# **Appendix D**
# Risk Assessment

Prepared for
Department of Chief Minister and Cabinet
ABN: 18 108 001 191 23

AECOM

# Risk Assessment

21-Oct-2021
Darwin Ship Lift Project

# Risk Assessment

Client: Department of Chief Minister and Cabinet

ABN: 18 108 001 191 23

Prepared by

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| | | | | |

# Appendix D – Risk Assessment

## D.1 Introduction

This semi-quantitative risk assessment methodology was selected for the Project because it enables assessment (on a relatively consistent basis) of risks associated with social, environmental, and economic issues and events. Complex systems involving feedback mechanisms and multi-faceted inter-relationships were incorporated into the interactive risk assessment process through the use of a team of subject matter specialists, considered experts in their respective fields. In general terms, the method is a cyclical process based on the ISO/Australia and New Zealand Standard for Risk Management (ISO 31000:2009) framework, as presented in Figure D-1.

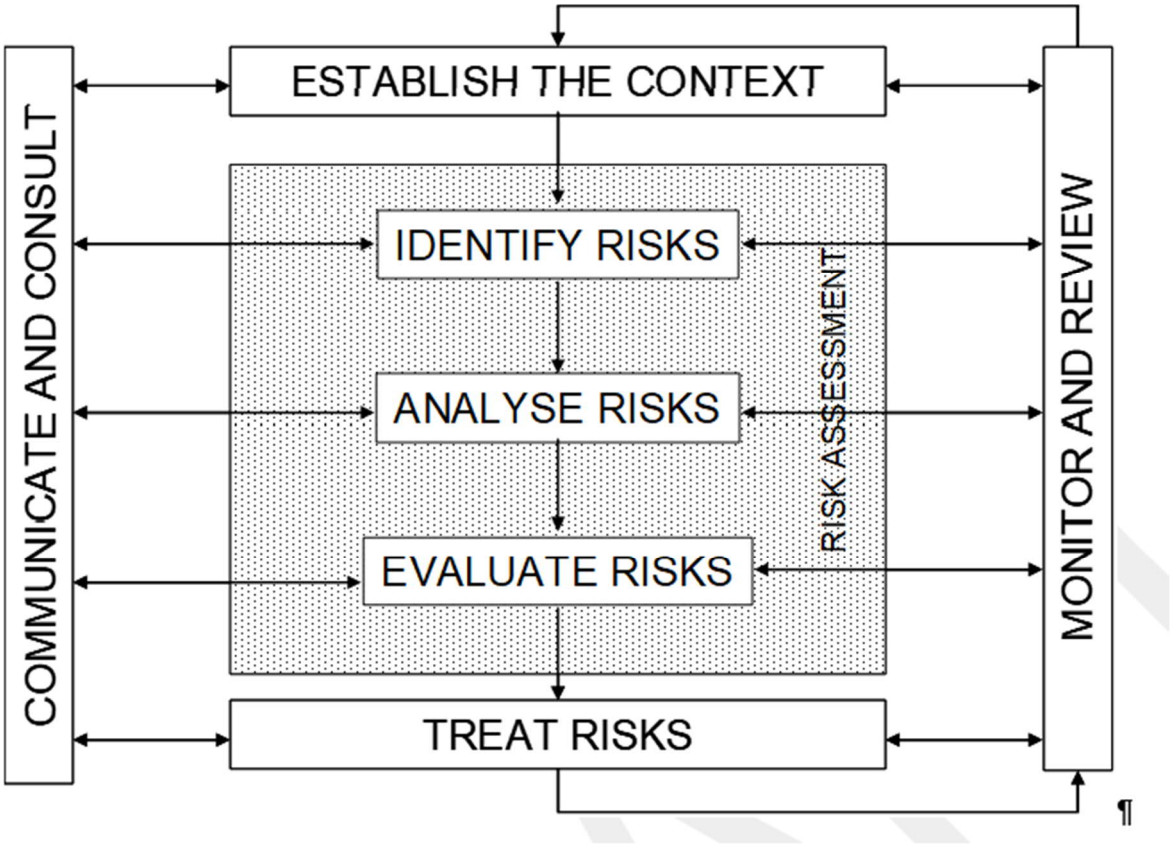


**Figure D-1 Overview of ISO 31000 risk assessment and management program**

## D-2 Risk Quotient

Risk is identified as a condition resulting from the likelihood of an event occurring and the magnitude of its consequences. Both likelihood and consequence can be measured in several ways using different techniques, depending on the aims of the risk assessment and the nature of the risk issue. For the purposes of this study, risks were assessed in quantitative terms and a “risk” was defined by a risk “quotient”, which is:

**Risk Quotient = Likelihood x Consequence**

Likelihood and consequence criteria are presented in Tables D-1 and D-2 respectively. Descriptors for environmental, social, economic and public health and safety consequence criteria are presented in Table D-3. The resulting risk matrix that determines the risk quotient is presented in Table D-4.

