APPENDIX G: RISK ASSESSMENT

1.1 ENVIRONMENTAL FACTORS AND OBJECTIVES

Environmental factors are elements of the environment that may be impacted by any aspect of a proposal. *NT EPA Environmental Factors and Objectives* (NT EPA, 2018) classifies 13 environmental factors to guide the structure of formal EIA in the NT. The potential impacts of a proposal are assessed against the NT EPA's objectives for each factor to determine whether the impacts of a proposal on each Environmental Factor are likely be significant.

As the Terms of Reference (TOR) for the Project (NT EPA, 2016) was released prior to the publication of *NT EPA Environmental Factors and Objectives* (NT EPA, 2018c), it does not identify specific Environmental Factors that the EIS must address. Discussions between the NT EPA and the Proponent subsequent to publication of the NT EPA (2018c) document have identified Environmental Factors that the EIS must address. These Environmental Factors, their objectives, and the EIS chapter in which potential impacts are assessed are listed in the main body of Chapter 7 of the EIS.

1.2 APPROACH AND METHOD

The TOR (NT EPA, 2016) requires identification, analysis and mitigation of potential environmental impacts of the Project through a whole-of-project risk assessment. The risk and environmental impact assessment process informing this EIS is illustrated in Figure 1 and described in the sections below. Chapters 7.2 to 7.12 of the EIS describe each Environmental Factor potentially impacted by the Project and are structured to reflect the risk and environmental impact assessment process.

1.2.1 Environmental Context

Environmental Factors that could potentially be significantly impacted by the Project were identified by the NT EPA, and the reasons for their selection are discussed in the TOR. The elements of the Project that can interact with the environment – the **environmental aspects** - were identified and their potential impacts on each of the specified Environmental Factors considered.

The Project could potentially have direct environmental impacts and/ or indirect environmental impacts. Direct environmental impacts are those impacts caused by direct interaction of the Project with an Environmental Factor, at the same time and in the same place as construction and/ or operation activities are occurring. Indirect environmental impacts are those impacts which are not a direct result of construction and/ or operation activities. They generally occur outside of the Development Envelope, and may be realised through relatively complex pathways. Sometimes referred to as second or third level impacts, or secondary impacts. For example, clearing of the Development Envelope is a direct impact on flora and vegetation. An indirect impact on flora and vegetation may be degraded condition resulting from the deposition of dust caused by increased traffic on unsealed roads.

The Project interacts with the environment at different scales for each Environmental Factor – for example, clearing of vegetation is highly localised and limited to the Disturbance Footprint, whereas degraded surface water quality may impact offsite receptors, and GHG emissions cause impacts at the global scale. The nature of potential direct and indirect impacts on each Environmental Factor determined the scope and scale at which each Environmental

Factor would be studied. The geographic extent of the environment considered, and the EIA, therefore varied across the Environmental Factors.

Having determined the extent and scale at which each Environmental Factor would be considered, desktop review, stakeholder consultation, technical studies and site surveys were undertaken to:

- Identify environmental values that could be impacted by the Project;
- Assess the conservation significance of the environmental values which could be impacted; and
- Determine how sensitive or vulnerable environmental values are to be impacted.

This information is documented in the EIS chapter for each environmental factor, under the heading 'Existing Environment'.

