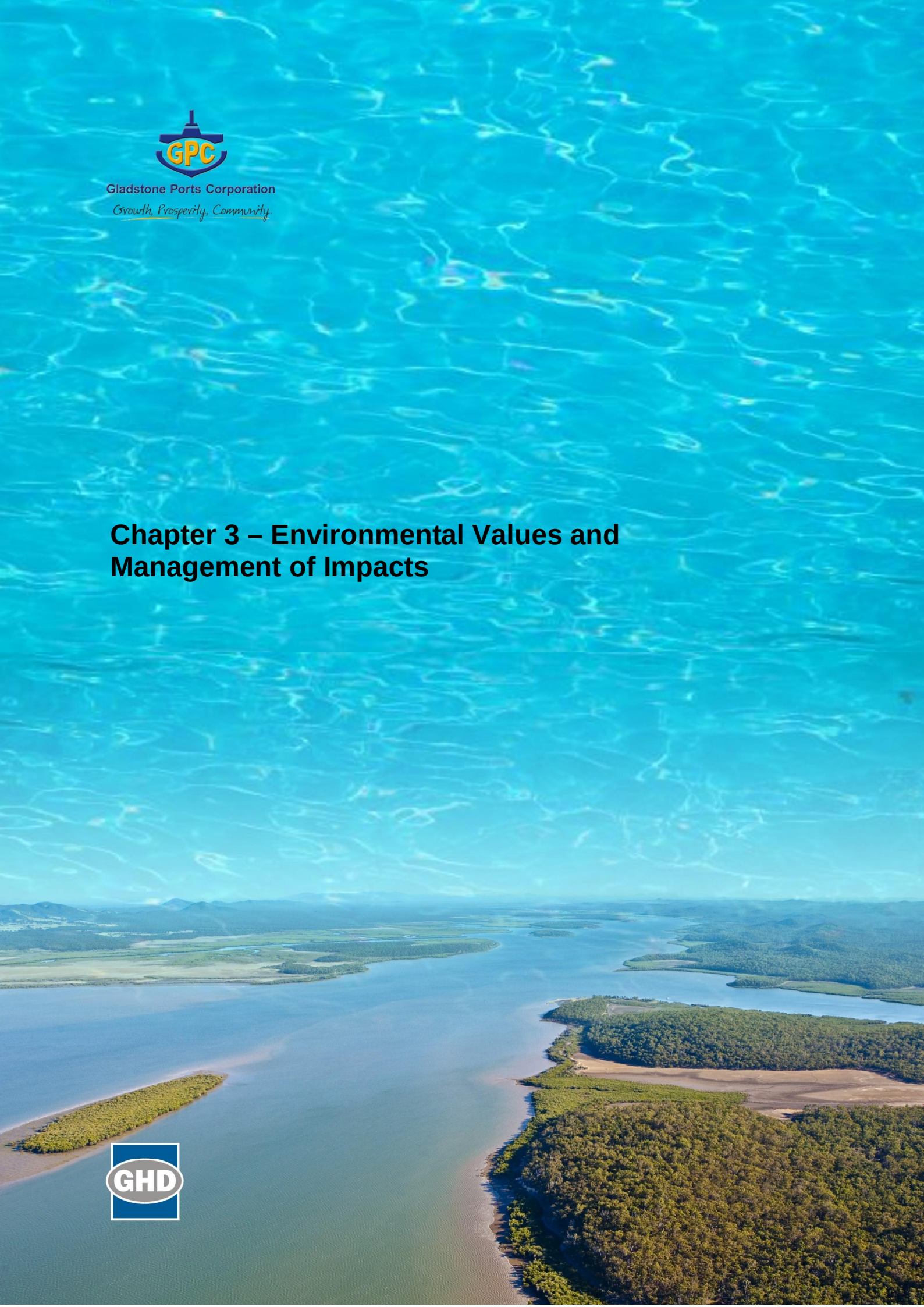
Gladstone Ports Corporation

Growth, Prosperity, Community.

Chapter 3 – Environmental Values and Management of Impacts



3. Environmental Values and Management of Impacts

3.1 Overview

This chapter provides an outline of the environmental impact assessment methodology used for this Project. A foundation element of the environmental impact assessment process is the identification and description of environmental values of an area that may be affected by a project. This provides a basis for the assessment of potential impacts and formulation of pro-active measures to manage and mitigate impacts that might arise during the construction and operational phases of the development.