**Table D-1 Likelihood criteria**

| | | |
|---|---|---|
| Likelihood | Almost Certain | Several incidents of a similar nature has occurred here. |
| | Likely | A previous incident of a similar nature has occurred here. |
| | Possible | Could have occurred already without intervention. |
| | Unlikely | Recorded recently elsewhere. |
| | Very Unlikely | It has happened elsewhere. |

**Table D-2 Consequence criteria**

| | | |
|---|---|---|
| Consequence | Extreme | As per consequence descriptor table. |
| | Major | As per consequence descriptor table. |
| | Moderate | As per consequence descriptor table. |
| | Minor | As per consequence descriptor table. |
| | Negligible | As per consequence descriptor table. |

**Table D-3 Consequence descriptors**

| CONSEQUENCE LEVEL | | Negligible | Minor | Moderate | Major | Extreme |
|---|---|---|---|---|---|---|
| **PROPERTY / INFRASTRUCTURE** | Cost to repair / replace (and lost revenues) | Approximate range from $0 to $0.1 million. | Approximate range from $0.1 to $1 million. | Approximate range from $1 to $10 million. | Approximate range from $10 to $100 million. | Approximate range $100 million to more than $1 billion. |
| **ENVIRONMENTAL** | Ecosystem Function (need to consider resilience and resistance) | Alteration or disturbance to ecosystem within natural variability. Ecosystem interactions may have changed but it is unlikely that there would be any detectable change outside natural variation / occurrence. | Measurable changes to the ecosystem components without a major change in function (no loss of components or introduction of new species that affects ecosystem function). Recovery in less than 1 year. | Measurable changes to the ecosystem components without a major change in function (no loss of components or introduction of new species that affects ecosystem function). Recovery in 1 to 2 years following completion of Project construction. | Measurable changes to the ecosystem components with a major change in function. Recovery (ie within historic natural variability) in 3 to 10 years following completion of Project construction. | Long term and possibly irreversible damage to one or more ecosystem function. Recovery, if at all, greater than 10 years following completion of Project construction. |
| **ENVIRONMENTAL** | Habitat, communities and / or assemblages | Alteration or disturbance to habitat within natural variability. Less than 1% of the area of habitat affected or removed. | 1 to 5% of the area of habitat affected in a major way or removed. Reestablishment in less than 1 year (relative to component seasonality) following completion of Project construction. | 5 to 30% of the area of habitat affected in a major way or removed. Reestablishment in 1 to 2 years following completion of Project construction. | 30 to 90% of the area of habitat affected in a major way or removed. Reestablishment in 3 to 10 years following completion of Project construction. | Greater than 90% of the area of habitat affected in a major way or removed. Reestablishment, if at all, greater than 10 years following completion of Project construction. |
| **ENVIRONMENTAL** | Species and / or groups of species (including protected species) | Population size or behaviour may have changed but it is unlikely that there would be any detectable change outside natural variation / occurrence. | Detectable change to population size and / or behaviour, with no detectable impact on population viability (recruitment, breeding, recovery) or dynamics. Recovery in less than 1 year (relative to species lifecycle) following completion of Project construction. | Detectable change to population size and / or behaviour, with no impact on population viability (recruitment, breeding, recovery) or dynamics. Recovery in 1 to 2 years following completion of Project construction. | Detectable change to population size and / or behaviour, with an impact on population viability and or dynamics. Recovery (ie within historic natural variability) in 3 to 10 years following completion of Project construction. | Local extinctions are imminent / immediate or population no longer viable. Recovery, if at all, greater than 10 years following completion of Project construction. |
| **CULTURAL HERITAGE** | Non-Aboriginal Heritage | No measurable alterations to existing natural and human processes already impacting on heritage sites. | Detectable impact to State or Commonwealth significant site with heritage values remaining largely intact.<br>OR<br>Partial reduction in heritage value intrinsic to non-State/Commonwealth significant site. | Partial reduction in heritage value intrinsic to State or Commonwealth significant site.<br>OR<br>Substantial reduction in heritage value intrinsic to non-State/Commonwealth significant site. | Substantial reduction in heritage value intrinsic to State or Commonwealth significant site.<br>OR<br>Complete loss of heritage value intrinsic to non-State/Commonwealth significant site. | Complete loss of heritage value intrinsic to State or Commonwealth significant site. |
| **CULTURAL HERITAGE** | Aboriginal Heritage | No measurable change in existing natural and human processes impacting on Aboriginal heritage sites. | Partial and localised impact on one or more Aboriginal heritage sites. | Substantial damage / destruction / removal of a single site. | Complete destruction / removal of multiple sites in a localised area. | Complete destruction / removal of sites across multiple areas. |
| **SOCIAL*** | Amenity - Recreation | Short term interruptions in recreational use (say 1 to 2 days). | Activities restricted in a localised area for short-term periods (months). | Restriction on whole or parts of communities to pursue personal recreational pursuits when visiting the area during construction period. No impact post construction period. | Long term inability for whole communities to pursue personal recreational pursuits when visiting the area post construction period (ie. > 2 yrs). | Long-term inability for the general community to pursue personal recreational pursuits when visiting the area post-construction period for more than 10 years. |
| **SOCIAL*** | Amenity - Sensory / Perception (visual, noise, odour). | Short term impacts that alter perception of area as a high amenity place to live / visit. Region still seen as attractive place to live. | Short term (months) localised impacts that alter perception of area as a high amenity place to live / visit. Region not locally seen as attractive place to live. | Medium term (1-2 years) impacts that alter perception of area as a high amenity place to live / visit. Region not widely seen as attractive place to live. | Community perception that the area is significantly impacted. Area loses appeal as residential area. Recovery > 2 years. | Community perception that the area is significantly impacted as a residential location and a recreational area and is a place to be avoided. Recovery, if at all, >10 years. |
| **ECONOMIC*** | Tourism | Limited and short-term reduction in tourist visitation. Limited impacts localised and not area wide. No significant impact on tourism | Short term reduction in tourism use. Recovery in less than 1 year. | Substantial reduction in tourism use. Recovery in 2-10 years. | Permanent reduction in visitation with changes in character of visitors. Impact area wide. Business viability compromised across wide range of sectors with substantial business failure in both direct | Permanent loss of icon tourism assets of national significance. Significant flow on affects to supporting businesses. |

