



CHAPTER 9

RISK AND IMPACT DEFINITION



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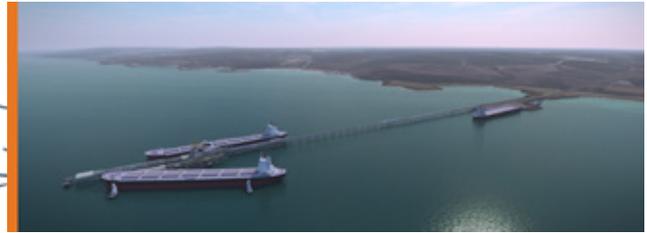
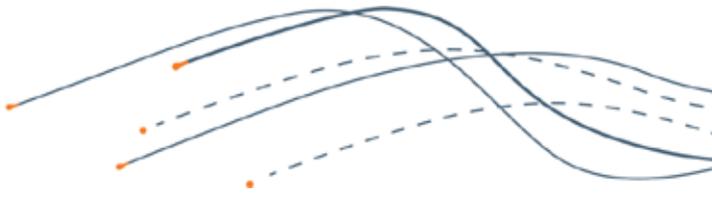
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9 Risk and Impact Definition

This chapter describes the Environmental Impact Assessment (EIA) methodology that was adopted for the CEIP Infrastructure. For the purposes of the EIA under the *Development Act 1993*, 'environmental impact' includes the possible positive or negative environmental (biological and physical), social and economic effects associated with a proposed development. To determine the actual and potential effects of the project, the EIA considers the controls and mitigation measures established to restrict negative environmental, social and economic effects. The Development Assessment Commission has prepared *Guidelines for the Preparation of an Environmental Impact Statement for the Cape Hardy deep sea port, infrastructure corridor and long term employee village* (the Guidelines) which were issued on 13 November 2014 (refer to Appendix C).

The EIA for the CEIP Infrastructure has been undertaken in accordance with the Guidelines to enable the Governor to consider both the ensuing environmental impacts as well as potential environmental risks when deciding whether to grant approval. It has been undertaken as a two-step process:

1. Impacts which are considered likely or certain to occur as a result of normal construction and operation of the CEIP Infrastructure have been considered via an Impact Assessment.
2. Potential adverse effects on the environment that may occur as a result of unplanned or unexpected events have been considered via a Risk Assessment.

An overview of these processes is shown in Figure 9-1.

The EIA methodology used the source, pathway and receptor approach in considering actual and potential effects. This approach requires a source, a receptor and a pathway linking the two to be present in order for an impact or risk to exist. In this assessment:

- Source is the origin of the contaminant or agent that is capable of causing harm, e.g. fine dust particles from blasting.
- Pathway describes the means or route by which a receptor can be exposed to, or be affected by, the contaminant/agent from the identified source, e.g. wind.
- Receptor is an entity or environmental value which is vulnerable to the adverse effects of the contaminant/agent (e.g. surrounding residents, buildings, flora or fauna, groundwater, surface water or marine environment).

Where a link between source, pathway and receptor was confirmed, the credible consequences or level of impact was determined.

In undertaking the EIA, the following definitions have been adopted:

- **Environmental Values:** Qualities of the natural, social or economic environment that require protection from the effects (both real and potential) of development activities under legislation, government policy or to respond to community and stakeholder expectations.
- **Environmental Aspect:** Elements of the project that interact with the environment, including land disturbance, discharges to land, atmospheric emissions, releases to water, resource use, waste generation, energy generation and alteration to amenity.
- **Environmental Impact:** Any change, positive or negative, to natural, community and economic values which are expected as part of normal operation of the project.
- **Residual Impact:** The negative environmental, social or economic change predicted to remain after design and management measures have been incorporated into the project.