The *Environmental Protection Act 1994*, Section 9, defines environmental values as:

> *(a) A quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or*
>
> *(b) Another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.*

Consistent with the requirements of the ToR for the Project, Chapters 4 to 17 of this EIS describe the existing terrestrial and marine environmental values of the Western Basin that may be affected by the Project. These chapters address all elements of the environment, such as land, water, air, noise, nature conservation, transport, cultural heritage, social, economic, health and safety and hazard and risk. Potential adverse and beneficial impacts of the Project on the identified environmental values are also described along with cumulative impacts caused by the Project, or in combination with other known existing or planned impacts associated with other development. The level of significance of the impacts is also presented within a risk framework where appropriate for the specialist investigations, providing an understanding of the likelihood of impacts and potential consequences. The approach to the risk framework is discussed in Section 3.2.

Chapters 4 to 17 also present environmental protection objectives, standards and measurable indicators to be achieved. Where relevant, each chapter details the environmental protection measures that have been incorporated into the planning, construction and associated works for the Project. Viable alternative strategies for managing impacts are also examined with respect to stated objectives and standards to be achieved. Special attention is given to those mitigation strategies designed to protect the values of any sensitive areas and any identified ecosystems of high conservation value within the area of possible proposal impact. These measures aim to minimise environmental harm and maximise social, economic and environmental benefits of the Project, and they form the basis of the Environmental Management Plan described in Chapter 19.

Any requirements and recommendations of the relevant State planning policies, environmental protection policies, national environmental protection measures and integrated catchment management plans are addressed throughout the chapters to demonstrate consistency of the Project with these statutory and policy obligations.

Following on from the descriptions of the various elements of the environment in Chapters 4 – 17, Chapters 18 and 19 provide a description of Sustainable Development and an Environmental Management Plan. Conclusions and Recommendations are detailed in Chapter 20. See Table 3-1 for a summary of EIS chapter where discussions of various environmental values can be found.

Table 3-1 EIS Chapters where Environmental Values and Management of Impacts are Presented for Elements of the Environment

Elements of the Environment	Chapter of EIS
Description of the Project (includes pre-construction activities; construction phase; methods of dredging; methods associated with disposal of the dredged material; infrastructure requirements including transport, water supply and storage, stormwater drainage, sewerage and energy)	Chapter 2
Environmental Values and Management of Impacts	Chapter 3
Climate and Climate Change	Chapter 4
Land	Chapter 5
Hydrodynamic Modelling	Chapter 6
Coastal Environment (Coastal Processes, Water and Sediment Quality)	Chapter 7
Water Resources (Surface Water and Groundwater)	Chapter 8
Nature Conservation (Marine and Terrestrial Ecology)	Chapter 9
Air Quality, Noise and Vibration	Chapter 10
Transport	Chapter 11
Cultural Heritage	Chapter 12
Social Impact	Chapter 13
Landscape and Visual Character	Chapter 14
Economic Impact	Chapter 15
Health and Safety	Chapter 16
Hazard and Risk	Chapter 17
Sustainable Development	Chapter 18
Environmental Management Plan	Chapter 19
Conclusions and Recommendations	Chapter 20

3.2 Approach to Environmental Risk Assessment

The risk and impact assessment process was used in conducting the assessments and developing management and mitigation strategies for each identified impact in a number of the specialist investigations:

- Marine Ecology and Megafauna;
- Terrestrial Ecology;
- Water Quality;

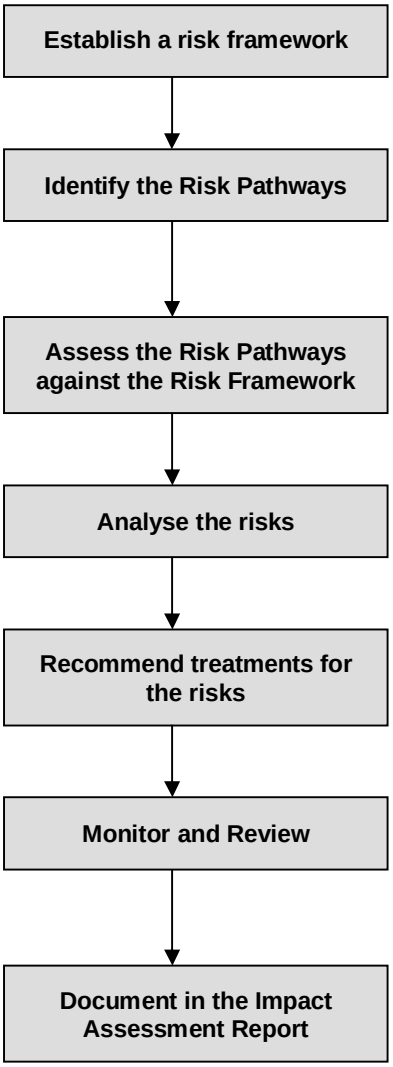
- Sediment Quality; and
- Hazard and Risk.

