Port of Gladstone
Gatcombe and Golding Cutting
Channel Duplication Project

Environmental Impact Statement

Gladstone Ports Corporation
Growth. Prosperity. Community.

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Hazard and risk

Contents

20 Hazard and risk

20.1 Chapter purpose

For each of the preceding chapters an assessment of the potential environmental impacts and risks has been undertaken with a re-assessment of residual hazard and risk following the implementation of mitigation measures.

A number of other Project risks may arise which are beyond the scope of the completed technical assessments and these matters are considered within this chapter, including a range of natural and technological/human generated hazards as well as occupational and public risk.

With respect to health and safety, hazards and risks may be associated with design or may arise because of potential accidents, spills and abnormal events that may occur during the Project's lifecycle. Potential causes may also include work and environmental factors associated with the Project activities which can affect human health, public safety and quality of life, such as air pollutants, odour, lighting and amenity, dust, noise, vibration and water quality. These latter matters have been considered in the social impact assessment (refer Chapter 18).

GPC is obliged to ensure that activities undertaken by, or on its behalf, do not present unacceptable risks to the environment and workplace health and safety as well as maintaining a compliant security regime within the Port area. In meeting its obligations, GPC adheres to a framework of Commonwealth, State, regional and local measures with respect to disaster prevention and management, and workplace health and safety. As such it has a range of policies and supporting standards and procedures to achieve these measures across its current activities and likewise the Project activities. Where necessary, additional bespoke measures are proposed for the Project activities.

A hazard is considered to be a source or situation with a potential for harm in terms of the following matters or a combination thereof:

- Human injury or ill health
- Damage to property
- Damage to the environment.

A risk is the likelihood and consequence of an injury or harm occurring as a result of a hazard. Risk management is the systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, assessing, controlling and monitoring risk. To enable effective risk management, some form of formal risk assessment is required to identify the risks associated with the Project. As with the preceding chapters, the formal risk assessment process applied follows the methodology outlined in AS/NZS ISO 31000-2009 Risk Management Principles and Guidelines (2009).

20.2 Methodology

The methodology adopted to assess potential hazard and risk, and health and safety impacts from Project activities includes:

- Identification of the existing Commonwealth, State, regional and local measures with respect to hazard prevention and management, and workplace health and safety which are relevant to the Project (refer Section 20.3)

- Identification of potential hazards and health and safety matters associated with the Project activities (refer Section 20.4)
- Assessment of the potential risks associated with the Project activities during the implementation and maintenance phases of the Project (refer Section 20.5)
- Identification of mitigation measures to be implemented to minimise the potential impacts (refer Section 20.6).

20.3 Legislation

Commonwealth and State legislation and guidance in terms of risk management for potential hazards and risks are summarised below.

20.3.1 Hazard management

- *The International Ship and Port Facility Security Code 2003.* The code provides an international framework involving cooperation between governments, agencies, and the shipping and port industries to identify and assess threats affecting ships and port facilities. Under the code, Australia's responses to maritime security incidents is undertaken through its law enforcement agencies and under existing arrangements for responding to terrorist incidents generally (e.g. through the National Counter-Terrorism Plan).
- *Maritime Transport and Offshore Facilities Security Act 2003* (Cth). This Act was introduced to meet obligations in response to Chapter XI-2 of the International Convention for the Safety of Life at Sea 1974 and the *International Ship and Port Facility Security Code 2003*. Its seek to safeguard against unlawful interference with maritime transport or offshore facilities and therefore sets out a regulatory framework which centres on maritime industry participants assessing their operations for security risks, and preparing a security plan which sets out measures to counter these identified risks. Security regulated port operators and port facility operators (of which GPC is one) are regulated under this framework.
- *National Plan for Maritime Environmental Emergencies 2017* (NPMEE). The goal of the National Plan is to maintain a national integrated government and industry organisational framework capable of effective response to pollution incidents. As part of this framework, emphasis is placed on avoidance in the first instance.
- *Queensland Counter-Terrorism Strategy 2013–2018*. The purpose of the Strategy is to provide guidance in the key areas of focus for counter-terrorism activities during 2013-18 within the State
- *Disaster Management Act 2003* (Qld). The main objects of this Act are:

  (i) To help communities mitigate the potential adverse effects of an event, prepare for managing the effects of an event, and effectively respond to, and recover from, a disaster or an emergency situation

  (ii) To provide for effective disaster management for the State

  (iii) To establish a framework for the management of the State Emergency Service and emergency service units to ensure the effective performance of their functions.
- *Queensland State Disaster Management Plan 2018*. The Plan has been prepared by the Queensland Disaster Management Committee and key stakeholders. Its aim is to describe the disaster management arrangements which implement the guiding principles and objectives of the *Disaster Management Act 2003*. It is supported by the Queensland Recovery Plan and other supplementary hazard-specific plans and functional plans to be produced at the regional and local level as appropriate.

- *Queensland Coastal Contingency Action Plan 2018* (QCCAP). The action plan supports Australia's national arrangements for oil and chemical spills under the NPMEE. QCCAP also links to Queensland's disaster management arrangements. Within Queensland's jurisdiction, TOMPA and *Transport Operations (Marine Pollution) Regulation 2008* (Qld) aim to protect Queensland's marine and coastal environment from the adverse effects of ship-sourced pollution. Section 93A(2) of the TOMPA appoints the General Manager, MSQ as the Marine Pollution Controller to direct the marine pollution response in Queensland coastal waters. Other relevant Queensland legislation is the *Maritime Safety Queensland Act 2002* (Qld) which establishes MSQ and empowers it to 'deal with the discharge of ship-sourced pollutants into Queensland Coastal Waters'.
- *State Planning Policy 2017*. The State Planning Policy seeks to ensure that risks associated with emissions, hazardous activities and natural hazards, including the projected impacts of climate change, are avoided or mitigated to protect people and property and where possible through development opportunities enhance a community's resilience to natural hazards. As a consequence, local government planning schemes are obliged to map natural hazard prone areas and set out associated provisions for development within such areas.

Also of relevance to hazard and risk are:

- AS 3846-2005 The handling and transport of dangerous cargoes in port areas (2005)
- AS/NZS 3833-2007 The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers (2007)
- SAA SNZ HB 76-2010 Handbook – Dangerous goods: initial emergency response guide (2010).

The above documents either require or have directed the preparation of regional and/or local management plans or guidance with respect to hazard and risk. Those documents considered relevant to the Project are listed below.

- *Port of Gladstone First-Strike Oil Spill Response Plan 2014*. This document supplements the QCCAP and confirms that while MSQ is both the Statutory and Combat Agency for response to all ship-sourced oil spills, GPC is responsible for First-Strike response for all oil spills within the Port limits which includes all Project activity areas. The EHP has, however, under the Oil Pollution First-Strike Deed responsibility for assuming the role of Environment and Science Coordinator for oil and chemical spills in working areas of the Port outside of the GBRMP, and coastal waters outside the GBRWHA.
- *GRC Planning Scheme 2015*. Whilst no portions of the Project impact areas are within the jurisdiction of the GRC Planning Scheme, the scheme does apply to land areas outside the boundaries of the GSDA and LUP 2012. The GRC Planning Scheme confirms areas prone to bushfire, coastal hazard (erosion and storm tide inundation) flooding and PASS.
- *GRC Local Disaster Management Plan September 2013* (LDMP). The LDMP provides a risk assessment and broad strategy of response for hazards that potentially occur in the Gladstone LGA.
- *Gladstone District Disaster Management Plan 2018* (GDDMP). The GDDMP provides a framework for comprehensive disaster management within the Gladstone District and to ensure that disaster management and disaster operations in the district are consistent with the State framework. It notes the Port of Gladstone as critical infrastructure within the District Disaster Management area. GDDMP incorporates hazard specific strategies for disaster management in respect to hazards identified through hazard analysis as having potential to cause significant losses within the community, physically, psychologically and economically.
- *Cyclone Contingency Plan – Port of Gladstone 2011* (CCP). The CCP prepared by MSQ sets out the protocol for all ships and vessels (both over and under 17m length overall) in the event of a cyclone warning, including information procedures, and evacuation to designated safe havens and port closure if warranted.