- **Residual Benefit:** The positive environmental, social or economic change predicted to occur as a result of the project and associated design and management measures.
- **Environmental Risk:** Potential for adverse effects to environmental, community and economic values to occur from unexpected or unplanned events associated with the project. Unexpected or unplanned events include failure of environmental controls, measured impacts being greater than predicted impacts and natural disasters or unpredictable events such as bushfire.
- **Residual Environmental Risk:** The environmental risk predicted to remain after design and management measures have been incorporated into the project to reduce either the likelihood of the risk eventuating or the consequence associated with the risk event.
- **As Low As Reasonably Practicable (ALARP):** An impact or risk is considered to be ALARP if the cost of any additional practicable measure to reduce the impact or risk can be shown to be grossly disproportionate to the benefit gained. The criterion is reasonably practicable, not reasonably affordable: justifiable cost and effort is not determined by the budget constraints/viability of a project (NOPSEMA 2014).

9.1 Impact Assessment

The impact assessment process recognises that, even with controls in place, normal or planned construction and operation of the CEIP Infrastructure will result in changes to environmental, community and economic values. These changes may be positive (benefits) or negative (impacts). The aim of the impact assessment was to identify the residual impacts and benefits associated with the CEIP Infrastructure and to categorise the residual impact or benefit in terms of the level of change to the environment. The key assumption for the impact assessment is that the identified changes will occur as a result of the project. As required by the Guidelines, the impact assessment has detailed the expected environmental, social and economic effects associated with the project.

The identified impacts and benefits were categorised as being negligible, low, medium or high. Criteria were developed to standardise the assessment and categorisation of impacts and benefits for the project (see Table 9-1).

The factors relevant to developing the project impact criteria included legislative criteria, the duration and frequency of the impact, the nature of the affected receiver and the geographic scale of the impact. Due to the nature of economic and social issues and the potential for changes to be effected more broadly on a regional scale than other project impacts, the criteria for categorising the residual project impacts and benefits were tailored for the purpose of the Economic (Chapter 21) and Social (Chapter 22) Impact Assessments. These impact criteria are presented in Table 9-2.

The impact assessment has focused on the major issues associated with the project, being those impacts identified as either medium or high. Residual impacts categorised as 'negligible' or 'low' were considered to be as low as reasonably practicable and do not warrant specific control measures, other than standard environmental management measures. Consequently, they were not considered further in the impact assessment. Where identified, benefits associated with construction and operation of the project have also been identified and described, as required by the Guidelines.

Table 9-1 General Criteria for Categorising Residual Project Impacts and Benefits

Category	Impacts		Benefits
	Legislative Criteria Exist	Legislative Criteria Do Not Exist	
Negligible	A negative change below detectable limits.	A negative change below detectable limits. OR No change to environmental value(s) ³ .	A positive change below detectable limits.
Low	Detectable negative change that is within regulatory limits/standards.	A short-term (<3 years) negative change affecting receivers located within the CEIP Infrastructure area ² boundary (local receiver) only. OR A long-term (>3 years) negative change with insignificant but detectable change.	A short-term (<3 years) positive change experienced within the CEIP Infrastructure area ² only. OR A long-term (>3 years) positive change with insignificant but detectable change.
Medium	A periodic and temporary non-compliance of a regulatory limit/standard ¹	A long-term (>3 years) negative change affecting receivers located within the CEIP Infrastructure area ² boundary (local receiver) only. OR A short-term (<3 years) negative change affecting receivers outside of ⁴ the CEIP Infrastructure area ² boundary, but not regionally.	A long-term (>3 years) positive change experienced within the CEIP Infrastructure area ² only. OR A short-term (<3 years) positive change experienced outside of ⁴ the CEIP Infrastructure area ² boundary (local receiver), but not regionally.
High	A regular or consistent non-compliance.	A negative change affecting regional receivers (Eyre Peninsula), state-wide receivers or environmental value(s) ³ .	A positive change experienced by the region (Eyre Peninsula), the state or by environmental value(s) ³ .

¹ 'Periodic and temporary impact' is defined as a daily exceedance of a specified limit occurring no more than once every two weeks.

² 'CEIP Infrastructure area' is defined as the proposed port site boundary, marine environment within immediate proximity to the proposed offshore infrastructure, and infrastructure corridor.

³ 'Environmental value' is a specific element of the environment that is afforded protection under legislation, including through licensing and permitting (e.g. listed species, native vegetation, groundwater abstraction, level of service for roads).

⁴ 'Outside of the CEIP Infrastructure area but not regionally' is considered to be receiving environments within 5 km of the project area.