Other sections of the EIS undertook risk assessments in a slightly different format, tailored to the particular environmental aspect under consideration:

- The Health and Safety assessment undertook a qualitative risk assessment that did not rate the risks according to the GPC risk matrix, but outlined potential impacts and mitigation measures in words. This risk assessment also overlapped with the Hazard and Risk assessment documented in Chapter 17;
- The Social Impact Assessment undertook a risk assessment that considered additional aspects relating to community such as duration, spatial extent, mitigatory potential and acceptability (Chapter 13 and Appendix W); and
- The Visual Impact Assessment undertook an impact assessment that considered the landscape impact, visual sensitivity of a site or impact and the overall significance of the impact (Chapter 14).

The risk assessment process outlined addresses the construction and operational aspects of development of the Project, and was developed to assess the risk posed to the terrestrial and marine environments by activities undertaken as part of the proposed Project.

3.2.1 Overview of the Risk Assessment Process



The risk framework comprises of the likelihood of an impact occurring (Table 3-3), the consequence of the impact (Table 3-2), and the overall risk matrix (Table 3-4)

This is a systematic process of identification of the various risks, as well as any other risks identified by the specialists or in consultation with other specialists.

Table 3-3 (likelihood), Table 3-2 (consequence) and Table 3-4 (risk matrix) are used to assess the risk pathways identified. Raw risks are assessed with standard mitigation and the overall risk (Very Low, Low, Medium, High) determined for each pathway.

Informed decisions about the treatment of the risks and prioritisation of this treatment. E.g. what risks require further mitigation and which risks have a priority for mitigation.

What are the additional (non-standard) mitigation measures?

As more information comes to light through site investigations, significance assessment etc, the risk assessment must be reviewed to ensure it is current with the Project information available.

The risk register is added to the impact assessment to provide a framework for the prioritised management and mitigation measures proposed within the specialist assessment.

Figure 3-1 Overview of the Risk Assessment Process

3.2.2 Objectives of a Risk Assessment

The objective of a risk assessment is to filter the minor acceptable risks from the major non-acceptable risks. It involves consideration of the sources of risk, the consequences and the likelihood that those consequences may occur.

3.2.3 Risk Assessment Methodology

The risk assessment methodology employed for the Western Basin Dredging and Disposal Project was based on the Australian Standard AS/NZS 4360: 1999 *Risk Management* (the Standard), HB 203: 2000 *Environmental Risk Management – Principles and Process* (the Guidelines), and the GPC Environment Procedure for Risk Assessment. The Standard and Guidelines set out a generic framework for establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risks. The Best Practice Environmental Management in Mining, Environmental Risk Assessment (EA, 1999)

also adopts this standard though different definitions have been adopted by EA. The GPC Environment Procedure for Risk Assessment provides a whole of business risk matrix to assist in calculating the level of consequence and likelihood for identified risks.

GPC Environment Procedure for Environmental Risk Assessment

In accordance with the Standard, GPC have developed an Environmental Aspects Procedure and set Risk Levels of relevance to activities undertaken by GPC. This procedure and the associated Risk Levels were used as the basis for the assessment undertaken for this Project and the bands, threshold values and indicative management actions applied to the Project are identified in the following sections. Within these, the environmental threat criteria are pollution focused, reflecting the day to day business needs of GPC. As the Project involves risks to the marine environment beyond pollution, the environmental criteria were adapted to be considerate of general disturbance to the marine environment, not just pollution based events. Further, "Process Interruption" criteria were adapted to reflect ecological systems processes, principally for benthic primary productivity. This criteria was used as a secondary criteria to the environmental criteria to assist in defining consequence scales for identified impacts.

