity increment is enclosed in Appendix A.

The PHA study identified a number of potential project improvements or areas for further study and/or investigation. The Risk Register is enclosed in Appendix B. Matrix risk assessment of the 35 hazards resulted in 12 high risks, 15 substantial risks, five medium risks, three low risks before mitigation measures. After mitigation measures, it resulted in 1 high risk, three substantial risks, 13 medium risks and 18 low risks. Summary of risks identified for the project is summarised in Table 4.

Table 4 Summary of Risks Identified Before and After Mitigation Measures

Project Phase	Risks Categories				
	Extreme	High	Substantial	Medium	Low
Before Mitigation	0	12	15	5	3
After Mitigation	0	1	3	13	18

Key risks identified are summarised in Table 5. Item numbers in Table 5 correspond to items in the Risk Register for Marine Precinct Project enclosed in Appendix B.

Table 5 Key Risks Identified for the Marine Precinct Project

Item Number	Potential Hazardous Event Description	Potential for Offsite Impact
	High Risks	
6	Dredging channel - mobilisation of heavy metals	Yes
7	Dredging channel - mobilisation of nutrients	Yes
8	Dredging channel - light attenuation/ increased turbidity	Yes
9	Accommodation/ services and social infrastructure in Townsville may not be adequate (insufficient for workforce during both construction and operation phase)	Yes
13	Member of public accessing the site	Yes
16	Increased traffic along Benwell road	Yes
24	Poor acidic sulphate soil management	Yes
26	Inadequate hygiene/ quarantine practices for vessel mobilisation (e.g. vessels coming in for repairs)	Yes
27	Increased vessel traffic due to improved facilities	Yes
28	Vessel collision	Yes
31	Damage due to tropical cyclone	Yes

Item Number	Potential Hazardous Event Description	Potential for Offsite Impact
32	Damage due to Tsunami	Yes
	Substantial Risks	
1	Storage and handling of hazardous materials and fuels	No
2	Fire at the marine workshop due to ignition and spreading due to appropriate wind conditions.	No
3	Increased traffic during construction and operation phase.	Yes
5	Construction and operation waste	Yes
11	Negative publicity	Yes
12	Construction workplace accidents	No
15	Noise from project activities	Yes
17	Discharge outside of license limit due to inadequate water management or inadequate system capacity or equipment failure.	Yes
22	Abrasive blasting	Yes
23	General Flora and fauna	Yes
25	Maintenance of offshore structures	Yes
29	Events such as floods, storm and natural fires	Yes
30	Seismic event causing damage to facilities	Yes
34	Vessel falls during lifting operations at ship lift	No
35	Fire and explosion on vessels anchored	No

The recommendations / additional controls are shown in the Tables 6 and 7 below. These correspond to the mitigation measures identified, which resulted in ranking of risk after mitigation measures. The item number corresponds to the item for which the recommendation / additional control was generated (see the Risk Register in Appendix B). Responsibilities/ delegations have been assigned to each of these items as per TPA Risk management Guidelines and a signoff should take place to ensure that they are actioned appropriately. Item numbers in Table 6 and 7 correspond to items in the Risk Register for Marine Precinct Project.

Table 6 Summary of Mitigation Measures identified for High Risks

Item	Recommendations/ Additional Control	Implementation Stage	
		Construction	Operation
6	Implement control measures identified from the dredging studies – heavy metals	√	√
7	Implement control measures identified from the dredging studies – nutrients	√	√
8	Implement control measures identified from the dredging studies - turbidity	√	√
9	Interact with local government. Government to provide required infrastructure.	√	√
13	More secure fences to prevent access to Marine Precinct area.	√	√
	Increased patrols.	√	√
16	Implement recommendations of traffic study.	-	√
	A new road and rail link is proposed to be built over the mouth of Ross River.	-	√
	Conduct road safety audits.	-	√
24	Develop and implement suitable ASS management plan (QASSMAC Guidelines, 1998)	√	√
26	Implement proper monitoring mechanism for quarantine practises.	-	√
	Provide training to the persons responsible for monitoring.	-	√
27	Monitor traffic and if required explore possibilities of harbour access control.	-	√
28	Emergency response plan for spill control and medical emergencies	√	√
31	Emergency response plan.	√	√
	Trained staff to respond during emergencies.	√	√
	Liaison with Local government, QFRS, QAS, and SES	√	√
32	Emergency response plan.	√	√
	Trained staff to respond during emergencies.	√	√
	Liaison with Local government, QFRS, QAS, and SES.	√	√

Table 7 Summary of Mitigation Measures identified for Substantial Risks

Item	Recommendations/ Additional Control	Implementation Stage	
		Construction	Operation
1	Spill control kits. Drain valve of bund always in closed position. Ensure proper disposal through qualified contractors.	√	√
2	Increase more awareness amongst staff/workers.	√	√
	Contractors to include adequate fire fighting provisions while working at site.	√	-
3	Consider use of bus for carrying people to and from the worksite, which will reduce chances of fatality.	√	-
	Manage deliveries outside shift change timings.	√	√
	Conduct Road safety audit.	-	√
	Traffic controls to be part of construction management plan.	√	-
	Monitor and repair roadways.	-	√
	Consider installing crash barriers between roadways and infrastructure	-	√
5	Avoid generation of wastes, consider reuse of wastes, consider recycling and ensure proper disposal.	√	√
	Implement controls identified in the waste management plan	√	√
11	Continue consultation	√	√
12	Monitor and ensure compliance with WH&S requirements.	√	-
	Implement Safety plans	√	√
15	Implement Management Procedures identified in Noise Assessment section of this EIS.	√	√
	Match operations to noise limits during the day.	√	√
	Provide Hotlines to receive complains from people.	√	√
17	Consider pumping out of all waste waters, storm waters.	√	√