Table 9-2 Criteria for Categorising Residual Project Impacts and Benefits for Economic and Social Issues

Category	Impacts	Benefits
Negligible	A negative change below detectable limits.	A positive change below detectable limits.
Low	A short-term (<3 years) negative change affecting receivers located within the local study area ¹ only.	A short-term (<3 years) positive change experienced within the local study area only.
Medium	A long-term (>3 years) negative change affecting receivers located within the local study area ¹ only. OR A short-term (<3 years) negative change affecting the regional study area ² or state-wide receivers.	A long-term (>3 years) positive change experienced within the within the local study area ¹ only. OR A short-term (<3 years) positive change experienced by the regional study area ² or state-wide receivers.
High	A long-term (>3 years) negative change affecting the regional study area ² or state-wide receivers.	A long-term (>3 years) positive change experienced by the regional study area ² or state-wide receivers.

¹ The local study area¹ is defined in the economic impact assessment and social impact assessments, Chapters 21 and 22 respectively.

² The regional study area² is defined in the economic impact assessment and social impact assessments, Chapters 21 and 22 respectively.

The impact assessment was an iterative process. For the purposes of this impact assessment, residual impacts categorised as 'negligible' or 'low' were considered to be as low as reasonably practicable (ALARP) and do not warrant specific control measures, other than standard environmental management measures. Consequently, they were not considered further in the impact assessment. 'Medium' and 'High' residual impacts required review and modification or redesign of the planned project activity and/or control measures in order to reduce the impact to ALARP.

The following steps define the impact assessment process:

1. **Define normal project activities and design elements:** What activities will be undertaken, when they will occur, how they will be executed.
2. **Identify environmental aspects associated with project activities:** What interactions with the environment will result from normal project activities.
3. **Define the design and management measures:** Identify the design and operational measures that will be incorporated into project design, construction and operation to minimise impacts on the environment.
4. **Undertake studies to measure the change to natural, social and economic values:** To determine the predicted residual impact or benefit, the studies took into account the identified control measures. Technical studies included baseline surveys, development of conceptual models, development of numerical models and desktop assessment. Where there was uncertainty around the level of impact, a range of credible impacts have been presented. Methods for dealing with uncertainty include describing the range of expected impacts and sensitivity testing of model inputs.
5. **Categorise the level of change:** The level of predicted change was determined with reference to the criteria for categorising residual project impacts and benefits (Table 9-1 and Table 9-2). Where legislative criteria exist, the predicted performance of the project versus these criteria takes precedence.

6. **Assess whether the impact is ALARP:** For the purposes of this assessment, impacts categorised as 'negligible' or 'low' were considered to be ALARP. 'Medium' and 'High' impacts required review to confirm whether impacts were ALARP. If impacts were not found to be ALARP, changes were implemented to the project to reduce the impact to ALARP. Impacts were required to meet legislative criteria in order to be considered ALARP. Reduction of impact level was achieved through consideration of alternative design measures or management controls. The level and categorisation of impact was then reassessed (Steps 4 and 5 were repeated). All benefits were considered acceptable, however, opportunities to enhance benefits were also considered.

In order to keep residual impacts ALARP, a robust implementation mechanism is required to support continuous environmental improvement. The Environmental Management Plan Framework presented in Chapter 24 provides the governance approach for ongoing management of both impacts and risks.

The impact assessment included the following:

- An impact assessment register was developed to define the project activities, aspects, impacts (source, pathway and receptor) and summarise relevant control measures.
- Preliminary impact categories were assigned to each impact in the register based on the EIS team's experience and knowledge with similar projects.
- The preliminary impact register was presented to Government agencies as a tool for discussing and identifying priority technical studies. It also provided an opportunity for potential gaps in the assessment to be identified.
- The impact register was further informed through community discussions, comments and feedback (refer to Chapter 6).
- Technical studies were subsequently undertaken to assess the environmental impact of the project. The outcomes of the technical studies are presented in Chapters 10-23.
- The impact assessment register was updated with residual impact levels, based on the outcomes of the technical studies.