In addition to the above documentation, GPC has produced the following policies and measures for all activities under its control within Port waters and for its landside operations:

- GPC's *Risk Management Policy 2014* and its supporting standards and procedures provide a framework to ensure that risks arising from the business are appropriately identified, assessed and managed
- GPC has developed an *Emergency Response Plan* that covers situations such as cyclones, marine incidents, bomb threats, fire, explosion or fatalities which has been developed in collaboration with the Regional Harbour Master, key port users and disaster management agencies.

20.3.2 Health and safety

- The Commonwealth of Australia operates its own legislative framework for health and safety at work. The *Work Health and Safety Act 2011* (Cth) and the *Work Health and Safety Regulations 2011* are supported by a set of codes of practice. It requires legislation at state level to reflect its contents.
- *Work Health and Safety Act 2011* (Qld) (WHS Act). The WHS Act provides a framework to protect the health, safety and welfare of all workers at work and other persons who might be affected by the work. The WHS Act is supported by the *Work Health and Safety Regulations 2011* which relate to the protection of the construction and operation workforces, as well as members of the public, including community receptors that may be affected by work-related hazards. The key aim of the WHS Act is to protect the health and safety of workers and other people by eliminating or reducing workplace risks. This legislation applies to all phases of a project and therefore is applicable to the Project.
- GPC's *Workplace Health and Safety Policy* and its supporting standards and procedures provide a framework to protect the health and safety of people entering, or working on, GPC owned and operated sites; and undertaking activities on behalf of GPC. The objectives of this Policy are listed below and the GPC Policy and supporting standards and procedures document how these objectives are to be achieved:
  - To ensure the health, safety and well-being of all workers and visitors entering, or working on, GPC owned and operated sites; and undertaking activities on behalf of GPC
  - To ensure, so far as is reasonably practicable, that the health and safety of people is not put at risk from work carried out as part of the conduct of GPC's business activities or undertakings
  - To actively promote the Zero Harm philosophy at all levels of GPC
  - To establish measurable objectives and targets for monitoring safety performance
  - To ensure compliance with all relevant legislative requirements
  - To ensure continual improvement in GPC's health and safety performance.

20.4 Existing situation

20.4.1 Overview

There will be a number of hazards and associated risks with both the construction and maintenance phases of the Project which will have potential health and safety issues for the workforce, but also other port users and community activities on the adjacent mainland. Some of these hazards and risks exist irrespective of the Project itself (e.g. natural hazards) while some arise only as a consequence of the Project (e.g. vessel movements, truck movements associated with the BUF and bund wall construction).

Natural hazards all exist independent of the Project and are features of the existing environment. Risk assessments have been undertaken in relation to those hazards that have the potential to occur in the Gladstone region within both the LDMP and the GDDMP. These documents outline responsibilities for hazard response and details for response management.

20.4.2 Natural hazards

20.4.2.1 Cyclone

Background

Tropical cyclones and tropical depressions are common phenomena for the Queensland coastal area. As noted in Section 11.3.7, on average 1.1 tropical cyclones can be expected to pass within 400km of Gladstone per year. However, this can range from zero to a maximum of seven, as was experienced in 1963.

The impacts of cyclone activity (wind or induced water level) can range in severity from heavy rain and little wind to high velocity wind and rain causing major structural damage and flooding over a wide area. For example, Tropical Cyclone Hamish which passed near the Gladstone coastline in March 2009, although it did not cross the coast, closed the Port of Gladstone temporarily due to severe weather conditions (GPC 2009). Tropical Cyclone Debbie, however, in 2017 created a mini tornado which swept through Miriam Vale, Agnes Water, Baffle Creek and Boyne Valley, and other areas were cut off completely and isolated due to flooding (GRC 2017).

The results from the climate change assessment undertaken for the Project (refer Chapter 11) indicate a decrease in the formation of tropical cyclones is likely to occur. However, the projection of increasing intensity of extreme rainfall events could indicate an increase in the intensity of rain associated with tropical cyclones and extreme storms.

The disaster management plans for Gladstone have concluded the following in terms of risk:

- GDDMP: there is the potential that a severe category cyclone will impact on the district causing widespread infrastructure, structural and environmental damage
  - A cyclone is a possible event, the consequence of which would be catastrophic with an overall extreme risk level
- LDMP: the risk of a cyclone is generally considered to occur during summer months, predominantly between November and March and within 50km from the coast
  - A cyclone is a likely event, the consequence of which would be extreme with an overall extreme risk level.

Hazard management

The BoM provides a cyclone watch and warning service with an outlook issued daily during the cyclone season. There are normally several days warning in which to prepare for a cyclone which may be felt throughout the whole of the Gladstone area and consequently, for the Project activity areas, allowing some time for the implementation of emergency measures.

A CCP for the Port is in place to which the Project marine based activities will need to comply while land based management will be directed by the appropriate agencies under the LDMP and GDDMP. As the Gladstone region does not have any specifically built cyclone rated emergency shelters, the preferred strategy is for residents to shelter in their home or voluntarily self-evacuate.

20.4.2.2 Storm surge/flooding

Background

In the Gladstone Disaster District, flooding mostly occurs during the storm season/summer months and occurs mainly as a consequence of heavy rain associated with low pressure systems. The Calliope River catchment which discharges into the central section of the Port is currently an unregulated system, while much of the runoff and catchment of the Boyne River is captured and stored within the Awoonga Dam. Flood hazard mapping has been undertaken to inform the GRC Planning Scheme and the areas of risk are illustrated in Figure 20.1.