| CONSEQUENCE LEVEL | | Negligible | Minor | Moderate | Major | Extreme |
|---|---|---|---|---|---|---|
| | | businesses. Region still seen as attractive place to visit. | | | and flow on sectors. Impact noticed on region. | |
| **ECONOMIC*** | Shipping/Mining/Other industries (East Arm specific) | Disruption is of negligible consequence. Disruption for 1-2 hours. | Disruptions to other businesses for a day | Other businesses need to close for 2 days, or significant ongoing unexpected interruptions to other business. | Other businesses closed for 2-6 days. | Other businesses impacted for more than a week. Closure of shipping channel to all vessels. Infrastructure loss has extreme consequences. Shipping channel is not able to be opened for more than 1 week. |
| **ECONOMIC*** | Delayed project benefits | Project delayed by <1 month | Project delayed by 1-3 months | Project delayed by 3- 6 months. | Project delayed by 6months - 1 year. | Project delayed by more than 1 year. |
| **PUBLIC HEALTH AND SAFETY** | Minor injury / illness | Minor injury or illness to less than 10 individuals. | Minor injury or illness to between 10 and 100 individuals. | Minor injury or illness to between 100 and 1000 individuals. | N/A | N/A |
| **PUBLIC HEALTH AND SAFETY** | Major injury / illness | N/A | Major injury or illness to 1 individual. | Major injury or illness to between 1 and 10 individuals. | Major injury or illness to between 10 and 100 individuals. | Major injury or illness to between 100 and 1000 individuals. |
| **PUBLIC HEALTH AND SAFETY** | Fatality / serious injury, disability | N/A | N/A | 1 fatality or serious injury | Between 1 and 10 fatalities or serious injuries | Greater than 10 fatalities / serious injuries |

*****This table was used to inform consequences during the initial risk assessment. Following the risk review process, a social and economic subject matter expert was engaged to assess the potential risks posed by the Project. The risk assessment methodologies used by these studies can be found in Appendix C: Social Impact Assessment.