Item	Recommendations/ Additional Control	Implementation Stage	
		Construction	Operation
22	Enclosed area for abrasive blasting over land	-	√
23	Implement control measures identified from the studies for protection of flora and fauna	-	√
25	Employ all controls. Comply with licence conditions for abrasive blasting	-	√
29	Emergency response plan.	√	√
	Trained staff to respond during emergencies.	√	√
	Liaison with Local government, QFRS, QAS, and SES.	√	√
30	Suitable emergency response plan.	√	√
	Trained response workers.	√	√
	Liaison with QFRS and QAS	√	√
34	Training to staff. Standard operating procedures.	-	√
35	Monitoring and control by each vessel operator	-	√

3. Risk Management Plan

A risk assessment and management approach at the EIS stage has a major advantage. Safety studies can be used in a complementary way from the initial planning for the project and selection of a site, through to its construction and operation. It is fundamental to safety planning that all hazards are identified and appropriate safeguards employed to address them during different stages of the project. The components are discussed in the following sections. The management of Marine Precinct will also develop a management structure for safe operations at the precinct.

3.1 Hazard Analysis

High risks identified for the project include dredging impacts, strain on existing infrastructure, member of public entering the site intentionally to cause harm, increased traffic, PASS, vessel collision, tropical cyclone related hazards. Port of Townsville will develop a suitable Dredging Management plan (described elsewhere in the EIS), Liaise with local government to upgrade infrastructure, consider providing separate accommodation for construction workforce, develop an acid sulphate soil management plan and an Emergency Management Plan to deal with situations related to intruders, vessel collision and tropical cyclones.

Substantial risks identified relate to hazardous materials, fire at workshops, increased traffic, waste generation, abrasive blasting, fire and explosion at vessels anchored, flooding and seismic hazards. Port of Townsville will develop suitable procedures for hazardous substances, continue liaison with community and local government, develop an Emergency Management Plan to deal with situations related vessel collision fire and explosions and natural hazards.

3.2 Management Plans

3.2.1 Emergency Response Team

An Emergency Response Team will be provided by the Developer at the Marine Precinct to ensure that adequately trained and equipped personnel are readily available in the event of an emergency. The team will consist of volunteers from each operations shift from the Developer staff plus the on-duty Essential Services staff. Each team will be adequately trained. Training will include the following aspects:

- Fire fighting for potential on-site and on vessels incidents;
- Oil spill;
- Dangerous goods spill (other than oil);
- Utility failure;
- Rescue situations such as person fallen in water;
- Use of air lines and self contained breathing apparatus;
- Confined space rescue;
- First aid; and

» Other aspects as deemed necessary due to operations at the Marine Precinct.

3.2.2 Emergency Response Plans

A number of Emergency Response Plans will be prepared for the Marine Precinct to guide those responding to a variety of potential emergency situations. These plans are discussed below and will be regularly reviewed during the life of the project.

a. Chemicals and Fuel Spill Emergency Response Plan

The Developer will prepare a suitable spill containment and cleanup procedure for the proposed Marine Precinct. This plan will detail the specific planning, training and response requirements for oil spill management.

The plan for oil spill emergency responses will include reporting of the oil spill to the Emergency Controller. The oil spill will be assessed to identify the type of oil, location of the spill source, the quantity of oil and the environment, marine life, community, health and safety impact. The Emergency Controller will undertake immediate steps to spill containment/control, recovery of spill material, waste management, and for community communications and media management. Recovery operations are then commenced which includes provision of welfare, reconstruction/clean up and replenishment of material stocks.

The following management plan will be adhered to:

Management Plan for Spills

Chemicals and Fuels Management Plan	
Elements	Spillage or leakage of chemical and petroleum products and regulated wastes to land or waters.
Management Objectives	To minimise contamination of land or waters from spilled chemicals and fuels.
Performance Criteria	Correct storage of fuel or chemicals including updated MSDS. Implementation of bunding, spill response training and spill response kits.