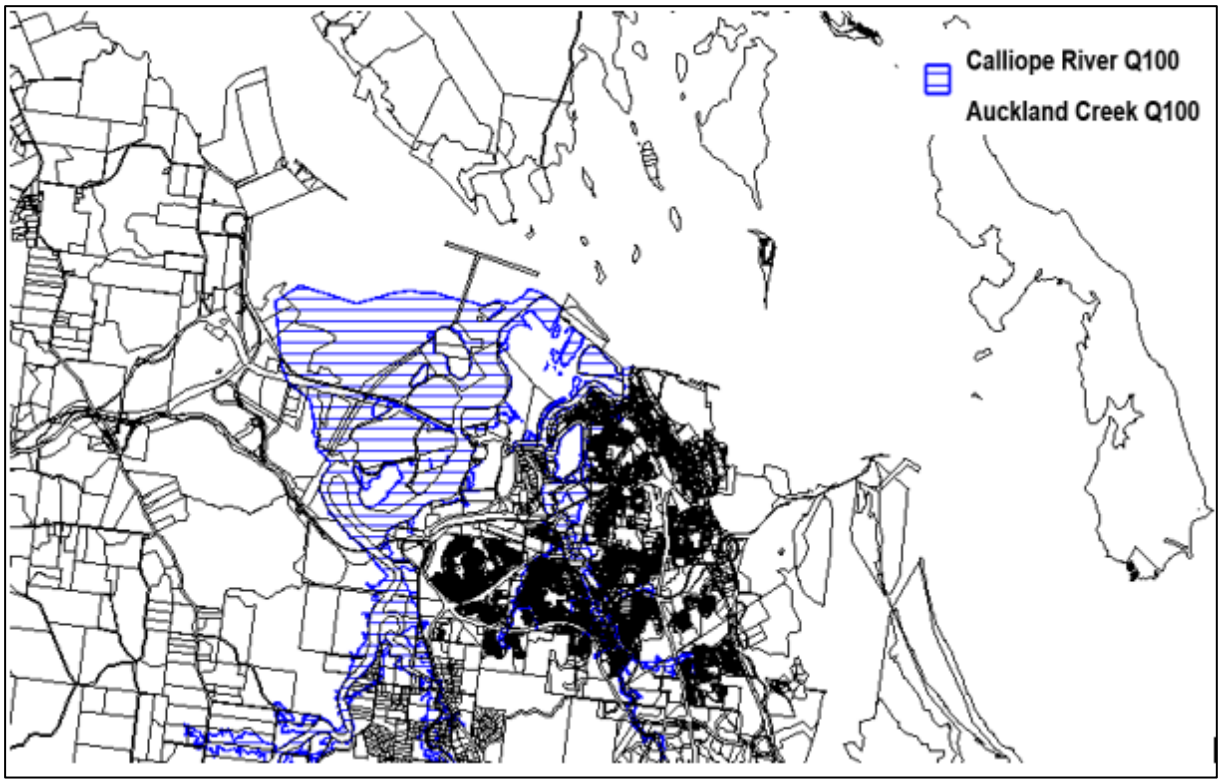

Figure 20.1 Flood hazard areas adjacent the Project activity areas

Source: GRC Planning Scheme maps

Numerous flood events have occurred along the Calliope River and Boyne River catchments, and these events have generally been associated with cyclones or associated rain depressions (GPC 2012). Significant rainfall events in previous years that have resulted in flooding, including the rain depression associated with Cyclone Benni in February 2003, flood events of the 2010/2011 wet season (Queensland's largest rainfall on record), and the significant rainfall event associated with ex-Tropical Cyclone Oswald in January 2013. A low pressure system in mid-January 2015 brought heavy rain, flooding and high winds, and Tropical Cyclone Marcia which made landfall in Central Queensland in February 2015 also brought heavy rain and high winds to the region. Above average rainfall associated with ex-Tropical Cyclone Debbie was also seen in March 2017 (BoM 2017).

Storm surges (associated with cyclones) coupled with high tides have caused coastal inundation in parts of Gladstone and waterfront areas such as Boyne Island and Tannum Sands (GRC 2013). The mapping of storm tide inundation areas has been undertaken to inform the GRC Planning Scheme and the areas of risk are illustrated in Figure 20.2.

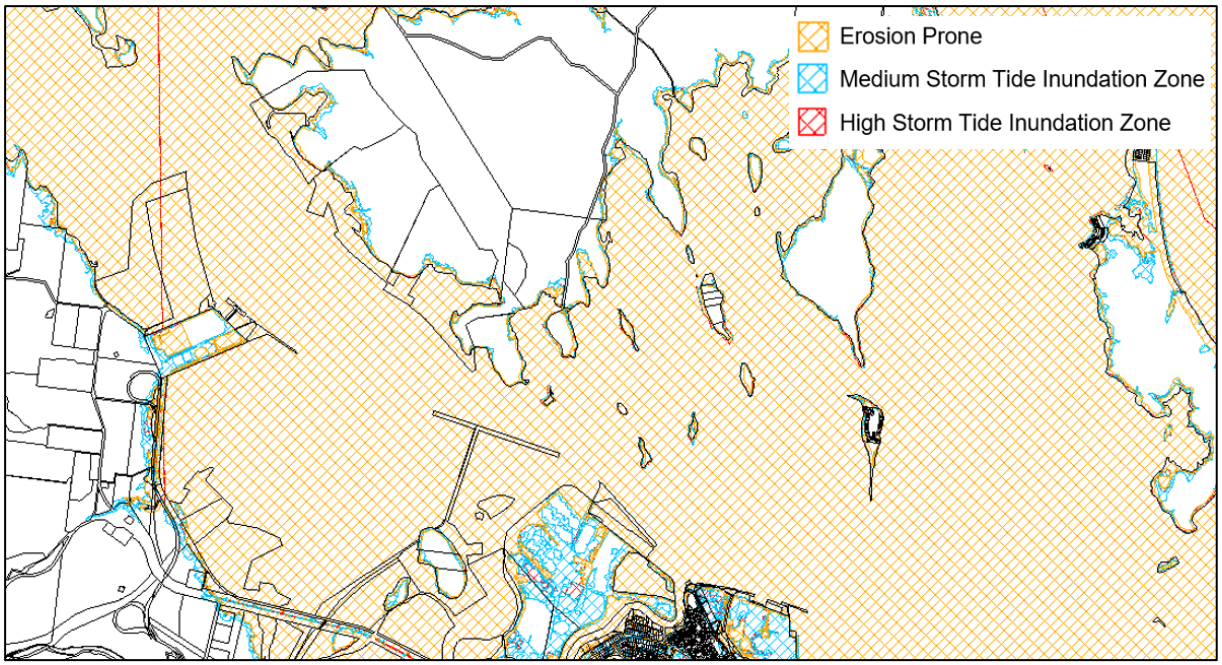

Figure 20.2 Storm tide inundation zones

Source: GRC Planning Scheme maps

Having regard to the information contained in Section 11.3.3, extremely high rainfall occurs predominantly during the monsoon season (November to April) and can be associated with tropical cyclone activity. However, the data also shows that high rainfall events are not necessarily associated with tropical cyclones and can potentially occur at any time of the year. However, future rainfall projections indicate a warming climate with a significant decrease in average rainfall for all periods but increasing intensity of extreme rainfall events is also predicted, which could point to an increase in the severity of flood and storm surge events.

The disaster management plans for Gladstone have concluded the following in terms of risk:

- GDDMP: District is susceptible to flooding and storm surge events with large disruptive events recorded
  - Flood is a likely event, the consequence of which would be major with an overall extreme risk level
  - Storm tide/surge is a possible event, the consequence of which would be high with an overall high risk level
- LDMP: Flash flooding is a rare event while storm surges coupled with high tides may cause coastal flooding
  - Flood is a likely event, the consequence of which would be minor with an overall high risk level
  - Storm tide is a likely event, the consequence of which would be moderate with an overall high risk level.

Hazard management

Flood and storm surge risk associated with cyclones are subject to cyclone alerts and warning procedures in place within the region, giving businesses and property owners time to plan and implement their emergency plan procedures. Extreme rainfall events which may give rise to catchment flooding are also monitored by the BoM with management directed by the appropriate agencies under the LDMP and GDDMP.

20.4.2.3 Earthquake

Background

Gladstone is located on the northern margin of the Wide Bay – Burnett earthquake zone, which is the most active earthquake area in Queensland stretching between Brisbane and Gladstone.