**Table D-4 Risk rating matrix**

| Risk Assessment Matrix | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | Extreme | Major | Moderate | Minor | Negligible |
| Likelihood | Almost Certain | Very High | Very High | High | Medium | Low |
| | Likely | Very High | High | Medium | Medium | Low |
| | Possible | Very High | High | Medium | Low | Low |
| | Unlikely | High | Medium | Low | Low | Low |
| | Very Unlikely | High | Medium | Low | Low | Low |

The risk assessment initially considered Project impacts in the absence of mitigation measures. Specific mitigation measures for adverse impacts were then considered and the assessment process was repeated to predict residual impacts (with the mitigation in place) to produce a draft risk register. Subject matter specialists reviewed and updated the draft risk assessment register and scoring as technical studies and stakeholder consultations were completed, and the Project design and management measures were refined. Separate risk assessments were conducted for social and economic studies to further assess the potential risks posed by the Project. The methodology of these assessments can be found in Appendix C: Social Impact Assessment. An iterative approach was taken to ensure that the mitigation and management measures were appropriate to achieve an acceptable level of residual risk. Mitigation measures are presented in the environmental factor chapters (Chapters 7 to 11) and Chapter 13: Environmental Management Framework and summarised in the risk register below.

The process for assessment of impacts and risk and application of mitigation measures is summarised in Figure D-1.

## Table D-5 EIS Risk Register*

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Marine environmental quality | Construction | Dredging and spoil disposal - liberation of sediments into water column | Likely | Moderate | Medium | A Dredging and Dredge Spoil Placement Management Plan (DDSPMP) will be developed that incorporates mitigation and management to minimise the impacts of suspended sediments on benthic communities.<br>Modelling and assessments to support this EIS. | Unlikely | Moderate | Low |
| Marine environmental quality | Construction | Disturbance of ASS - Potential to generate acidic and metal drainage/runoff | Likely | Moderate | Medium | A Construction Environmental Management Plan (CEMP) which includes:<br>• Acid sulfate soil (ASS) Management Plan<br>• unexpected finds protocol<br>• Erosion Sediment Control Plan (ESCP)<br>• suitable methodologies to minimise mud waving. | Unlikely | Moderate | Low |
| Marine environmental quality | Construction | Earthworks - Discharge of sediment and associated contaminants from exposed soil during earthworks/construction phase | Almost certain | Moderate | High | Construction methodologies.<br>Soil contamination investigations prior to EIS (Appendix N).<br>A CEMP which includes:<br>• ASS Management Plan<br>• unexpected finds protocol<br>• ESCP.<br>DDSPMP.<br>Use of silt curtains during reclamation activities. | Unlikely | Moderate | Low |
| Marine environmental quality | Construction and Operation | Reportable spills (hydrocarbons, chemicals, metals, paints etc) into marine environment | Almost certain | Moderate | High | Engaging with Port of Darwin regarding the Port Environmental Protection Plan.<br>Marine Spill Response Plan in line with the Darwin Port Oil Spill Contingency Plan (OSCP) and (DIPL Marine) OSCP.<br>Compliance with AS1940-2004 (Storage and handling of flammable and combustible liquids).<br>Refuelling management plan.<br>Spill kits located on site and appropriate personnel trained in their use. | Unlikely | Moderate | Low |
| Marine environmental quality | Operation | Discharge of contaminants (stormwater) | Almost certain | Moderate | High | Stormwater and wastewater system maintenance.<br>OEMP to include mitigation to reduce build-up of contaminants on hardstand areas. | Unlikely | Moderate | Low |
| Marine flora and fauna | Construction | Dredging and Reclamation - Habitat modification | Very unlikely | Negligible | Low | DDSPMP, including monitoring and reactive management protocols.<br>Modelling and assessments undertaken and included in EIS. | Very unlikely | Negligible | Low |