Implementation Strategy	**Responsibility**
Retain only the minimal required quantities of chemicals, fuels, oils etc at construction sites or contractor laydown areas at any particular time. Purchase the products on an 'as required' basis in accordance with the provisions of the *Workplace Health & Safety Act 1995*.	Construction Contractor
Store fuels, lubricants and chemicals in appropriate containment facilities away from water storage areas and at a distance of 100 m from natural or built waterways.	Construction Contractor
Undertake maintenance and servicing of vehicles at Contractor lay down areas or other appropriate facilities. Daily servicing only may be undertaken	Construction Contractor

Chemicals and Fuels Management Plan	
on site; however such activity will be undertaken at a minimum separation distance of 100 m from drainage lines or waterways.	
Ensure safe handling techniques during refuelling to prevent spillage.	Construction Contractor
Immediately clean up petroleum product spillages with dry absorbent materials or sand or have the area remediate.	Construction Contractor
Place absorbent materials used in the clean up of hydrocarbons or other chemicals in an appropriate container marked 'regulated waste' and consign to a waste contractor licensed to receive such waste.	Construction Contractor
Chemicals and fuels will be stored in accordance with AS: 1940 – The storage and handling of flammable and combustible liquids.	Construction Contractor/ Developer's Project Manager
Locate Material Safety Data Sheets (MSDS) at the Site Construction Office / Site Administration Office for all hazardous and dangerous goods stored and used.	Construction Contractor/ Developer's Project Manager
Ensure temporary chemical storage is in accordance with Material Safety Data Sheets (MSDS) and store non-compatible chemicals separately, as required.	Construction Contractor/ Developer's Project Manager
Clean up spills in accordance with relevant Material Safety Data Sheets and Australian Standard AS: 1940.	Construction Contractor/ Developer's Project Manager
Isolate chemical spills that occur in bunded areas from the trade waste system and ensure that the contaminated wastewater is removed by a licensed contractor.	Construction Contractor/ Developer's Project Manager
Contain and collect spills of hazardous materials for treatment at a licensed waste disposal facility.	Construction Contractor/ Developer's Project Manager
In the case of a spill to ground, initiate clean up immediately and seek the advice of a qualified professional to minimise the risk of groundwater contamination.	Construction Contractor/ Developer's Project Manager
Ensure spill kits including containment and treatment equipment and materials are available near storage areas of hazardous materials.	Construction Contractor/ Developer's Project Manager
Provide totally enclosed containment for all waste.	Construction Contractor/ Developer's Project Manager

Chemicals and Fuels Management Plan	
Ensure persons handling dangerous chemicals wear appropriate PPE and receive appropriate training in its use.	Construction Contractor/ Developer's Project Manager
Monitoring	» In the case of a spill or other accident, monitoring of the receiving environment shall be undertaken by an experienced professional. » The Construction Supervisor or Workplace Health & Safety Officer shall regularly inspect all temporary chemical and petroleum product storage areas for leakages and release any clean stormwater accumulated in temporary bunded areas, after each rainfall event. Environmental Representative shall also audit the contractor's procedures to check for compliance.
Reporting	» Daily or weekly reports (as appropriate) will be completed on-site and reviewed by each Supervisor. » In the case of environmental nuisance or harm, Environmental Representative is to report the incident to EPA and local council. » If a spill occurs, a report detailing corrective actions and monitoring requirements shall be prepared.
Corrective Action	» The Construction Manager and the Environmental Representative are to be notified in the event of non-compliance. » Redesign control measure if inadequate. » Investigations/corrective actions undertaken as a result of complaints will be documented and compiled within the Complaints Register. Corrective actions shall be closed out by senior management according to an agreed responsibility and timescale. » Construction Manager to identify sources of contamination and arrange for affected areas to be re-mediated in consultation with EPA. » Immediately clean up any spilt chemicals and fuels and replace any spills kits. » In the event of contaminant release to land or water that has the potential to cause environmental harm, the Construction Manager shall immediately arrange for any necessary works to contain the contaminant and control/stop the source of the release. The Construction Manager will notify the Project Environmental Representative and Project Manager. The Project Environmental Representative will advise the EPA as may be necessary. The following constitute an incident or failure to comply in relation to chemical and dangerous goods management: – Significant chemical spill;

Chemicals and Fuels Management Plan	
	– Storage areas not meeting Australian Standards; – Chemicals stored in areas not containing suitable bunding; and – Release of chemicals or dangerous goods to the environment. Should an incident occur, a selection of the following corrective actions will be undertaken as appropriate: – Contain and clean up spill material immediately and remediate or appropriately dispose of contaminated material; – Repair bunds; – Relocate chemicals to appropriately bunded or approved storage areas; and – In the case of a significant chemical spill, the Site Emergency Plan will be followed and the EPA and local Council notified as soon as possible.

The following procedure will be in place during period of precinct construction for adjacent Port Access Road construction and can be activated in case of spills at the request of the Developer:

» Draft Emergency Response Procedure, EPBC Reference 2003/1011 Supplementary IAS Report Attachment D, Townsville Port Access Project – Eastern Access Corridor: This procedure applies to managing spills on the road or within the containment ponds. Spills: Hydrocarbon, chemical, metal concentrate, fertiliser, manure, herbicide or miscellaneous spills.

b. Fire/Explosion Emergency Response Plan

The plan for emergency response to a fire or explosion includes immediate actions of raising alarms and taking life saving actions. An assessment is made of the situation including the environmental impact and access control to the site. Planning is then initiated for a containment plan, plan for dealing with casualties and a survey for effects on the environment. The emergency is then responded to for issues including fire management and containment, rescue, casualty management, and environmental impact actions. Recovery operations are then initiated which include the restoration of essential services, provision of welfare, clean up, reconstruction and replenishment of stocks consumed during the emergency response.