Among the largest eastern Australian earthquakes with an approximate magnitude of 6.0, was the June 1918 earthquake which struck some 135km offshore of Gladstone and affected an area from Rockhampton in the north to Bundaberg in the south, causing minor structural damage. Other noteworthy earthquakes resulting in minor structural damage near Gladstone include the 1953 Many Peaks earthquake, the Heron Island 1978 earthquake, and the 1998 offshore Rockhampton earthquake (Queensland University Advanced Centre for Earthquake Studies 2018).

The disaster management plans for Gladstone have concluded the following in terms of risk:

- GDDMP: District is susceptible to earthquake events with historic large events recorded
  - Earthquake is an unlikely event, the consequence of which would be major with an overall high risk level
- LDMP: a 10% chance in 100 years of the Gladstone/Calliope area experiencing an earthquake exceeding velocity of 90mm per second and with an earthquake of this magnitude large scale property damage and some loss of life is predicted (GRC 2010)
  - Earthquake is an unlikely event, the consequence of which would be major with an overall high risk level.

Hazard management

While seismic activity is the subject of national and international monitoring, there is usually very little prior warning. A Standard Emergency Warning Signal would be used in the event of an earthquake. General advice is provided on Commonwealth and Queensland Government websites regarding actions to be undertaken in the event of an earthquake. GPC will adhere to all local action and response measures.

20.4.2.4 Tsunami

Background

The most common cause of a tsunami is a seafloor earthquake, however, other triggers are undersea landslides, undersea volcanic eruptions, and meteorite impact. The strength of a tsunami depends on the amount of displacement in the water column caused by the triggering event, the offshore bathymetry, and gradient of the shoreline. According to the BoM, there have been more than 50 tsunami events in Australia since 1788 with tsunami recorded in Australia about once every two years, but are very small. Due to the seismic characteristics of the Gladstone area and its eastern aspect, there is the potential for earthquake generated tsunami.

- GDDMP concludes that tsunami is a rare event, the consequence of which would be major with an overall high risk level
- LDMP conclusion is not dissimilar to the GDDMP rating a tsunami as an unlikely event, the consequence of which would be major with an overall high risk level.

Hazard management

The Australian Tsunami Warning System provides a comprehensive tsunami monitoring and warning system which allows for planning and action in a timely manner. In the event of a warning for the Gladstone region, the Queensland Tsunami Notification procedures will be enacted with mobilisation of the Local and District Disaster Management Groups. Evacuation protocols will be followed for both land and port areas with people required to move to higher ground above the 6m AHD contour or above and shipping to adhere to the instructions of the Regional Harbour Master.

20.4.2.5 Bushfire

Background

The entire Gladstone region is at risk from bushfires. September to February is the main fire season but this may extend further with dry weather. Bushfires can last for days destroying pasture and stock as well as threatening lives and homes. The bushfire prone areas have been mapped under the GRC Planning Scheme and are illustrated in Figure 20.3.

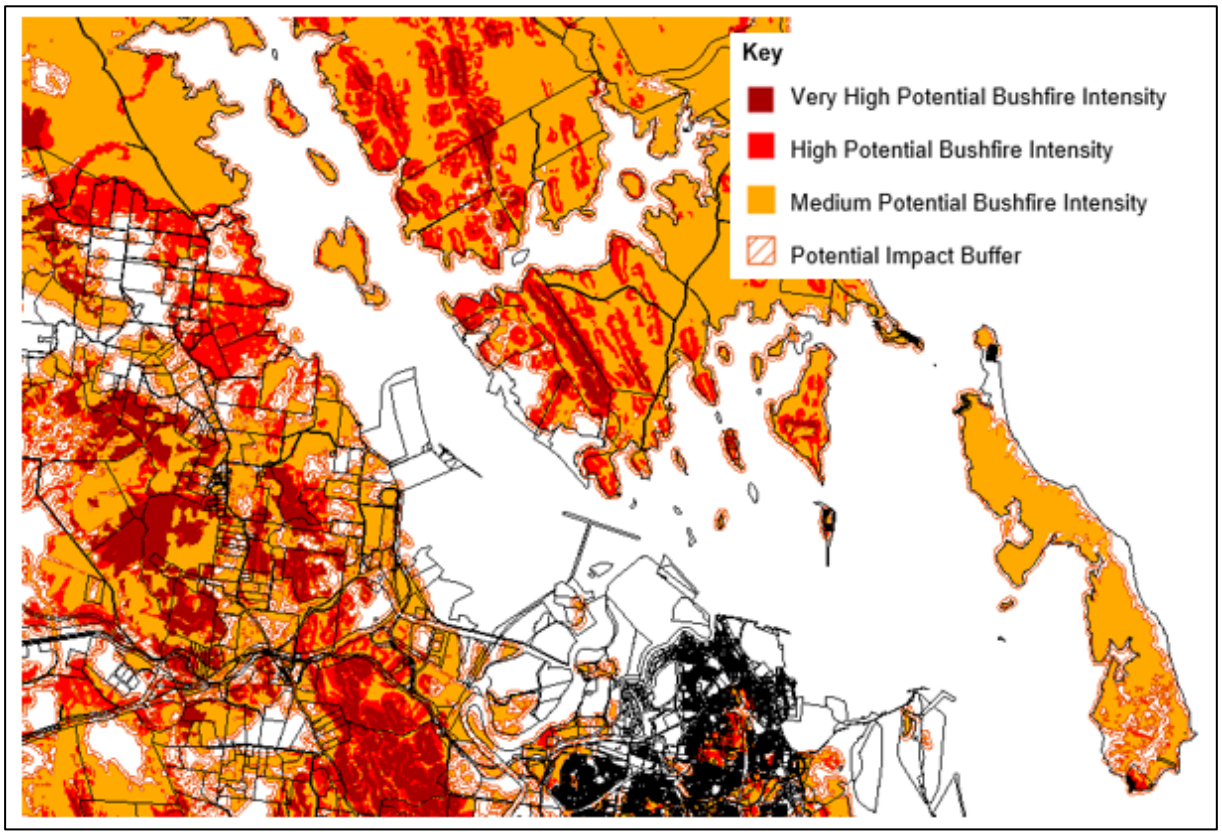

Figure 20.3 Bushfire prone areas adjacent the Project activity areas

Source: GRC Planning Scheme maps

The disaster management plans for Gladstone have concluded the following in terms of bushfire risk:

- GDDMP: Bushfire is an almost certain event, the consequence of which would be minor with an overall extreme risk level
- LDMP: Similarly concludes that bushfires are an almost certain event, the consequence of which would be minor with an overall high risk level.

Hazard management

The Planning Scheme considers the physical constraints to development within bushfire prone areas. The Queensland Fire and Rescue Service has in place a regional Wildfire Mitigation and Readiness Plan which coupled with the management directed by the appropriate agencies under the LDMP and GDDMP, provides an appropriate level of hazard management within the region.

20.4.3 Other hazards

20.4.3.1 Oil and liquid spills

Background

The Port of Gladstone is highly susceptible to liquid spills due to the large number of shipping movements throughout the harbour. Flammable liquids, fuel, diesel and lubricating oils, along with acids and caustic soda are the main types of spills likely to be encountered. Spills can arise due to accidental spillage, poor maintenance or vessel strike/collision. Such spills can cause a dangerous situation in close proximity to the spill.

Hazardous materials being transported through the Port include liquid petroleum gas, natural gas, fuel, chlorine, sodium cyanide (both solid and liquid), sodium hydroxide, sodium hypochlorite, hydrochloric acid, sulfuric acid and anhydrous ammonia.