3.2.4 Risk Analysis

Risk analysis may be undertaken to various degrees of refinement depending upon the risk information and data available. Analysis techniques include:

- Qualitative assessment;
- Semi-quantitative assessment; and
- Quantitative assessment.

In practice, a qualitative analysis is often used to first obtain a general indication of the level of risk and then a more quantitative analysis is applied to refine the risk.

A quantitative risk assessment can be undertaken based on statistical analysis for various consequences and probabilities. In the absence of statistical data, an estimate may be made of the degree of the consequence and frequency (refer to Section 4.3 of the Standard).

The risk assessment methodology for this EIS uses a semi-quantitative process for determining risk. The semi-quantitative process estimates the degree of the consequence and probability and assigns a score to each. The assigned scores for consequence and probably are not linearly related to each other or to the level of environmental impact but are weighted descriptors (refer to Section 4.3.4 of the Standard). The risk and impact assessment process used here to assess and weight potential project risks was undertaken using an Environmental Risk and Likely Impact ("ERLI") approach. For each possible impact aspect, two key areas were addressed:

Environmental Risk

This essentially considered the risk of irreversible change to natural ecological processes and community interaction. Assessment addressed:

- Conservation significance of environmental, social and cultural values and regional context of these values;
- Current level of integrity of natural ecosystem processes;
- Known sensitivity of ecosystem processes/natural values to human induced change;

- Natural change and resilience of relevant ecosystem processes/natural values;
- Potential for cumulative social and environmental impacts; and
- Level of scientific certainty of the above factors.

Likely Impact

This considered the likely impact of the Project, as modified and undertaken in accordance with mitigation strategies (including any environmental management plans or conditions from licensing/approval agencies) and includes:

- Geographic extent of the activities;
- Duration of the activities;
- Magnitude of potential environmental change;
- Confidence in prediction of impact;
- Confidence in mitigation strategies to minimise ecological and social risks; and
- Ability to monitor the impacts and detect change before irreversible change to system processes occurs.

The approach considered direct and indirect impacts, short and long term, cumulative, temporary and irreversible, and adverse and beneficial impacts.

The relative importance of each impact was examined to provide context and an ability to justifiably determine the impact's significance. In particular, the duration of the impact (temporary versus permanent) and reversibility were considered. The ability of natural systems (including population, communities and ecosystems) to accept or assimilate impacts was also considered.

The above approach is used to provide the essential information that is used in the formal Risk Assessment as based on the Australian/New Zealand Standard 4360:2004. This methodology is outlined below:

Stage 1: Identification of Risk

This included identification of all relevant risks and addressed all known activities and related environmental aspects of the Project.

Stage 2: Risk Analysis

An important feature is recognition of the fact that an event's consequence extends beyond the immediate impact. This methodology ensures that the full consequences of events are visible to risk owners and managers and that the effects on the project are all understood and treated. Each class of consequence is rated a score of 0 - 5, where "0" is nil consequence to "5" is catastrophic. Definitions and scales for consequences are shown in Table 3-2.

Table 3-2 Threat Criteria and Consequence Scales

Category	Workplace Health & Safety	Environment	Financial Impact on Earnings before Interest and Tax	Community or Customer Reputation	Legal	Process Interruption
1 Minor	Near miss/no injury	On site release of pollutant contained without external assistance	Losses less than $100,000	Isolated complaint	Court action with small fine – less than $10,000	Less than 1 hour
2 Moderate	First Aid Treatment	On site release of pollutants contained with external assistance	Losses of $100,000 to $1 million	Multiple community or customer complaints	Court action with moderate fine - $10,000 to $75,000	1 hour to 1 shift
3 Significant	Medical treatment	Significant on or off site release and detrimental impacts	Losses of $1 million to $2.5 million	Community action with possible delays to project	Court action with significant fine - $75,000 to $250,000	1 shift to 1 day
4 Major	Serious injury/lost time injury	Major offsite release and detrimental impacts	Losses of $2.5 million to $5 million	Community action severely delays project	Court action with major fine - Greater than $250,000	1 day to 1 week
5 Critical	Major extensive injury (permanent disablement) or fatality	EPA ordered shutdown of major part of process	Losses of greater than $5 million	Community or customer outrage prevents projects or results in severe damage to Corporate image which limits future options	Court action with jail sentence	More than 1 week

Source: GPC Environment Procedure for Risk Assessment

An analysis of each risk is undertaken to determine an environmental event's likelihood of occurrence and its consequences. A five-level qualitative description of the likelihood and consequences for each risk enables a semi-quantitative method to be used to calculate a 'score' for each risk. Definitions and scales for Likelihood are shown in Table 3-3.