The Developer will prepare a suitable fire/ emergency response plan for the proposed Marine Precinct. This plan will detail the specific planning, training and response requirements for fire/ explosion emergencies and will also list contact details for state emergencies personnel.

The Developer will develop the following procedures that will be activated in the event of an emergency.

» Building Emergency Fire Procedure: This Handbook will provide emergency contact numbers and assists Fire Wardens by providing a step by step summary of actions required in the event of any building emergency;

- Emergency Notification System: The purpose of this document will be to inform all Marine Precinct Users, Contractors, Staff and all other relevant parties, within the Marine Precinct status and requirements in the event of an emergency and /or the requirement to evacuate part or wholly the Marine Precinct area; and
- Whole of Marine Precinct Evacuation Plan: The aim of this whole of Marine Precinct evacuation plan is to identify arrangements for the relocation of Marine Precinct employees, other users of the precinct, contractors, visitors and related personnel from a dangerous or potentially dangerous area to safer areas.

c. Total Power Outage Emergency Response Plan

The plan for response to a total power outage will include start-up of the diesel generators and ensuring that the emergency power is available. Plan to be developed will include steps for an assessment on the cause for the outage and how long it will take to restore full normal power. Recovery steps will involve pre-start tests and then re-establishment of power supplies from the state power supply grid.

d. Natural Hazard Emergency Response Plan

The plan for response to a flooding event includes immediate actions of providing an alert, monitoring of flood levels, and monitoring of road access. The emergency is then assessed for electrical, process, and environmental impact due to overflows of sewage, oil or any other substances and access to required areas including evacuation if required. Response to emergencies could be through activation of power cuts, chemical or fuel spill emergency response, access restrictions, and monitoring road conditions. Procedures for these will be developed. Closeout to emergency response will involve required clean ups, repair of damaged equipment and repair of infrastructure.

The Project Area is in a known cyclone prone area. The Developer will prepare an Emergency Response Plan for Cyclone Emergencies. The procedure will be developed to ensure the maximum protection of people and assets against the effects of tropical cyclones. The strategy adopted will be in:

- Responsible housekeeping and appropriate preparation;
- Timely assessments of a developing cyclonic event;
- Effective responses.

The priorities in an emergency situation are the safety of employees and port users, the minimisation of damage to Marine Precinct infrastructure and protection of the environment.

This procedure will detail the preparatory steps to be taken by Developers employees to ensure readiness in the event of a cyclone; the actions to be taken when a cyclone threatens the Marine Precinct and the recovery activities necessary to resume normal operations as soon as possible after the cyclonic event has passed

In a worst case scenario that the facility was impacted by a cyclone, the largest inventory available to be spilled would be from the petrol or diesel storage tanks. If this were to occur then the bunding system would be easily able to contain a spill. Another scenario could be spillage of hydrocarbons in the water in which case the Fuel Spill Management Plan will be activated.

e. Other Emergency Response Plans

This includes responses relating to terrorist or bomb threat. The Developer will establish the following procedures for the Marine Precinct to be activated as required:

» Security Personnel Procedure for Marine Precinct; and

» Emergency Response Plan Bomb Threat.

3.2.3 Emergency Services

The Developer of the Marine Precinct will provide regular training to staff members on first aid, other safety courses and conduct seminars. For any major incident, additional support will be provided from Port of Townsville and other facilities at the Townsville if required.

Townsville is covered under the northern region of the Queensland Fire and Rescue Services (QFRS). Northern Region has 20 urban fire stations and an operational staff of 165 full-time and 215 auxiliary firefighters. Northern Region Headquarters, Fire Communications Centre and functional area managers are located in Townsville. The permanent station of QFRS is located at Morey Street in Townsville which is close to the proposed Marine Precinct.

Townsville is the Queensland Health tertiary referral centre for North Queensland. The Northern Region plays an active role in the Queensland Emergency Medical System (QEMS), with involvement in numerous retrieval and primary response tasks with The Townsville Hospital, Queensland Rescue and the Royal Flying Doctor Service. Appropriately qualified Townsville officers respond to retrievals for the Queensland Rescue helicopter service. The Communications Centres receive calls via 000 and also through direct contact with the centre on listed numbers. Any 000 call made to the centres gets directed to the most appropriate (closest) centre for response. Townsville Communications Centre has Caller Line Identification (CLI) systems installed so that callers to 000 have their address displayed on a computer screen. This provides an advantage to Communications staff if information regarding location of an emergency is difficult to obtain, eg if caller is panicking or unable to speak due to illness, or if the call is lost. The CLI only provides location for landlines, not for mobile phones.

A Police Station is also located close to the proposed Project Area.

3.3 Construction and decommissioning safety

The construction phase of a development, as well as de-commissioning, is critical to overall safety in two important respects: (a) the hazards which arise in the construction and decommissioning process can result in significant levels of risk to surrounding land uses, and (b) for the Marine Precinct to operate safely it is essential that it is constructed in accordance with design intent, and to an appropriate level of quality.

Construction and decommissioning safety studies will relate to:

» The construction and de-commissioning program;

» The safety and emergency procedures; and

» Safeguards required ensuring safety on site and in surrounding areas during the construction phase of the Marine Precinct.