A risk assessment conducted by the Queensland Government in 2000, in collaboration with the GBRMPA identified six areas with a higher than average risk of a serious marine pollution event which were classified Marine Environment High Risk Areas. In addition to these higher risk areas, it was acknowledged that the Queensland coastal waters and offshore areas should be protected from marine pollution.

An Assessment of the Risk of Pollution from Marine Oil Spills in Australian Ports and Waters was undertaken by Det Norske Veritas for the Australian Maritime Safety Authority in 2011. The report identified that the eastern Queensland coast, particularly from Townsville to Hay Point, had a relatively high oil spill risk, arising mainly from bunkering of bulk carriers and cargo transfer on oil tankers in ports such as Hay Point, Gladstone and Brisbane. However, smaller spills from small commercial vessels and shore-based activities were also noted as contributing factors.

The report advised that the Port of Gladstone had a medium risk but was noted as having an increase in risk when compared to the findings of a previous 2003 assessment with the change mainly attributed to an increase in ship arrivals.

The disaster management plans for Gladstone have concluded the following in terms of risk:

- GDDMP: The Port of Gladstone, being a major industrial port is highly subject to liquid spills due to the large number of shipping movements
  - Oli spill is an unlikely event, the consequence of which would be minor with an overall low risk level
- LDMP: The foreshores within the Gladstone region are at risk from spills
  - Marine spill is an unlikely event, the consequence of which would be major with an overall high risk level.

Hazard management

The operators of ports, maritime facilities, oil and chemical terminals are normally a designated Control Agency and have a responsibility for maintaining appropriate equipment stocks commensurate with the risks posed by their operations, and access to sufficient trained personnel to effectively deploy that equipment.

Under the NPMEE, an Incident Management System will be implemented for the management of marine pollution incidents which is designed to be adaptable to the individual circumstances of the incident or the particular agencies involved. The following are a designated Control Agency under the NPMEE:

- In Port water – the Port Authority (i.e. GPC for the Port of Gladstone)
- Great Barrier Reef Marine Park – Queensland Government
- Hazardous and noxious substance incidents in Queensland waters – MSQ.

As part of emergency response, it is noted that Gladstone is a confirmed dispersant location with Brisbane and Townsville identified as National Equipment Stockpiles

Under the QCCAP, a Port of Gladstone First-Strike Oil Spill Response Plan (2014) has been prepared and GPC is responsible for First-Strike response.

20.4.3.2 Industrial accident

Background

The Port area supports a large industrial sector which includes the WICT facility, the Curtis Island LNG complex and Yarwun alumina refinery. There is also the storage of fuel, gas and coal at the wharves together with other dangerous chemicals and grain silos. Added to this there are small depots and businesses with stocks of fuel and inflammable chemicals, gasses and the like within the wider area.

An industrial incident could be initiated by a number of individual factors or a combination there of, such as a natural disaster, malicious act, disruption to electrical or other utilities, a process or equipment failure or human error. Incidents could range from small fires and process failures to explosions and significant emissions.

The disaster management plans for Gladstone have concluded the following in terms of risk:

- LDMP: Industrial incident is an unlikely event, the consequence of which would be moderate with an overall moderate risk level.

The GDDMP does not provide a risk assessment for industrial incidents.

Hazard management

All industrial sites have rigorous mandatory prevention, containment and mitigation systems which are designed to avert a major failure or minimising the consequences of an incident. The management of incidents which impact the Port of Gladstone is the responsibility of GPC.

20.4.3.3 Port and shipping incident

Background

The Port of Gladstone is one of Australia's busiest ports and vessel movements are continuing to increase. Shipping accidents can occur due to mechanical failure, human error and criminal interference. The Port can have up to 300 vessel movements per day with a number of vessels carrying up to 400 passengers to and from the islands (Queensland Government 2016b). A shipping accident shore side or port side may have environmental (loss of wildlife and habitat), economic (restriction of access to port by trade ships, damage to infrastructure) and human impacts (loss of life).

The disaster management plans for Gladstone have concluded the following in terms of risk:

- GDDMP: The Port of Gladstone is a major industrial port with a large number of shipping movements

- Shipping incident is a possible event, the consequence of which would be minor with an overall medium risk level.

The LDMP does not provide a risk assessment for port and shipping incidents.

Hazard management

The Port of Gladstone has well established procedures and guidelines for vessel movements and associated activities as discussed in the Chapter 15 (transport). These clearly detail the transit routes to be utilised by ships moving from the existing harbour channels to the wharf berthing locations. The procedure also provides relevant ship passing and weather restrictions. Gladstone Harbour Control is responsible for vessel movement within the Port, including vessel speed, interaction with other vessels and anchorage/berthing arrangements. Compliance with the procedures and instruction from Gladstone Harbour Control provides an appropriate level of hazard management.

20.4.3.4 Maritime security

Background

Unauthorised access to the port area and wharves has the potential to impact on the health and safety of Port employees and the safe undertaking of Port operations. Maritime security can be the subject of terrorist attack, including sabotage, bombing or arson.

The disaster management plans for Gladstone do not consider maritime security in its own right but have concluded the following in terms of risk with respect to associated security hazards:

- GDDMP: Terrorism is an unlikely event, the consequence of which would be major with an overall high risk level
- LDMP: considers the following security hazards:
  - Terrorist attack, bombing and sabotage of essential services are rare events, the consequence of which would be major with an overall high risk level
  - Arson is an unlikely event, the consequence of which would be moderate with an overall moderate risk level.

Hazard management

The Port of Gladstone is a security regulated port under the *Maritime Transport Security Act 2003* (Cth). Security risk assessments on the Port have been carried out and a security plan for the Port has been prepared and approved by the regulator. Both internal and external audits of compliance with the plan are carried out annually. Access to port facilities is restricted to authorised personnel with visitors subject to admittance procedures.

20.4.3.5 Port health and safety

The Port has a strong health and safety culture and GPC in collaboration with Port users ensures these values are upheld. GPC is committed to:

- Providing a safe working environment for all employees within the Port and on Port land
- Preventing all workplace injuries and illnesses
- Promoting safe work practices (e.g. safety inductions, use of safety equipment, inspections)
- Incorporating safety and environmental considerations into decision making and work practices related to GPC's core functions.

Health and safety and the management of workplace hazards in the Port is reinforced through GPC's Health and Safety Committee, its Risk Management Plan, Emergency Management Planning and its Environmental Monitoring System. Contractors and Port tenants are required to have health and safety plans in place. General public safety is protected through the Port's work place practices and its environmental management policies and procedures.

20.5 Potential impacts

This section outlines the potential risks to the Project activities, and from the Project activities, in terms of the hazards considered in Section 20.4.

20.5.1 Natural hazards

All Project activities have the potential to be affected by a cyclone with implications for the health and safety of the workforce and the integrity of Project infrastructure/equipment. The Project activities will comply with regional Cyclone Warning procedures and the CCP for vessels within the Port. A stockpile of armour material will be held at the Targinnie/Yarwun quarry, sufficient to cover any exposed core material at the WBE reclamation area if a cyclone were to approach Gladstone.

The western side of the WBE reclamation area is located in proximity to an area of medium potential bushfire intensity located on the mainland. While it is not considered that the WBE reclamation area itself would be at risk from bushfire, the route to and from the site may be affected. Consequences of this could be driver safety risk (rock haulage or site workforce) or isolation of workforce at the WBE reclamation area. Conversely, the proximity of a working area in which activities could potentially generate sparks or result in flames may, to a bushfire prone area may act as a wildfire catalyst dependent on wind direction and fuel conditions of the wider area.