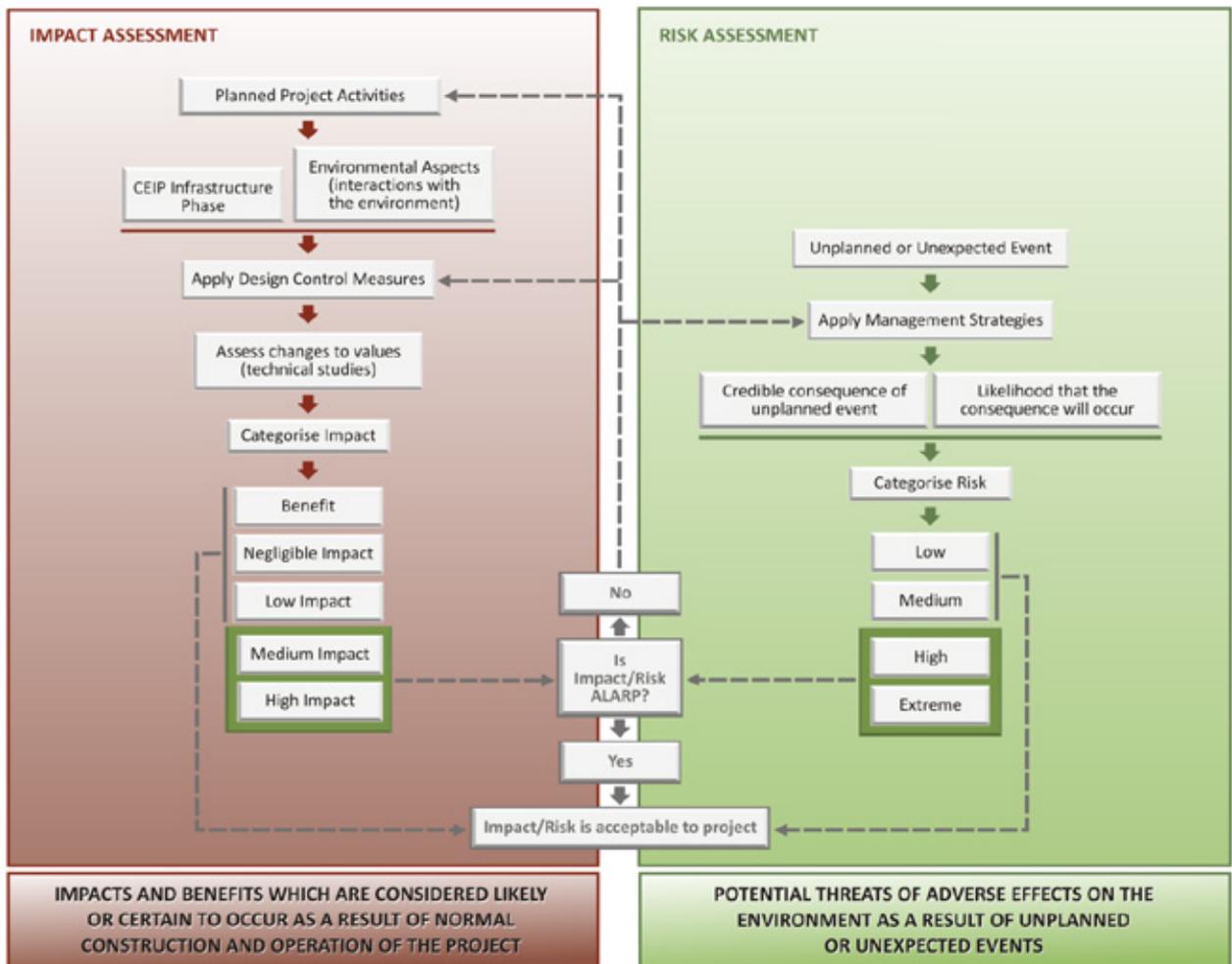


Figure 9-1 Overview of Environmental Impact Assessment Methodology

9.2 Risk Assessment

Faults, failures and unplanned events may occur with the potential to cause environmental impact despite best efforts to avoid or mitigate impacts. The EIA process has accounted for the possibility of such events occurring via an environmental risk assessment. A key distinction from the impact assessment process is that the identified risks may or may not eventuate.