The following are the key elements of construction and decommissioning safety:

» Familiarisation with past, existing and proposed operations and preliminary review of construction program;

- Identification of hazards specific to construction operations and assessment of associated safeguards. Assessment of operational safeguards for the construction period;
- Review of safety assurance system;
- Finalisation of construction/commissioning programs; and
- Review of procedures for management of change during construction/commissioning.

The objectives of the Construction and Decommissioning Safety Study are to:

- Identify all of the hazardous events associated with the construction of the Marine Precinct Project;
- Assess the level of risk posed to the site, the surrounding community and the environment by these hazardous events; and
- Document the existing control measures in place to prevent or mitigate the risks posed by these hazardous events, with the focus being on potential incidents with impacts.

Port of Townsville will ensure that the Developer conducts a separate Construction Safety Study before the actual construction phase after identification of the construction contractor.

4. Conclusions

The Hazard and Risk assessment has identified the nature and scale of hazards that might occur during the design and construction, operation and decommissioning of the proposed Marine Precinct Project. The study team comprised a core group of knowledgeable personnel, well versed in the proposed technology and mode of operation of the project. The study identified a total of 35 hazards that resulted in 12 high risk, 15 substantial risk, five medium risk and three low risk hazards before mitigation measures. After mitigation measures, it resulted in 1 high risk, three substantial risk, 13 medium risk and 18 low risk hazards. These risks along with mitigation measures have been listed in Table 8, 9 and 10 of this report.

Port of Townsville Marine Precinct will not significantly impact on the amenity of sensitive receivers, providing appropriate management procedures are implemented as identified in the assessment studies.

Based on the assessments conducted by GHD, it can be concluded that there are no hazards that have offsite impacts. The controls in place adequately safeguard against safety, asset and environmental consequences from hazards associated with stated dangerous substances.

It is important to note that the hazard and risk studies conducted are the start of the process, not the end. A successful outcome depends on methodical close out of the recommendations and additional controls identified in the assessment process.

5. References

1. AS/NZS 4360 – 2004 Risk Management
2. AS 1940-2004 The storage and handling of flammable and combustible liquids
3. AS/NZS 203 – 2006 Environmental Risk Management Principles and Processes
4. Australian Government, Bureau of Meteorology, www.bom.gov.au accessed on 3/12/2008
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9. Hazardous Industry Planning Advisory Paper No. 4: Risk Criteria for Land use Planning, New South Wales Department of Planning
10. Hazardous Industry Planning Advisory Paper No. 6: Guidelines for Hazard Analysis, New South Wales Department of Planning
11. Lees F P, 1996. Loss Prevention in the Process Industry, Butterworth Heineman
12. Natural Hazards and the risks they pose to South-East Queensland, K. Granger (ed), AGSO Geosciences and BoM, Australia, 2001
13. QFRS website http://www.fire.qld.gov.au/about/regions/region2.asp
14. QAS Website http://www.ambulance.qld.gov.au/northern/commcentres.asp

Appendix A

Port of Townsville Risk Matrix

QUALITATIVE MEASURES OF CONSEQUENCE OR IMPACT

Rank		Financial Loss	Asset Loss	Interruption to Services	Reputation & Image	Performance	Criminal Penalty	Safety	Health	Nature & Extent of Environmental Harm	Sensitivity of Receiving Environment	Frequency & intensity of activity
1	Insignificant	$0 - $50K	Little or no impact on assets	< ½ day	Unsubstantiated, low impact, low profile or no news items	Up to 5% variation to KPI	Pecuniary	Minor temporary – irritation, first aid treatment required	Reversible health effects of concern	Minimal environmental harm resulting in minor impacts on community, plants and wildlife	No real impact on community, plants and wildlife within surrounding area	Low frequency / intensity / duration activity (temporary - days).
2	Minor	$50K - $250K	Minor loss or damage to assets	½ - 1 day	Substantiated, low impact, low news profile	5 -10% variation to KPI	Pecuniary	Minor temporary – medical treatment required	Severe reversible health effects of concern	Environmental harm or nuisance resulting in minor adverse impacts on or unreasonable interference with the community, plants and wildlife	Minor impact on or interference with the environment in surrounding area but negligible affect on amenity or life in residential/ business areas	Minor frequency / intensity activity carried out during business hours in the short term (3 months)
3	Serious	$250K - $1m	Major damage to assets	1 day – 1 week	Substantiated, public embarrassment, moderate impact, moderate news profile	10-25% variation to KPI	Imprisonment	Major permanent – loss of body part or function	Irreversible health effects of concern	Actual or potential material environmental harm – local adverse impact on community, plants and animals within surrounding area	Noticeable adverse impact on environment in surrounding area (including business/ residential areas), which may affect amenity or life	Medium frequency / intensity activity carried out for a significant period of time on most days.
4	Disastrous	$1m - $5m	Significant loss of assets	1 week – 1 month	Substantiated, public embarrassment, high impact, high news profile, third party actions	25-50% variation to KPI	Imprisonment	Major permanent – single fatality, total blindness, quadriplegia	Life threatening or disabling illness	Material environmental harm. Significant impact on community, plants and animals as a result of duration or magnitude/nature of impact.	Significant adverse impact on environment within surrounding area (including business/ residential areas) which will adversely affect amenity or life in the long term.	Long term (decades) high frequency / intensity activity carried out during most hours of the day.
5	Catastrophic	> $5m	Complete loss of assets	> 1 month	Substantiated, public embarrassment, very high multiple impacts, high widespread news profile, third party actions.	>50% variation to KPI	Imprisonment	Multiple fatalities	Long term, possibly irreversible or chronic health effects to many people	Serious environmental harm – irreversible, high or widespread impact on environment, high conservation or special significance area	Severe impact on environment. Permanent or irreversible affects to amenity or life. Activity is in close proximity to residential and business areas.	Permanent high frequency / intensity activity carried out 24/7.