Additional hazard risks at the WB and WBE reclamation areas and BUF include:

- Cyclone, Tsunami and extreme rain and/or flooding – risk during construction and in the future of inundation or instability of resulting in structural damage and the discharge of material (sediment and rock debris) into the Port which may create risks for vessels or have environmental impacts (e.g. water quality and ecology) for the harbour
- Extreme rain and flooding – risk during construction and in the future of surface water ponding and water damage to plant and equipment
- Earthquake – risk of liquefaction or structural integrity failure of the bund wall and BUF.

20.5.2 Other hazards

20.5.2.1 Oil and liquid spills

The construction of the WBE reclamation area and BUF may involve the storage and handling of dangerous goods and substances which have the potential to be accidentally released and enter the marine environment or create circumstances for increased slips, falls and loss of plant/equipment control within the site. Any storage of dangerous goods and substances within the WB or WBE reclamation area compounds will be within a designated secure area contained by a leachate bund as per best practice arrangements.

Vessels associated with dredging activities will also contain oil and fuels. The accidental release of liquids may occur as a result of third party vessel collision, human error or equipment failure. During the removal and installation of the navigational aids there is also the potential for the accidental release of oils or liquids from the piling rig and support boats required to undertake the activity.

The spillage of any flammable substance has the inherent secondary risk of creating a fire hazard.

20.5.2.2 Industrial accident

The location of the WB and WBE reclamation areas and BUF is at some distance from the existing industrial area of the Port and therefore, the likely risk associated with industrial accidents elsewhere within the Port area is considered low. As the dredging and maintenance phases of the Project will by their very nature be undertaken within the Port waters, the associated risk from industrial accidents is most likely confined to debris entering the dredging area or the closure of the Port with the Regional Harbour Master requiring vessels to vacate the area.

20.5.2.3 Port and shipping incident

The Port of Gladstone has well established procedures and guidelines (Port Procedures) for vessel movements and associated activities. The Regional Harbour Master will be consulted in relation to Project generated vessel movements and activities within the Port. Dredging equipment and associated vessels will obtain the Regional Harbour Master approval prior to commencing work (where required).

It is important to note that while the Project will facilitate an improvement in the existing and future vessel movement efficiency, and a reduction in the likelihood of vessel incident risk, the duplication of the Gatcombe and Golding Cutting Channels will not have any direct influence on increasing vessel movement numbers within the Port.

20.5.2.4 Maritime security

A construction compound will be located within the vicinity of the WBE reclamation area with site office, welfare facilities and workshop. The facility will be occupied 24/7 during the construction phase, however, during the maintenance and stabilisation phase of works, on site workforce will initially be daily reducing to adhoc visits.

The WB and WBE reclamation areas will be fully enclosed with appropriate fencing to restrict unauthorised access to the site. Site access will be through a principal secured entry point which will only be accessible by authorised site personnel. Any visitors to the site will be subject to strict admittance procedures, as such the potential for a maritime security incident is considered to be very low.

The Project's dredging, navigational aid installation and maintenance dredging activities will be required to comply with all existing maritime security requirements for the Port of Gladstone. It is considered that these Project activities will not create any additional risks to maritime security over and above the existing identified risk level.

20.5.3 Health and safety

All hazards noted above have the potential to create occupational risk and expose the Project workforce to situations which may lead to unsafe work practices, injury and fatality.

Health and safety impacts can result from incremental changes over the Project life cycle. Generally, work presents hazards capable of impacting workers either immediately as an injury (e.g. a cut) or aggregated through exposure (e.g. deafness).

Health and safety risk considerations during the Project's construction and maintenance phases include:

- Failure to meet legal requirements (e.g. statutory obligations, duties, licences and permits conditions)
- Incorrect interpretation and translation of design to implementation
- Incorrect management of physical risk sources (i.e. energy, equipment, processes and materials)
- Incorrect management of human resources (e.g. roster, leave)

- Failure to undertake maintenance requirements
- Failure to ensure adequate risk information transfer.

20.6 Mitigation measures

20.6.1 Safety in design

'Safety in design' principles are applicable to the Project and these principles are also underpinned by statutory obligations imposed through the Queensland WHS Act on designers (plant, substances and structures) and 'persons conducting business or undertakings'.

Designers must test and analyse the risk associated with their designs and provide sufficient information to end users. The designer may also be requested to provide current information about the design and relevant risks associated with its use.

The Project design, will continue to be subject to safety in design procedures with particular emphasis placed on the detailed design of the BUF and WBE reclamation area bund walls with respect to cyclone, Tsunami, storm surge and earthquake risk. It should be noted that the EIS preliminary design for the BUF and bund walls has allowed for a storm tide and sea level change allowance of +1.88m above the existing HAT level at Fisherman's Landing (i.e. 5.12m LAT), which is slightly greater than the predicted 1,000 year ARI storm tide and climate change conditions of +1.79m.

20.6.2 Cyclone management plan

The most likely hazard event with the highest consequence and risk profile for the Project and all its component activities is that of a cyclone. Cyclone damage has the possibility of triggering a range of secondary hazards (e.g. spills, vessel collision or collision with the BUF, WB or WBE reclamation area bund wall, worker/third party exposure to injury or fatality).

While a CCP is in place for the Port with respect to vessels, the Project will prepare a Cyclone Management Plan which will formulate procedures for cyclone preparedness for both landside and water based activities as well as response measures.

20.6.3 Project Environmental Management Plans

The relevant contractor will prepare a Project EMP for the Project activity (i.e. construction of the WBE reclamation area bund walls and BUF, installation of navigational aids and maintenance activities on the WB and WBE reclamation areas) based on the plan provided in Appendix Q2. The Project EMP will contain management and mitigation measures to minimise the impact of the Project activities on the environment and to achieve worker and public safety. It will include measures to minimise water quality, noise, vibration and dust impacts, manage PASS, minimise the risk of unintended release of fuel, oil or other chemical spills, and emergency response.

20.6.4 Dredging Environmental Management Plan

The dredging contractor will prepare a Dredging EMP for the Project based on the plan provided in Appendix Q1. The Dredging EMP will contain management and mitigation measures to minimise the impact of the Project dredging activities on the environment and to achieve worker and public safety.

20.6.5 Emergency preparedness

An Emergency Response Plan for the Project will be developed as part of the Project's health and safety management system and the environmental management of the Project prior to commencement of the construction activities. The systems will be updated as works transition through the Project activity cycle or in response to legalisation or guidance change.

The Emergency Response Plan will include specific procedures aimed at identifying and minimising risks in an emergency response situation, address rescue and escape procedures, provide for regular testing and review of emergency response procedures and prescribe the requirement for routine auditing to ensure the consistence and effectiveness of the system.

Project safety inductions will be required to specify emergency response procedures for all Project activities with rescue and response procedures defined in addition to onsite first aid and infrastructure and processes.

The WBE reclamation area and BUF construction contractor will prepare an emergency plan which will include procedures to address severe climatic events such as cyclones and minimise where practicable the potential environmental impacts from the reclamation works.

20.6.6 Health and safety procedures

A Health and Safety Management Plan will be prepared for the Project based on the GPC Health and Safety Policy. Work procedures will be implemented by GPC and contractors during all phases of the Project to enable safe and efficient work practices. Each work procedure will cover a different activity (e.g. stabilisation, refuelling, passenger transfer boat to vessel).