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Marine flora and fauna | Construction | Dredging and Reclamation - Liberation of sediments into water column (turbid plumes) | Likely | Moderate | Medium | DDSPMP, including monitoring and reactive management protocols.<br>Modelling and assessments undertaken and included in EIS. | Unlikely | Moderate | Low |
| Marine flora and fauna | Construction | Dredging and Reclamation - Deposition of liberated sediments (sedimentation) | Likely | Moderate | Medium | DDSPMP, including monitoring and reactive management protocols.<br>Modelling and assessments undertaken and included in EIS Modelling and assessments undertaken and included in EIS. | Unlikely | Moderate | Low |
| Marine flora and fauna | Construction | Dredging and Reclamation - Changes in hydrodynamic and wave conditions (erosion and accretion) | Unlikely | Minor | Low | DDSPMP, including monitoring and reactive management protocols.<br>Modelling and assessments undertaken and included in EIS. | Unlikely | Minor | Low |
| Marine flora and fauna | Construction | Dredging and Reclamation - Underwater noise and vibration | Likely | Minor | Medium | DDSPMP, including monitoring and reactive management protocols.<br>Modelling and assessments undertaken and included in EIS. | Unlikely | Minor | Low |
| Marine flora and fauna | Construction | Piling - Underwater noise and vibration | Likely | Minor | Medium | Marine Noise and Vibration Management Plan, incorporating marine fauna observations and reactive management protocols. | Unlikely | Minor | Low |
| Marine flora and fauna | Construction | Earthworks - Discharge of contaminants (sediments, stormwater) | Almost Certain | Minor | Medium | ESCP.<br>Stormwater Management Plan.<br>Compliance with AS1940-2004 (Storage and handling of flammable and combustible liquids).<br>Stormwater retention and treatment systems incorporated into Project design. | Possible | Minor | Low |
| Marine flora and fauna | Construction | Earthworks- Potential to generate acidic and metal drainage, mud waving and stockpiling of ASS | Likely | Moderate | Medium | ASS Management Plan.<br>Adoption of construction methodologies that reduce potential for mud waving to as low as reasonably possible. | Unlikely | Moderate | Low |
| Marine flora and fauna | Construction and Operations | Vessel discharges - Hydrocarbon or chemical spills | Almost Certain | Moderate | Medium | Marine Spill Response Plan.<br>Refuelling plan. | Unlikely | Minor | Low |
| Marine flora and fauna | Construction and Operations | Marine traffic - Vessel strike | Possible | Major | High | Vessel speed limitations aligned with Darwin Port Harbourmaster requirements.<br>Standard navigational procedures and navigation aids. | Unlikely | Major | Medium |
| Marine flora and fauna | Construction and Operations | Marine traffic - Vessel grounding | Likely | Negligible | Low | Vessel speed limitations aligned with Darwin Port Harbourmaster requirements.<br>Standard navigational procedures and navigation aids. | Possible | Negligible | Low |
| Marine flora and fauna | Construction and Operation | Lighting | Unlikely | Minor | Low | CEMP and OEMP will dictate that light spill be reduced to as low as reasonably possible. | Unlikely | Minor | Low |

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Marine flora and fauna | Operation | Discharge of contaminants (stormwater) | Almost Certain | Minor | Medium | Stormwater and wastewater system maintenance.<br>OEMP that includes spill response measures. | Unlikely | Minor | Low |
| Marine flora and fauna | Construction and Operation | Introduction of marine pests | Likely | Extreme | Very High | Preparation and implementation of a Biosecurity Management Plan and inspection protocols.<br>Consultation with the Aquatic Biosecurity Unit to ensure consistency with existing quarantine arrangements for Darwin Harbour facilities.<br>Waste management procedures to capture biofouling removed from vessels on the hardstand areas. | Unlikely | Extreme | High |
| Air quality and greenhouse gas | Construction | Dust emissions from activities, including reclamation, dredge spoil placement and stockpiles | Likely | Minor | Medium | Incorporation of a Construction Air Quality Management Plan (CAQMP) into the CEMP.<br>Inform adjoining neighbours of construction activities.<br>Dust management controls including limiting movement of dusty materials when bushfire smoke levels are high, eliminating dust production at the source, use of water trucks and covering materials during transport. | Unlikely | Minor | Low |
| Air quality and greenhouse gas | Construction | Emissions from plant and vessels | Likely | Minor | Medium | Incorporation of a CAQMP into the CEMP.<br>Limit vehicle speed on site.<br>Seal permanent roads and areas planned to be sealed as soon as practicable.<br>Efficient operation of machinery, equipment, vehicles, ships and dredges to minimise emissions.<br>Clean up residues and spills in a timely manner. | Unlikely | Minor | Low |
| Air quality and greenhouse gas | Operation | Emissions from sandblasting and paint spraying | Likely | Minor | Medium | Incorporation of a CAQMP into the OEMP.<br>Blast and paint facility to operate under negative pressure to ensure air emissions are released via roof vents.<br>Air released to atmosphere via the roof exhaust stacks shall be passed through particulate, VOC and odour capturing filters prior to exhaust to the atmosphere.<br>Test for lead paint before blasting.<br>Develop procedures for spray painting and managing anti fouling paint.<br>Minimise the use of hull stain removers.<br>Storage of solvents and waste material in containers to prevent emissions.<br>Keep spray guns and lines clean and well maintained. | Unlikely | Minor | Low |
| Air quality and greenhouse gas | Operation | Emissions from operational traffic, vessels and plant | Likely | Minor | Medium | Incorporation of a CAQMP into the CEMP.<br>Use of shore power while ships are at berth.<br>Operate machinery and equipment to minimise exhaust emissions. | Unlikely | Minor | Low |