QUALITATIVE MEASURE OF LIKELIHOOD

Level	Descriptor	Description
1	Rare	May only occur in exceptional circumstances
2	Unlikely	Could occur at some time
3	Possible	Might occur at some time
4	Likely	Will probably occur in most circumstances
5	Almost Certain	Expected to occur in most circumstances

RISK EVALUATION FACTORS

	Consequence	Insignificant	Minor	Serious	Disastrous	Catastrophic
Likelihood	Score	1	2	3	4	5
Rare	1	L 1	L 2	L 3	L 4	M 5
Unlikely	2	L 2	L 4	M 6	M 8	S 10
Possible	3	L 3	M 6	M 9	S 12	H 15
Likely	4	L 4	M 8	S 12	H 16	E 20
Almost Certain	5	M 5	S 10	H 15	E 20	E 25

DELEGATIONS

Risk Level	Code	Delegate	REF Range		Meaning	Criteria for Management of Risk (Risk Treatments)
Low	L	Employee	0	4	Little or no impact on the achievement of objectives or capability.	Acceptable without review. Rationale should be documented.
Medium	M	Employee	5	9	Degrades the achievement of objectives or capability.	May be acceptable with review. Rationale should be documented.
Substantial	S	Senior Management	10	14	Will degrade the achievement of objectives or capability.	Only acceptable with formal review. Risk requires documented action plans.
High	H	General Managers CEO	15	19	Significantly degrades the achievement of objectives or capability.	Undesirable. Risk must be eliminated or reduced. Risk requires documented action plans.
Extreme	E	FARM Committee / Board	20	25	Significant capability Loss and the achievement of objectives is unlikely.	Unacceptable. Eliminate or reduce risk through Control measures. Risk requires documented action plans.

Appendix B

Marine Precinct Risk Register

Table 8 Risk Register for Marine Precinct – Port of Townsville

Item	Environmental Aspect	Potential Consequences	Current Control Strategy	Current Risk Rating			Additional Control Strategy	Delegate	Risk Rating After Control		
				Consequence	Likelihood	Rating			Consequence	Likelihood	Rating
1	Storage and handling of hazardous materials and fuels	Land/ surface contamination. May lead to contamination of waters if these get transported to the creek. May result in injury or sickness and adverse impact on marine life. Reduced public amenity. Clean-up costs. Outbreak of fire resulting in smoke, likely fatality.	List of potential chemicals to be used will be identified. Spill containment (Bunding of chemicals and fuels). Store away from drains. Storages designed to Australian Standards. Provision of suitable fire fighting system and tank cooling system. Code requirements will be followed. Insurance guidelines will also be followed to minimise risks.	3	4	Substantial	Spill control kits. Drain valve of bund always in closed position. Ensure proper disposal through qualified contractors.	Senior Management Individual facilities at the marine precinct	1	1	Low

Item	Environmental Aspect	Potential Consequences	Current Control Strategy	Current Risk Rating			Additional Control Strategy	Delegate	Risk Rating After Control		
				Consequence	Likelihood	Rating			Consequence	Likelihood	Rating
2	Fire at the marine workshop due to ignition and spreading due to appropriate wind conditions.	Loss of life, damage to property.	Induction for all workers. TPA has site operating procedures Designated smoking areas will be provided. JSA system mandatory for contractors before start of any job and advice on notification of emergencies to TPA.	3	4	Substantial	Increase more awareness amongst staff/workers. Contractors to include adequate fire fighting provisions while working at site.	Senior Management Individual facilities at the Marine Precinct	1	1	Low

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3	Increased traffic during construction and operation phase.	Increased risk for accident and fatality. Damage to infrastructure especially with heavy vehicle accidents.	Existing access to the Project site is via Benwell Road, South Townville. Apply speed limits and provide signage's. Define traffic movement areas during construction.	4	3	Substantial	Consider use of bus for carrying people to and from the worksite which will reduce chances of fatality. Manage deliveries outside shift change timings. Conduct Road safety audit. Traffic controls to be part of construction management plan. Monitor and repair roadways. Consider installing crash barriers between roadways and infrastructure	Senior Management	4	3	Substantial

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4	Disruption to local community during construction phase.	Loss of TPA reputation. Potential for adverse publicity. Strain on local services.	TPA identifying suitable location for construction camp site. TPA has a specific contractor terms and condition which addresses issues related to behaviour of contractor staff. Suitable disciplinary action on workforce. Education/ awareness of workforce.	3	3	Medium	Try to employ local workforce. Monitoring and screening of workforce.	Employee	2	1	Low