Table 3-3 Likelihood Rating

Likelihood	Rating	Likelihood Calculator
Rare	1	The risk may occur only in exceptional circumstances (The risk is not likely to occur in the next 25 years)
Unlikely	2	The risk could occur at some time (The risk is likely to occur once in the next 5-25 years)
Possible	3	The risk might occur at some time (This risk is likely to occur in the next 2-5 years)
Likely	4	The risk will probably occur in most circumstances (The risk is likely to occur in 1-2 years)
Almost Certain	5	The risk is expected to occur in most circumstances (The risk is likely to occur within the next 12 months)

Stage 3: Calculation of Risk Level

Two levels of risk are used:

The **Primary Risk Level (PRL)** is a conservative measure of risk, based on the most severe consequences across all the relevant criteria. PRL is calculated according to the equation:

Primary Risk Level (PRL) = Likelihood Rating X Maximum Consequence Rating

The **Secondary Risk Level (SRL)** is a less conservative measure of risk, which incorporates all relevant criteria, not just the most severe ones. SRL is calculated according to the equation:

Secondary Risk Level (SRL) = Likelihood Rating X Average Consequence Rating

In most circumstances, PRL should be the preferred measure, as it is more conservative. Risk scores are banded into risk levels which provide a "plain English" view of the risk. This is known as the risk assessment matrix, and scores will always be visible to enable prioritisation within bands. Table 3-4 shows the risk assessment matrix used, with the bands and their threshold values. Table 3-5 shows the indicative management action as a result of the risk assessment.

Table 3-4 Risk Assessment Matrix

	Consequence				
Likelihood	**Critical (5)**	**Major (4)**	**Significant (3)**	**Moderate (2)**	**Minor (1)**
Almost Certain (5)	High	High	High	Medium	Medium
Likely (4)	High	High	Medium	Medium	Low
Possible (3)	High	Medium	Medium	Low	Low
Unlikely (2)	Medium	Medium	Low	Low	Very Low
Rare (1)	Medium	Low	Low	Very Low	Very Low

Table 3-5 Risk Levels and Management Action (example)

Risk Level (PRL or SRL)	Descriptor	Indicative management action
1-4	Low	Manage by routine procedures, unlikely to need specific application of resources
5-10	Medium	Manage by specific monitoring or response procedures, develop more detailed actions as resources allow
10-16	High	Senior management attention needed and management responsibilities specified for further action
17-25	Extreme	Immediate action required, senior management will be involved

Stage 4: Determination of Options for Treatment of Risks

Following the analysis of a risk, it is necessary to investigate the options available for risk treatment and then determine the option or options that provide the greatest cost benefit.

Risks may be treated in one or a combination of ways[1]:

- Avoiding a risk by preventing the activity that leads to the risk eventuating;
- Reducing the likelihood of the risk eventuating;
- Reducing the consequences if the risk does eventuate;
- Transferring the risk; and
- Retaining the risk.

Limitations

As with any model, the relevance and applicability of the risk model revolves around a number of basic assumptions and limitations. The application of the risk model has been based on subjective ranges of consequences and probabilities.

Considerations for the application of the risk methodology for this study include:

- The assessment is based on the professional judgement of a limited number of experienced GHD staff and does not incorporate the collective experience of all parties involved with the project. Consultation by GHD staff with key stakeholders including DERM (C. Limpus) and DEEDI (L. Johns and R. Coles) was, however, undertaken prior to completion of an in-house cross-discipline risk assessment workshop. Issues and concerns raised by various stakeholders were represented as raised within the workshop forum and taken into consideration in developing an understanding of the Project risks and mitigation measures; and
- The assessment has been limited to a selected number of primary risks and the assessment of cumulative risk to the environment from multiple pollution sources or sources of environmental degradation has not been addressed. Cumulative risks are approached for this study in a qualitative manner only.

[1] After AS/NZS 4360:2004

Although a semi-quantitative methodology was used to conduct the risk assessment, the resultant risk estimation is purely relative. The risk estimations do not imply an absolute scale of risk that can be applied to any other situation or assessment.