The risk assessment process integrates approaches from the following sources:

- AS 31000: 2009 Risk Management – Principles and Guidelines
- HB 203: 2012 Managing Environment Related Risk
- Arup (2008) BHP Billiton Olympic Dam Development Study Risk Assessment

The following definitions were adopted for the risk assessment:

- **Event:** Occurrence or change of a particular set of circumstances. An event can have one or more occurrences, and can have multiple causes. An event may not have a physical consequence. An event may consist of something not happening.
- **Consequence:** Outcome of an event that affects social, economic or environmental values.
- **Likelihood:** The chance of an event occurring resulting in the identified outcome (the consequence).
- **Residual risk:** Remaining risk after treatment.

The following steps define the risk assessment process:

- **Identify unplanned or unexpected events:** What could reasonably cause a change to predicted operations and impacts? What can happen if circumstances change? Considerations include:
 - Potential for failure or ineffectiveness of impact control measures.
 - Potential that predicted impacts do not reflect actual or measured impacts.
 - Potential that impacts could arise that are additional to those predicted by the impact assessment.
 - Identification of hazards (sources of potential harm).
- **Develop an understanding of the risks and controls in place:**
 - *Environmental Controls:* Develop an understanding of the controls in place.
 - *Credible consequences:* Determine the credible range of consequences in the context of the existing controls. A consequence rating was applied for each risk item (Table 9-4).
 - *Likelihood:* What is the likelihood of those consequences arising? A likelihood rating was applied for each risk item (Table 9-6).
- **Categorise risk:** Consequence and likelihood were combined to produce an estimated level of risk (Table 9-3).
- **Assess whether the risk is ALARP:** For the purposes of this risk assessment, risks categorised as 'low' or 'medium' were considered to be ALARP. 'High' and 'extreme' risks required review to confirm that they were ALARP.

In order to keep residual risks ALARP, a robust implementation mechanism is required to support continuous environmental improvement. The Environmental Management Plan Framework presented in Chapter 24 provides the governance approach for ongoing management of both impacts and risks. Implementation mechanisms included in the framework include management plans, monitoring programmes with triggers for adaptive management, auditing and review.

The risk criteria developed for the project to standardise the assessment and categorisation of risks are presented in Table 9-3 to Table 9-6.

Table 9-3 Risk Matrix

			Consequences				
			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	A	Almost certain	Low	Medium	High	Extreme	Extreme
	B	Likely	Low	Medium	High	Extreme	Extreme
	C	Possible	Low	Low	Medium	High	Extreme
	D	Unlikely	Low	Low	Medium	High	High
	E	Rare	Low	Low	Low	Medium	High

Table 9-4 Criteria for Categorising Consequence

Category	Level	Injury and/or Fatality	Air Quality and Noise	Cultural	Social	Contamination	Recharge
Insignificant	1	No injury to the public.	Insignificant effect.	No impact to items of cultural significance.	No impact or minor social impacts on local population. Mostly reparable.	Insignificant effect.	Insignificant effect.
Minor	2	Moderate level of injuries to the public requiring off-site (doctor) medical treatment	Local short-term and minor exceedance of air quality or noise standard.	Damage to items of cultural significance.	Ongoing social issues. Minor reparable/reversible damage to landholder property/structures.	Local contamination that can be immediately remediated.	Local minor change in recharge patterns within sub-catchments.
Moderate	3	Significant level of injuries requiring hospitalisation.	Local minor long-term exceedance of air quality or noise standard. Widespread minor short-term exceedance of air quality or noise standard. Local major short-term exceedance of air quality or noise standard.	Significant damage to items of cultural significance.	Ongoing serious social issues. Significant damage to local landholder property/structures reparable/reversible in the short term.	Local contamination that can be remediated in the long term.	Local major changes in recharge patterns within sub-catchments.
Major	4	Irreversible disability or impairment or serious injuries requiring long-term hospitalisation to one or more people. Single fatality.	Widespread (regional) major short-term exceedance of air quality or noise standard. Regional long-term exceedance of air quality or noise standard.	Irreparable damage to items of cultural significance.	Very serious wide spread social impacts. Significant damage to local landholder property/structures reparable/reversible in the long term.	Local contamination that cannot be remediated in the long term. Widespread contamination that can be remediated in the long term.	Widespread major changes in recharge patterns within sub-catchments. Minor changes in regional recharge patterns.
Catastrophic	5	Several fatalities.		Irreparable damage to highly valued items of great cultural significance.	Complete breakdown of social order.	Widespread contamination that cannot be remediated.	Regional major changes in recharge patterns.