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5	Construction and operation waste	Failure to segregate waste will result in contamination issues. Community complaints. Damage to marine life. Visual amenity.	Waste to be segregated and reused where possible. Waste to be disposed at licensed disposal areas. Follow transportation guidelines. Waste management plan being developed.	4	3	Substantial	Avoid generation of wastes, consider reuse of wastes, consider recycling and ensure proper disposal. Implement controls identified in the waste management plan	Senior Management	2	2	Low
6	Dredging channel - mobilisation of heavy metals	Heavy metals will enter marine fauna potentially resulting in bioaccumulation in food sources.	Dredging studies are being conducted	4	4	High	Implement control measures identified from the studies	Senior Management	3	3	Medium
7	Dredging channel - mobilisation of nutrients	May result in algal bloom, affecting seagrass	Dredging studies are being conducted	4	4	High	Implement control measures identified from the studies	Senior Management	3	3	Medium

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8	Dredging channel - light attenuation/ increased turbidity	Decrease in phytoplankton productivity resulting in reduced food availability for marine fauna. This consequence will be restricted during the dredging activity period.	Dredging studies are being conducted	4	4	High	Implement control measures identified from the studies	Senior Management	3	3	Medium
9	Accommodation/ services and social infrastructure in Townsville may not be adequate (insufficient for workforce during both construction and operation phase)	Inadequate houses, construction resources, increased cost for rent and getting the resources. Property prices increase in the area. Increased traffic. Strain on schools, hospitals.	Engage agencies with proper contract conditions.	4	4	High	Interact with local government. Government to provide required infrastructure.	Senior Management	3	3	Medium

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10	Site sanitation during construction	Inadequate facilities results in disposal issues. Contamination of land, water.	Good housekeeping. Proper planning to provide facilities.	1	2	Low	_____	_____	_____	_____	_____
11	Negative publicity	Complaints from neighbours. Loss of reputation	Consultation and communication with community. Community consultation program.	3	4	Substantial	Continue consultation	Senior Management	2	2	Low
12	Construction workplace accidents	Exposure to heavy equipments, tools may result in injury or fatality of workers	Workplace Health and Safety requirement compliance. Training to workers	3	4	Substantial	Monitor and ensure compliance with requirements. Implement Safety plans	Senior Management	3	2	Medium

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13	Member of public accessing the site with intention of harm	Affects TPA property and workers. Public safety. Fire caused by persons entering the area. Illegal dumping of material	Security patrols. Fencing of Marine Precinct area. Installation of appropriate signage. Interaction with local authorities.	4	4	High	More secure fences to prevent access to marine precinct area. Increased patrols.	General Manager	2	1	Low
14	Failure of reclaimed area	Siltation of waterways, impact on water turbidity and aquatic ecosystem.	Design to appropriate engineering standards. Routine inspection and maintenance of reclaimed area.	2	1	Low	____	____	____	____	____

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15	Noise from project activities	Likely sleep disturbances and nuisance to neighbours. Impact on fauna. Loss of reputation. Noise due to dredging equipment results in nuisance, physical damage to marine animals. Pile driving for construction on marine precinct results in nuisance to communities.	Baseline noise monitoring study. Noise modelling studies will consider impact on sensitive receptors. Based on the output of modelling studies, recommendations will be implemented. Equipment to be maintained as per manufacturer's specification.	3	4	Substantial	Implement Management Procedures identified in Noise Assessment section of this EIS. Match operations to noise limits during the day. Provide Hotlines to receive complains from people.	Senior Management	2	1	Low

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16	Increased traffic along Benwell road.	Road accident may result in fatality. Roads may deteriorate from increased traffic (impact to the public and Dept of Main Roads)	Traffic studies are being conducted.	4	4	High	Implement recommendations. A new road and rail link is proposed to be built over the mouth of Ross River. Conduct road safety audits.	General Manager Individual industries at the Marine Precinct	4	4	High
17	Discharge outside of license limit due to inadequate water management or inadequate system capacity or equipment failure.	Serious non-conformance issues related to Environment Protection Act. Impact to other water users and aquatic ecosystems.	Design of site water management and appropriate retention capacities and durations. Redundancy of key equipment.	4	3	Substantial	Consider pumping out of all waste waters, stormwater.	General Manager Individual industries at the Marine Precinct	1	1	Low

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18	Dust from reclaimed area	Dust on roofs which enter water tanks along with rain water with possible heavy metal contamination. Nuisance dust. Impact on vegetation. Deposition on seawater and impact on aquatic life.	Dust modelling is in progress. Sprinkle water on roads during movement of vehicles and certain wind conditions. Geochemical analysis of soil and dust. Monitor wind speed and wind direction. Provide dust monitors at appropriate locations. Provide appropriate vegetation belt around the source to act as an enclosure.	3	3	Medium	Based on the modelling studies consider source suppression. Conduct geochemical test on dust and toxicology studies. Consider use of water sprays if required.	Employee	2	2	Low