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Air quality and greenhouse gas | Construction | Increase in greenhouse gas emission resulting in global warming | Possible | Moderate | Medium | Maintain equipment and vehicles to ensure engine and fuel efficiency.<br>Reduce travel distances both on-site and off-site.<br>Minimise idling time of plant and equipment and switch engines off when not in use.<br>Minimise the extent of vegetation cleared during construction.<br>Recycle any waste produced where feasible. | Unlikely | Moderate | Low |
| Air quality and greenhouse gas | Operation | Increase in greenhouse gas emission resulting in global warming | Possible | Moderate | Medium | Consider NTG's towards 2050 policy.<br>Procure power from renewable energy suppliers wherever possible.<br>Prioritise the selection and use of electric vehicles and equipment if possible.<br>Maintain equipment and vehicles to ensure engine and fuel efficiency. | Unlikely | Moderate | Low |
| Terrestrial environmental quality | Construction | Disturbance of contamination, ASS, or leaching of acid water, during construction. | Likely | Moderate | Medium | Preparation of an ASS Management Plan<br>Mangrove area will be filled without the removal of trees.<br>An unexpected finds procedure to identify and manage contaminated materials if present. | Unlikely | Moderate | Low |
| Terrestrial environmental quality | Construction | Loss of containment of construction wastes | Likely | Major | High | Engineering design to capture all hazardous waste and wastewater.<br>A water treatment system installed during Project construction.<br>Waste management programs. | Unlikely | Moderate | Low |
| Terrestrial environmental quality | Construction and Operation | Loss of containment or spills of chemicals, hydrocarbons, and hazardous substances | Possible | Major | High | Chemical storage and handling procedures which includes minimising storage onsite<br>Stormwater management system.<br>Spill response procedures including marine spill response plan and availability of spill kits and training. | Unlikely | Moderate | Low |
| Terrestrial environmental quality | Operation | Loss of containment or wastes (including potentially hazardous grit blast waste material, antifoulant, organisms cleaned from vessels, removal of anodes, paint, sewage, run-off) | Possible | Moderate | Medium | Waste management programs which includes a routine maintenance for all waste management systems.<br>Routine maintenance of wastewater and water treatment systems with links to Biosecurity Management Plan.<br>Routine maintenance of stormwater management systems. | Unlikely | Minor | Low |
| Terrestrial flora and fauna | Construction | Impacts on migratory birds known to roost on Pond D at East Arm Wharf from pile driving activities | Possible | Minor | Low | Adoption of suitable construction methodologies to minimise impacts from pile driving noise.<br>Preparation and implementation of a Construction Noise and Vibration Management Plan (CNVMP) to support the CEMP. | Unlikely | Minor | Low |

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Terrestrial flora and fauna | Construction | Spread of introduced weed species and pest species from movement of vehicles, vessels, machinery, materials and equipment | Likely | Moderate | Medium | Management practices to prevent the introduction and spread of weeds to be included in the CEMP and linked to the Biosecurity Management Plan as appropriate. | Possible | Minor | Low |
| Terrestrial flora and fauna | Operation | Spread of introduced weed and pest species movement of vehicles, vessels, machinery, materials and equipment | Likely | Moderate | Medium | Management practices to prevent the introduction and spread of weeds to be included in the OEMP and linked to the Biosecurity Management Plan as appropriate. | Possible | Moderate | Low |
| Inland waters and hydrological processes | Construction | Discharge of sediments and contaminates from exposed soils | Almost Certain | Moderate | High | Preparation of a CEMP containing an ESCP reflecting relevant Australian Standards including the use of silt curtains.<br>Unexpected finds protocols for contamination and ASS.<br>Stormwater management system. | Possible | Moderate | Medium |
| Inland waters and hydrological processes | Construction | Loss of containment or spills of chemicals, hydrocarbons and hazardous substances | Possible | Major | High | Chemical storage and handling procedures including minimising hazardous materials stored on site.<br>Stormwater management system.<br>Spill response procedures including marine spill response plan and availability of spill kits and training. | Unlikely | Moderate | Low |
| Inland waters and hydrological processes | Construction | Increased peak flow rate of stormwater discharges due to increase in impervious areas | Likely | Moderate | Medium | Project design and drainage strategy to incorporate stormwater outfall structures with appropriate energy dissipation measures.<br>Ongoing monitoring and maintenance of stormwater systems. | Unlikely | Minor | Low |
| Inland waters and hydrological processes | Operation | Loss of containment or spills of chemicals, hydrocarbons and hazardous substances | Possible | Major | High | Contain, treat and reuse wastewater from wash down and blast and paint bays and manage solid waste material to system.<br>Ongoing monitoring and maintenance of wastewater treatment system and stormwater management system.<br>Chemical storage and handling procedures including minimising hazardous materials stored on site.<br>Spill response procedures including marine spill response plan and availability of spill kits and training. | Unlikely | Moderate | Low |