Table 9-5 Criteria for Categorising Consequence

Category	Level	Effect on Behaviour of Listed Fauna	Effect on Viability of Listed Flora and Fauna Species	Effect on Behaviour and Viability of Fauna (non-listed)	Effect on Flora Community	Habitat	Ground, Surface and Marine Water Quality
Insignificant	1	Insignificant effect.	Insignificant effect.	Local short-term behavioural effect.	Local short-term decrease in abundance of some species without reduction in local community viability.	Insignificant effect.	Minimal change with no significant loss of quality.
Minor	2	Local short-term behavioural effect.	Local short-term decrease in abundance with no lasting effects on local population.	Local long-term behavioural effect that does not unduly affect the ecology of the population and/or local long-term decrease in abundance without reduction in local population viability.	Local long-term decrease in abundance of some species resulting in little or no change to community structure.	Disturbance of well-represented landforms/habitats.	Local minor short-term reduction or change in quality.
Moderate	3	Local long-term behavioural effect with no significant effects on the ecology of the species.	Local long-term decrease in abundance without reduction in local population viability.	Local long-term behavioural impact that significantly affects the ecology of the population and/or regional long-term decrease in abundance and/or local reduction or loss of population viability.	Regional long-term decrease in abundance of some species and/or local loss of some species diversity resulting in some change to the community structure.	Local loss of well-represented landforms/habitats.	Local minor long-term or widespread short-term, or local major short-term reduction or change in water quality.
Major	4	Local long-term behavioural effect that significantly affects the ecology of the species.	Regional long-term decrease in abundance and/or local loss resulting in reduction in regional viability.	Local long-term behavioural impact that significantly affects the ecology of the species and/or regional reduction or loss of population viability.	Regional long-term decrease in abundance of numerous species and /or some loss of species diversity resulting in significant changes to community structure.	Local loss of a unique or critical landforms/habitat.	Widespread (regional) major short-term reduction or change in quality.
Catastrophic	5	Regional extinction of the species.	Regional extinction of the species.	Regional extinction of the species.	Regional long-term loss of numerous species resulting in dominance of only a few species.	Regional loss of unique or critical landforms/habitats.	Regional long-term reduction or change in water quality.

Table 9-6 Criteria for Categorising Likelihood

Descriptor	Level	General Description	Chance p.a.	Frequency
Almost certain	A	This event is expected to occur in most circumstances Expected to occur at least once each year	>90%	1/year
Likely	B	This event may occur in some given circumstances May occur during any given year	20%	1/5 years
Possible	C	This event might occur at some time during the project life Not likely to occur in any given year, but is possible	5%	1/25 years
Unlikely	D	This event could occur at some time Very unlikely to occur in any given year	1%	1/100 years
Rare	E	This event may only occur in very exceptional circumstances Examples of this have occurred historically, but is not anticipated	<1%	<1/100 years

Notes:

The intention is to describe the probability or frequency of an event on an annualised basis such that the impacts or exposure (risks) faced by society and the environment are recorded as those present during any given year of the life of the project, including the construction phase.

The risk assessment was undertaken following the impact assessment and documented as follows:

- An initial register was developed identifying potential risk events based on the identified impacts and experience.
- The risk register was refined based on possible events and hazards identified through the completion of the technical studies and from issues raised throughout the consultation process (refer to Chapter 6 – Stakeholder Engagement).
- A likelihood and consequence was assigned to each event to determine the risk level.
- Where risk events were identified not to be ALARP, risk control options were investigated or changes made to the project design to reduce/eliminate risk.
- The risk assessment register was updated with residual risk levels, based on agreed risk control measures.
- The risk control options adopted for the project have been documented in the EIA (Chapters 10 to 23) and summarised in the Environmental Management Framework (Chapter 24).