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19	Subsidence of reclaimed areas.	Land erosion resulting in siltation of the creek. Potential water quality issues. Impact on marine life	Design and construct to appropriate engineering standards. Sediment and erosion controls in place.	2	1	Low	____	____	____	____	____
20	Sediment and erosion control measures not performing as expected	Water contamination and impact on marine habitat	Develop sediment and erosion control plan to minimise sedimentation Trained workers to inspect and maintain control measures	3	3	Medium	Ensure erosion and sediment control measures are maintained and inspected regularly.	Employee	3	1	Low

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21	Community concern due to excessive air/ dust emissions	Loss of amenity, nuisance to community, impacts on life styles of community and safety issues.	Appropriate air emission controls in place, dust control measures especially during construction and abrasive blasting. Defined work hours for air and noise emission related activities. Stabilise reclamation progressively. Facilities to be maintained as per manufacturers specifications. Ensure good house keeping	3	3	Medium	Consider street sweeping.	Employee	2	2	Low

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22	Abrasive blasting	Excessive air emissions dust and noise. Workplace health and safety issue. Contamination of land and water. Impact on marine habitat	EPA guidelines for abrasive blasting will be followed Individual facilities will obtain required permits from EPA.	4	3	Substantial	Enclosed area for abrasive blasting over land.	Senior Management Individual facilities at the marine precinct	3	2	Medium
23	General Flora and fauna	Loss of fauna and marine habitats	Survey in progress Movement confined to defined areas. Defined working hours. Adequate vegetation of the reclaimed area	4	3	Substantial	Implement control measures identified from the studies	Senior Management	4	2	Medium

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24	Poor acidic sulphate soil management	Acidic runoff in waterways. Land contamination.	Field investigation studies in progress. PASS in samples obtained across marine precinct.	4	4	High	Develop and implement suitable ASS management plan (QASSMAC Guidelines, 1998)	Senior Management	3	3	Medium
25	Maintenance of offshore structures	Abrasive blasting results in contamination of sea water and bed.	Conform to abrasive blasting guidelines by EPA. Obtain licences.	3	4	Substantial	Employ all controls. Comply with licence conditions.	Senior Management	2	2	Low
26	Inadequate hygiene/ quarantine practices for vessel mobilisation (e.g. vessels coming in for repairs)	Introduction of marine species which may cause reduction in biodiversity Threat to local aquaculture	Adopt appropriate quarantine practices	4	4	High	Implement proper monitoring mechanism. Provide training to the persons responsible for monitoring.	Senior Management	2	1	Low

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27	Increased vessel traffic due to improved facilities	Collision with local marine species Port congestion resulting in restricted commercial/ recreational access to harbour	Monitor marine fauna. Define movement paths	4	4	High	Monitor traffic and if required explore possibilities of harbour access control.	Senior Management	2	3	Medium
28	Vessel collision	Possible fatality Uncontained hydrocarbon spill leading to contamination of coastal waters impacting marine life	Defined vessel movement paths.	4	4	High	Emergency response plan for spill control and medical emergencies	Senior Management	4	2	Medium

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29	Events such as floods, storm and natural fires	Water quality degradation due to loss of control measures on waste, hazardous substance storages. Construction and Operational delays. Loss of marine habitat.	Early warning systems. Design to appropriate engineering standards. Ensure good housekeeping. Sediment and erosion control. Adequate elevation above ground level.	4	3	Substantial	Emergency response plan. Trained staff to respond during emergencies. Liaison with Local government, QFRS, QAS, and SES.	Senior Management	3	3	Medium
30	Seismic event causing damage to facilities	Damage to structures, land contamination, sea contamination, impact on marine habitats, likely fatality	Area has low seismic activity. Design as per appropriate engineering standards. Storages of substance as per applicable Australian Standards (e.g. AS 1940 for Flammable and Combustible liquids).	4	3	Substantial	Suitable emergency response plan. Trained response workers. Liaison with QFRS and QAS	Senior Management	3	3	Medium

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31	Damage due to tropical cyclone	Impact to water quality due to flooding, erosion and contamination. Waste management issues. Visual amenity.	Early cyclone warning Facilities constructed above appropriate flood levels Ensure site is cleaned before cyclone season	5	3	High	Emergency response plan. Trained staff to respond during emergencies. Liaison with Local government, QFRS, QAS, and SES.	Senior Management	5	2	Substantial
32	Damage due to Tsunami	Impact to water quality due to flooding, erosion and contamination. Waste management issues. Visual amenity.	Early tsunami warning Facilities constructed above appropriate flood levels Ensure site is kept cleaned	5	3	High	Emergency response plan. Trained staff to respond during emergencies. Liaison with Local government, QFRS, QAS, and SES.	Senior Management	5	2	Substantial

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33	Lighting from the marine precinct area.	Nuisance to neighbours	Visual landscape studies are in progress which includes lighting.	3	3	Medium	Ensure lights angled downwards. Design to consider shielding if lighting is an issue.	Employee	1	1	Low
34	Vessel falls during lifting operations at ship lift	Injury/ fatality. Damage to assets. Loss of reputation.	Qualified staff.	3	4	Substantial	Training to staff. Standard operating procedures.	Senior Management	3	1	Low
35	Fire and explosion on vessels anchored	Injury/ fatality. Damage to assets.	Qualified operators. Operation and maintenance as per manufacturer's specifications.	3	4	Substantial	Monitoring and control by each vessel operator	Senior Management	3	3	Medium

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