| Factor | Phase | Aspect | Pre-mitigation Risks | | | EIS mitigations | Residual Risk | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Pre-mitigation risk Rating | | Likelihood | Consequence | Post-mitigation risk Rating |
| Human health | Construction | Increase in biting insect populations and associated health risks to workers and community | Likely | Moderate | Medium | Designs and stormwater management plans to include a drainage strategy.<br>Biting Insect Management Plan compliant with NT Medical Entomology guidelines<br>Monitor impacts associated with disposal of dredge spoil to land (if required).<br>Ensure Biosecurity Management Plan includes requirements in relation to mosquitoes and international health regulations. | Possible | Minor | Low |
| Human health | Construction | UXO detonation disturbance or detonation | Possible | Major | High | Heritage assessment including liaison with Heritage Branch regarding historical activities and surveys for UXO (Appendix M: Cultural Heritage Assessment).<br>UXO to be incorporated into unexpected finds procedures.<br>UXO risk assessment to be undertaken prior to construction works. | Very unlikely | Moderate | Low |
| Human health | Operation | Increase in biting insect populations and associated health risks to workers and community | Likely | Moderate | Medium | Biting Insect Management Plan compliant with NT Medical Entomology guidelines<br>Ensure Biosecurity Management Plan includes requirements in relation to mosquitoes and international health regulations. | Possible | Minor | Low |

**Note:**

- The pre and post-mitigation risks for Table D-5 have been assessed based on the methodology described above. This differs to the methodology detailed in Table D-6, which used the risk methodology detailed in Appendix C: Social Impact Assessment.

## Table D-6 SIA Risk Register

| Factor | SIA theme | Phase | Social impact or opportunity | Initial rating | SIA mitigation s | Residual rating |
|---|---|---|---|---|---|---|
| Social economic and cultural | People and communities - impacts on social fabric, health and wellbeing, vulnerable community segments | Construction | Reduced sense of safety as a result of road trauma | High | Traffic Management Plan covering construction traffic and haul roads.<br>Organised bus transport for workers to reduce the number of vehicles travelling to site and potential traffic congestion.<br>Collaboration with Landbridge's traffic management plan for Darwin Port.<br>Communication with other road users during any peak transport tasks, such as haulage of equipment and materials.<br>Government's proposed overpass at the intersection of Berrimah Road and Tiger Brennan Drive. | Low |
| Social economic and cultural | People and communities - impacts on social fabric, health and wellbeing, vulnerable community segments | Construction and Operation | Reduced sense of marine safety as a result of dredging and increased marine activity on the harbour | Medium | Navigational requirements and marine safety plan including high safety standards and communication of standards and expectations to all Project staff.<br>Harbour Master's Notices to Mariners.<br>Good communication with other harbour users, including recreational fishing/boating community before the start of marine works and during the design and construction phase to advise of operations and safety requirements. | Low |
| Social economic and cultural | Cultural identity | Construction and Operation | Loss of cultural heritage due to damage, or reduced access, including fears and anxieties of damage to sites or custodians' responsibilities. | High | Aboriginal Areas Protection Authority (AAPA) Certificate.<br>Cultural Heritage Management Plan including implementing restricted work areas and cultural protocols.<br>Unexpected finds protocols.<br>Monitor changes in tidal flow and sediment mobility at Catalina Island and Old Man Rock areas pre- and post-construction.<br>Close working relationship with custodians to monitor and avoid damage. | Medium |
| Social economic and cultural | Cultural identity | Construction | Loss or damage to declared or valued European heritage sites, including World War II sites. | Medium | While no declared heritage sites are in the project's footprint, work with the Heritage Branch or Heritage Advisory Council on interpretive signage telling the story of World War II historical and non-declared sites that will be lost.<br>Monitoring of sediment impacts on Catalina 2 and 3 pre- and post-construction.<br>Larger vessel exclusion zone around Catalina 2 during construction.<br>Arrange for the *Rushcutter* to be moved to a place where it can be protected and restored.<br>Unexpected finds protocols. | Medium |
| Social economic and cultural | Economics -including jobs, industry participation, livelihoods, economic development) | Construction and Operation | Strong and more diverse economy from enabling economic infrastructure and capacity building | Noticeable (positive) | Northern Territory Government's economic and investment attraction strategies to maximise benefits unlocked by the infrastructure:<br>• collaborative strategic planning between the Marine Industry Development Plan, gas industry task force and Middle Arm master planning<br>• a Territory Benefit Plan for the project, to maximise local industry participation and jobs<br>• NTG to prepare an Australian Industry Participation Plan. | Beneficial (positive) |
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Construction and Operation | Local businesses benefit from winning work and enhanced capabilities | Imperceptible (positive) | Design and construct contractor's local industry and Aboriginal participation plan, to meet NTG's Territory Benefit Plan. To include outline of how tenders will be packaged and promoted to suit local capacity, procurement processes that prioritise the local market and good communication of opportunities for local businesses.<br>Industry Capability Network capability mapping to highlight local capacity and address any gaps.<br>Maritime Industry Development Plan.<br>Industry briefings in conjunction with the NT ICN to enhance the preparedness of local businesses to win work and manage expectations.<br>Accountability and reporting requirements for prime contractors and their sub-contractors against local participation provisions. | Noticeable (positive) |