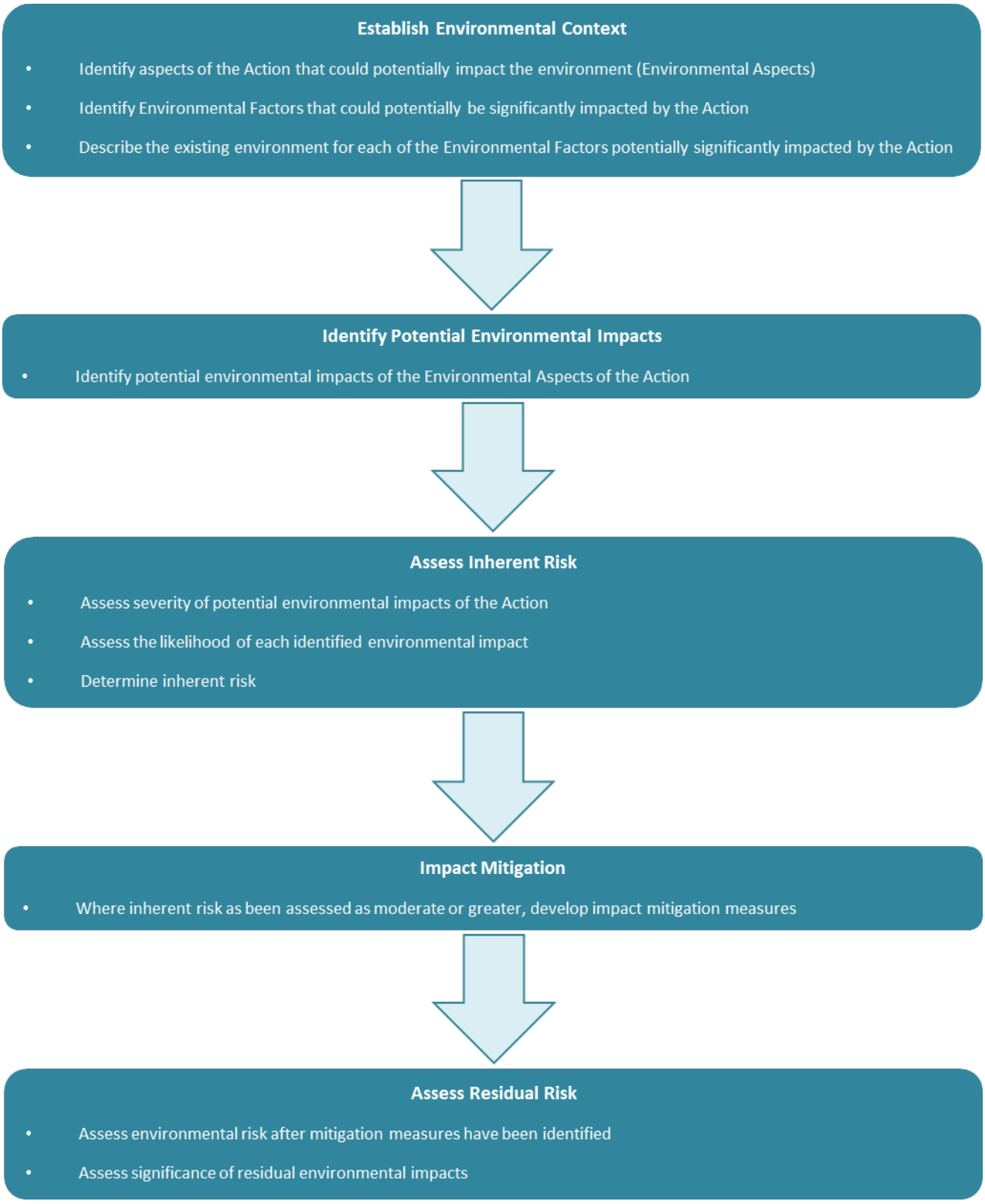

Figure 1: Risk and Environmental Impact Assessment Process

1.2.2 Impact Analysis

For the purpose of impact assessment, the Project was divided into construction and operational phases. This differentiation simplifies impact assessment due to the significant differences in activities and potential impacts, and significantly different time scales over which activities take place, between the two phases. Environmental aspects of Site closure and rehabilitation have not been assessed in this EIS as the considerable project life (approximately ~40 years) makes it difficult to predict the local demand for land, development plans and strategies, and other future social and environmental conditions likely to influence post-project land use at the Site.

Environmental Aspects of the Project were identified by considering the potential pathways along which different Project elements could interact with Environmental Factors. The pathways identified informed the development of a conceptual site model, and the Environmental Aspects and their interactions with the environment form the basis of the EIA. Identified environmental aspects are categorised according to the relevant stage/s of the Project in Table 1.

Table 1: Environmental Aspects of the Project and Relevant Phases

Environmental Aspect	Construction	Operation
Clearing of native vegetation	✓	
Water supply and use		✓
Non-process Waste management	✓	✓
Traffic	✓	✓
Chemical Management	✓	✓
Power generation and use		✓
Greenhouse gas emissions	✓	✓
Process emissions		✓
Process waste management - effluent		✓
Process waste management - solids		✓
Storm water management	✓	✓
Workforce	✓	✓
Process		✓
Train loading and unloading		✓
Stockpiling		✓

For each environmental aspect of the Project, events/ incidents that could impact environmental values were identified. Potential direct and indirect impacts were then identified by considering cause and effect pathways for impacts to each Environmental Factor. The severity of each potential impact was assessed using the following criteria:

- Scale (extent);
- Intensity; and
- Duration and frequency.

Categories used to rate the severity of impacts are shown in Table 2.

Table 2: Categories used to assess the severity of potential impacts

Scale			
Widespread	Regional	Localised	Limited
Impact occurs at a NT, national, international or global scale	Impact extends to the Darwin/ Palmerston region, and/ or greater Darwin Harbour	Impact is confined to the Site and areas directly adjacent to the Site, such as other allotments, Elizabeth River, and estuarine watercourses adjacent to the Site	Impact limited to the Site
Intensity			
High	Moderate	Low	Very Low
Impact irreversibly compromises the integrity of environmental values	Integrity of environmental values altered but impact can practicably be reversed	Impact alters the quality, abundance or distribution of environmental values without compromising their integrity, and can be easily and cheaply reversed	Impact does not significantly alter the quality, distribution or abundance of environmental values.
Timing, duration and frequency			
Permanent	Long term	Medium term	Short-term
Impact that is permanent; environmental values will not recover on human time scales	Impact that is measurable post-Project	Impact that is felt up to completion of operations	Impact that is felt up to completion of construction

1.2.3 Risk Assessment

The risk that potential Project impacts will result in one or more NT EPA objectives for an Environmental Factor being compromised was assessed in accordance with qualitative risk management principles described in *ISO 31000:2018 Risk Management – Principles and Guidelines* (International Standards Organisation, 2018).