These procedures will be reviewed regularly and updated to reflect any Project activity specific requirements which may arise. In preparing the Plan, regard to the appropriate Australian Standards as per the Guide to Standards for Occupational Health and Safety (SAI Global 2014) will be carried out. All Project contractors will be required to meet the requirements of the Plan as minimum.

20.7 Risk assessment

20.7.1 Methodology

To assess and appropriately manage the hazards and risks discussed in this chapter, a risk assessment process has been implemented (herein referred to as 'risk assessment'). The risk assessment methodology adopted is based on principles outlined in the:

- AS/NZS ISO 31000:2009 Risk management – Principles and guidelines
- HB 203:2012 Handbook: Managing environment-related risk.

The risk assessment identifies and assesses the hazards (natural and human/technological) and health and safety risks to and from Project for the establishment of the WBE reclamation area and BUF, dredging activities, installing navigational aids and maintenance activities on the WB and WBE reclamation areas.

The purpose of this risk assessment is to identify potential hazard, health and safety impacts to prioritise environmental management actions and mitigation measures, and to inform the Project decision making process.

The risk management framework incorporates the Australian/New Zealand Standard for Risk Management (AS/NZS 4360:2004) and contains quantitative scales to define the **likelihood** of the potential impact occurrence and the **consequence** of the potential impact should it occur.

An overview of the interaction between Project activities (drivers/stressors), sensitive values/receptors and the risk impact assessment process is provided in Figure 20.4.

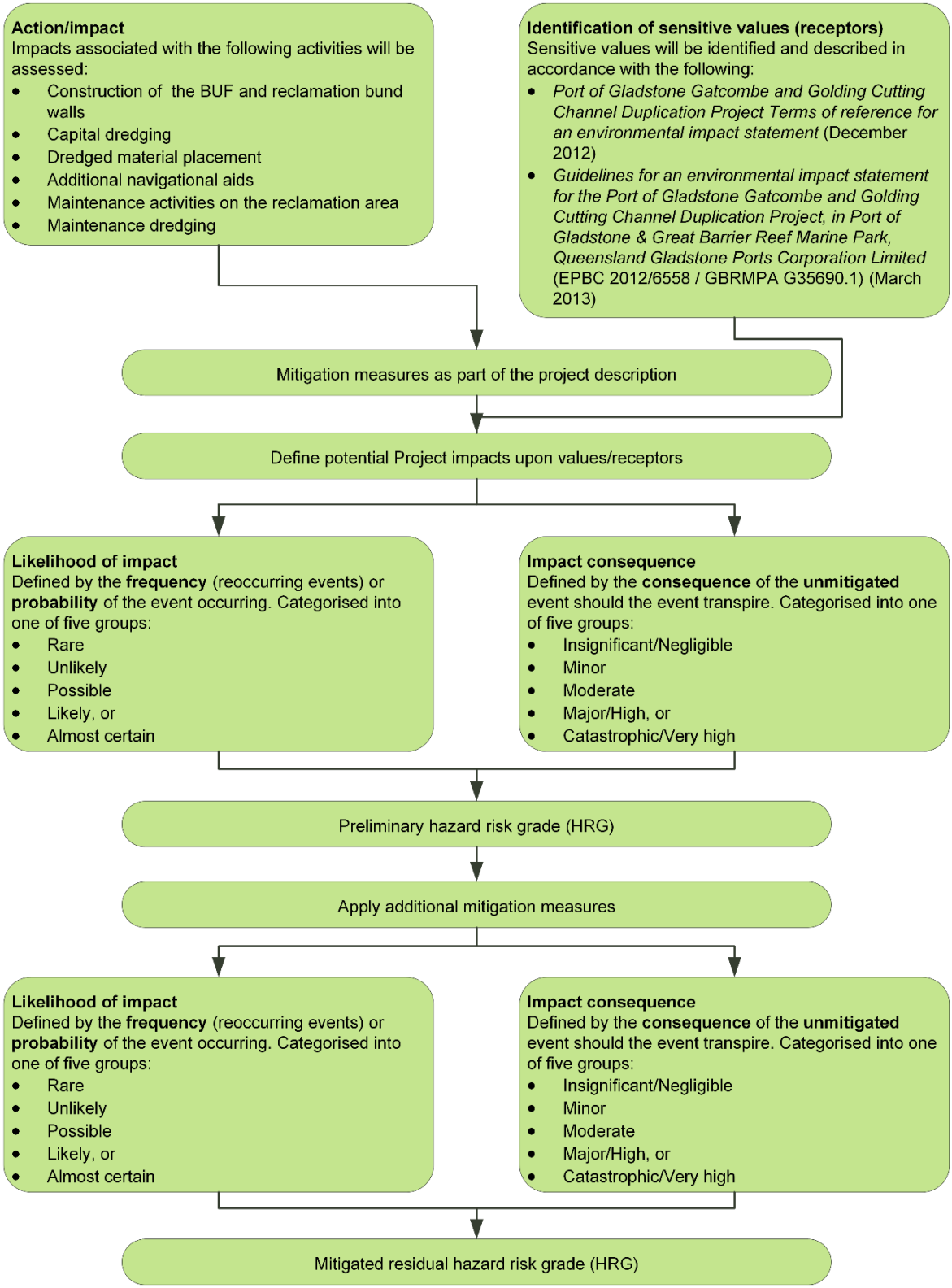

Figure 20.4 Risk assessment framework

Criteria used to rank the **likelihood** and **consequence** of potential impacts are provided in Table 20.1 and Table 20.2, respectively.

Table 20.1 Environmental (ecosystem), public perception and financial consequence category definitions (adapted from GBRMPA 2009)

Description	Definition/quantification[1]		
	Environmental*	**Public perception**	**Financial**
Negligible (Insignificant)	No impact or, if impact is present, then not to an extent that would draw concern from a reasonable person No impact on the overall condition of the ecosystem	No media attention	Financial losses up to $500,000
Low (Minor)	Impact is present but not to the extent that it would impair the overall condition of the ecosystem, sensitive population or community in the long term	Individual complaints	Financial loss from $500,001 to $5 million
Moderate	Impact is present at either a local or wider level Recovery periods of 5 to 10 years likely	Negative regional media attention and region group campaign	Financial loss from $6 million to $50 million
High (Major)	Impact is significant at either a local or wider level or to a sensitive population or community Recovery periods of 10 to 20 years are likely	Negative national media attention and national campaign	Financial loss from $51 million to $100 million
Very high (Catastrophic)	Impact is clearly affecting the nature of the ecosystem over a wide area **or** impact is catastrophic and possibly irreversible over a small area or to a sensitive population or community Recovery periods of greater than 21 years likely **or** condition of an affected part of the ecosystem irretrievably compromised	Negative and extensive national media attention and national campaigns	Financial loss in excess of $100 million

Table notes:

1 Quantification of impacts should use the impact with the greatest magnitude in order to determine the consequence category

* For Matters of National Environmental Significance (MNES) protected under the provisions of the EPBC Act the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1 – Environmental Protection and Biodiversity Conservation Act 1999* (DoE 2013) are to be used to determine the consequence category

Table 20.2 Likelihood category definitions (adapted from GBRMPA 2009)

Description	Frequency	Probability
Rare	Expected to occur once or more over a timeframe greater than 101 years	0-5% chance of occurring
Unlikely	Expected to occur once or more in the period of 11 to 100 years	6-30% chance of occurring
Possible	Expected to occur once or more in the period of 1 to 10 years	31-70% chance of occurring
Likely	Expected to occur once or many times in a year (e.g. 1 to 250 days per year)	71-95% chance of occurring
Almost certain	Expected to occur more or less continuously throughout a year (e.g. more than 250 days per year)	96-100% chance of occurring

Once the likelihood and the consequence has been defined, determination of the HRG of the potential hazard will be determined through the use of a five by five matrix (refer Table 20.3).