| Factor | SIA theme | Phase | Social impact or opportunity | Initial rating | SIA mitigation s | Residual rating |
|---|---|---|---|---|---|---|
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Construction | Frustration by businesses who fail to win tenders or have unrealistic expectations of opportunities | Low | Territory Benefit Plan to outline requirements for design and construction contractor, including packaging and promoting tenders to suit local capacity, procurement processes that prioritise the local market and good communication of opportunities for local businesses.<br>Industry briefings in conjunction with the NT ICN to enhance the preparedness of local businesses to win work and manage expectations.<br>Accountability and reporting requirements for prime contractors and their sub-contractors against local participation provisions.<br>Ongoing communication to manage local content expectations and provide early advice of opportunities. | Low |
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Construction and Operation | Enhanced employment and training of local people | Imperceptible (positive) | Territory Benefit Plan and contractor participation plans, including recruitment processes prioritising the local market.<br>Maritime Industry Development Plan on workforce development.<br>Good communication about jobs available on the Project. | Noticeable (positive) |
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Construction and Operation | Aboriginal jobs and training as a result of the project | Imperceptible (positive) | Aboriginal Engagement Plan (required by Northern Australia Infrastructure Facility) to maximise Aboriginal employment and Aboriginal enterprises winning work on the project.<br>Territory Benefit Plan to outline approach to employment and training of local Aboriginal people. Ongoing development of workforce development and skills development for the marine sector, through the Marine Industry Development Plan.<br>Good communication about jobs available on the Project.<br>Compliance framework to ensure accountability by contractors against commitments to employ and train local Aboriginal people. | Noticeable (positive) |
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Operation | Crowding out of other economic sectors on the harbour such as tourism and recreational fishing | Low | While the Project is predicted to have negligible to no impact on recreational and tourism businesses, monitor during construction. | Low |
| Social economic and cultural | Economics (jobs, industry participation, livelihoods, economic development) | Planning and Operation | Detrimental impacts on competing maritime businesses | Medium | Development of a common user facility and expanded marine repairs and maintenance industry grows the sector.<br>Development of a Maritime Industry Development Plan with input from local industry to enhance capacity development. | Low |
| Social economic and cultural | Living environment | Construction | Reduced residential amenity due to traffic and noise during construction | Low | Management plans in place, including:<br>• Traffic Management Plan<br>• Air Quality Management Plan<br>• Construction Noise and Vibration Management Plan<br>• Marine Works Safety Plan.<br>Monitoring and adaptive management of amenity impacts, such as noise and vibrations from piling, road and sea traffic congestion, dust and dredge plumes.<br>Environmental incident reports on exceedances that create amenity impacts, such as noise and vibrations, road and sea traffic congestion, dust and dredge plumes.<br>DIPL to maintain a hotline and complaints register to record and respond to complaints, communication plan to ensure the residents of affected residential areas are kept informed on road train movements. | Low |

**Note:**

- Following the risk review process, a social and economic subject matter expert was engaged to assess the potential risks posed by the Project. The risk assessment methodologies used by these studies can be found in Appendix C: Social Impact Assessment.