Table 20.3 Hazard risk assessment matrix (adapted from GBRMPA 2009)

Likelihood	Consequence rating				
	Negligible (insignificant)	Low (minor)	Moderate	High (major)	Very high (catastrophic)
Rare	Low	Low	Medium	Medium	Medium
Unlikely	Low	Low	Medium	Medium	High
Possible	Low	Medium	High	High	Extreme
Likely	Medium	Medium	High	High	Extreme
Almost certain	Medium	Medium	High	Extreme	Extreme

Table note:

Hazard risk categories identified in Table 20.3 are defined in Table 20.4

Table 20.4 Risk definitions and actions associated with hazard risk categories (adapted from GBRMPA 2009)

Hazard risk category	Hazard risk grade definition
Low	These risks should be recorded, monitored and controlled. Activities with unmitigated environmental risks that are graded above this level should be avoided.
Medium	Mitigation actions to reduce the likelihood and consequences to be identified and appropriate actions (if possible) to be identified and implemented.
High	If uncontrolled, a risk event at this level may have a significant residual adverse impact on MNES, MSES, GBRWHA and/or social/cultural heritage values. Mitigating actions need to be very reliable and should be approved and monitored in an ongoing manner.
Extreme	Activities with unmitigated risks at this level should be avoided. Nature and scale of the significant residual adverse impact is wide spread across a number of MNES and GBRWHA values.

20.7.2 Summary of risk assessment

The risk assessment framework developed for the Project was applied to the potential impacts of hazard, health and safety on construction and maintenance activities. A summary of the risk assessment together with proposed mitigation measures to manage risk to acceptable levels is provided in Table 20.3. In general, the potential impacts identified can be managed through a combination of design mitigation measures for natural hazard events and the implementation of the Project EMP, Dredging EMP, a Cyclone Management Plan as well as a Project Health and Safety Plan and an Emergency Response Plan.

Risk is the likelihood of disaster or hazard. This probability is implied to occur to an asset or a resource. In determining risk, mitigation measures could be implemented in order to reduce the likelihood of risk.

Table 20.5 Potential hazard and health and safety impacts and risk assessment ratings

Potential impact	Project phase					Preliminary HRG			Post mitigation HRG		
	Reclamation area and BUF establishment	Dredging	Navigational aids	Demobilisation	Maintenance	Likelihood	Consequence	HRG	Likelihood	Consequence	HRG
Tropical storms and cyclones, increased intensity											
Potential injury or death – drowning from dredging vessel or swept to sea from the BUF, WB or WBE reclamation areas	✓	✓	✓	✓	✓	Possible	High	High	Unlikely	High	Medium
Dredging vessels and/or other Project equipment incident potential injury or death or damage to equipment	✓	✓	✓	✓	✓	Possible	High	High	Unlikely	High	Medium
Damage of outer bund walls or BUF resulting in decrease in marine water quality	✓	✓			✓	Possible	Moderate	High	Unlikely	Moderate	Medium
Increased sediment load in the channel resulting in an increased requirement for maintenance dredging and associated costs					✓	Possible	Low	Medium	Unlikely	Low	Medium
Damage to bund walls or BUF and movement of sediment leading to potential decrease in surrounding water quality, time delays due to additional dredging and clean up requirements, including additional costs	✓	✓			✓	Possible	Moderate	High	Unlikely	Moderate	Medium
Storm surge/flooding											
Potential injury or death ■ Falling from dredging vessel or other Project vessel; swept to sea from BUF, WB or WBE reclamation areas ■ Equipment failure ■ Vehicle loss of control due to wet conditions	✓	✓	✓	✓	✓	Possible	High	High	Unlikely	High	Medium
Future inundation of the BUF and reclamation area and not providing long term beneficial land use outcomes	✓				✓	Possible	Low	Medium	Unlikely	Low	Low

Potential impact	Project phase					Preliminary HRG			Post mitigation HRG		
	Reclamation area and BUF establishment	Dredging	Navigational aids	Demobilisation	Maintenance	Likelihood	Consequence	HRG	Likelihood	Consequence	HRG
Damage to bund walls or BUF and movement of sediment leading to potential decrease in surrounding water quality, time delays due to additional dredging and clean up requirements including additional costs	✓	✓			✓	Possible	Moderate	High	Unlikely	Moderate	Medium
Remobilisation of dredged material in extreme flood events	✓				✓	Possible	Moderate	High	Unlikely	Moderate	Medium
Earthquake											
Damage to bund walls or BUF and movement of sediment leading to potential decrease on surrounding water quality, time delays due to additional dredging and clean up requirements including additional costs	✓				✓	Unlikely	Moderate	Medium	Rare	Moderate	Medium
Bush fire											
Potential injury or death	✓					Unlikely	Low	Low	Rare	Low	Low
Hydrocarbons, including chemicals, fuels or other liquid spills											
▪ Contamination of soil and sediment through leaching ▪ Contamination of water ▪ Toxicity to marine and/or intertidal flora and fauna ▪ Odour	✓	✓	✓		✓	Likely	Moderate	High	Unlikely	Moderate	Medium
Vessel collision											
Potential injury or death – drowning from dredging vessel or swept to sea from BUF, WB or WBE reclamation areas						Possible	High	High	Unlikely	Moderate	Medium

Potential impact	Project phase					Preliminary HRG			Post mitigation HRG		
	Reclamation area and BUF establishment	Dredging	Navigational aids	Demobilisation	Maintenance	Likelihood	Consequence	HRG	Likelihood	Consequence	HRG
Third party vessel collides with dredger, barge, tug, dredging equipment, bund wall, BUF and/or reclamation area. Resulting in spill from dredger or barge: potential injury/fatality; time delays; increase in dredging and navigational aid installation costs; damage to GPC reputation		✓	✓		✓	Possible	High	High	Unlikely	High	Medium
Dredger pipeline leaking and/or breaking releasing dredged material during barge access channel dredging		✓			✓	Possible	Moderate	High	Unlikely	Moderate	Medium

20.8 Summary

The Project hazard and risk assessment has concluded that there are three main areas of risk associated with the Project, namely:

- Natural hazards that exist in the Gladstone region and for which established management and response systems or design standards are in place
- Project-specific elements and activities that have required detailed assessment and will require targeted management
- Construction and maintenance risks that would apply to any similar project in the Gladstone area and that are routinely dealt with by GPC and its contractors.

The design, construction and maintenance of the Project are covered by an extensive regulatory and hazard management framework, including health and safety requirements. The management of health and safety risks is an integral part of GPC's core functions which the Project will comply with.

Adherence to the mitigation measures for environmental management as provided in this EIS and the hazard mitigation outlined in Section 20.7 provide important elements for the mitigation of health and safety risks to workers and in turn the wider community.

The construction hazards and risks identified for the Project have a low to medium residual risk rating, whilst the maintenance phase hazards and risks are identified as being a low residual risk rating due to these hazards and risks being well known and already addressed by GPC systems and procedures.