Risk is a function of the likelihood of an impact occurring and the consequence of that impact on Environmental Factor objectives. The likelihood and consequence categories adopted are listed in Table 3 and Table 4, respectively. The consequence assessment was informed both by the outcomes of the impact severity analysis described in the previous section, and the importance/ sensitivity of environmental values. Likelihood and consequence ratings were combined to derive an overall risk rating using the matrix shown in Table 5.

Table 3: Likelihood Categories Adopted in Risk Assessment

Likelihood category	Description
Almost certain	The event/ impact will occur or is expected to occur. The impact occurs regularly in association with similar projects and/ or in similar environments.
Likely	The impact will probably occur in most circumstances but there is some uncertainty about the likelihood. The impact has occurred on more than one occasion in association with similar projects and/ or in similar environments.
Possible	The impact could occur in some circumstances. The impact has occurred infrequently on similar projects and/ or in similar environments.
Unlikely	The impact is not expected to occur. The impact occurs very infrequently on similar projects and/ or in similar environments.
Rare	The impact is very unlikely to occur. The impact has not occurred on similar projects and/ or in similar environments.

Table 4: Consequence Categories Adopted in Risk Assessment

Consequence or severity of Impacts	Score	Terrestrial Environmental Quality	Terrestrial Flora and Fauna	Hydrological Processes	Inland Water Environmental Quality	Marine Environmental Quality	Benthic Habitat and Communities	Marine Fauna	Air Quality and Greenhouse Gases	Social, Economic and Cultural Surroundings	Human Health
Severe A Severe impact has two or more of the following characteristics: Widespread - Impact occurs at a NT, national, international or global scale High Intensity - Impact irreversibly compromises the integrity of environmental values Permanent - environmental values will not recover on human time scales	5	Soil disturbance, erosion or contamination that is measurably and permanently impacting environmental values that rely on good soil quality throughout the NT	Extinction of terrestrial flora, vegetation or fauna	Change in surface water flow volumes and/ or timing that permanently alters the ecological functioning and/ or amenity of Arafura Sea Change in ground water in a regional scale aquifer that permanently alters ecological health, beneficial uses and/ or amenity	Exceedance of baseline water quality that permanently alters the ecological functioning and/ or amenity of Elizabeth River	Exceedance of baseline water quality that permanently alters the ecological functioning and/ or amenity of Arafura Sea	Complete loss of a benthic habitat or community type	Extinction of marine flora or fauna	Measurable increase in global GHG concentrations, or increase in exceedances of air quality regulations throughout the NT	Permanent impact that is felt by the majority of the NT population Unauthorised destruction of Aboriginal heritage item and/ or sites of world or national heritage significance	One or more fatalities More than one person injured with permanent disabilities
Major A Major impact has two or more of the following characteristics: Regional - Impact extends to the Darwin/ Palmerston region, and/ or greater Darwin Harbour Moderate - Integrity of environmental values altered but impact can practicably be reversed Long term - Impact that is measurable post-Project	4	Soil disturbance, erosion or contamination that compromises regional environmental values that rely on good soil quality, and would be costly and technically challenging to remediate	Regional scale impacts on terrestrial flora, vegetation or fauna that compromise post-Project biodiversity and/ or ecological integrity	Reduction in surface water flow volumes, groundwater levels and/ or timing of flows/ discharges that compromises regional ecological functioning, land use and/ or amenity post-Project Drawdown of groundwater in a regional scale aquifer that alters ecological health, beneficial uses and/ or amenity post-Project	Exceedance of baseline Elizabeth River water quality that continues for many years post-Project	Exceedance of baseline Darwin Harbour water quality that continues for many years post-Project	Regional scale impacts on benthic habitat or community that compromise post-Project biodiversity and/ or ecological integrity	Regional scale impacts on marine flora or fauna that compromise post-Project biodiversity and/ or ecological integrity	Significant increase in NT GHG emissions, or increase in exceedances of air quality regulations in the Darwin/ Palmerston region	Impact that is felt by a majority of the regional population post-Project Unauthorised damage/ desecration of Aboriginal heritage item and/ or sites of regional heritage significance such that integrity is lost	No fatalities One injury with permanent disability More than 10 injuries requiring hospitalisation

Consequence or severity of Impacts	Score	Terrestrial Environmental Quality	Terrestrial Flora and Fauna	Hydrological Processes	Inland Water Environmental Quality	Marine Environmental Quality	Benthic Habitat and Communities	Marine Fauna	Air Quality and Greenhouse Gases	Social, Economic and Cultural Surroundings	Human Health
Moderate A Moderate impact has two or more of the following characteristics: Localised - Impact is confined to the Site and areas directly adjacent to the Site, such as other allotments, Elizabeth River, and estuarine watercourses adjacent to the Site Low - Impact alters the quality, abundance or distribution of environmental values without compromising their integrity, and can be easily and cheaply reversed Medium term - Impact that is felt up to completion of operations	3	Medium term soil disturbance, erosion or contamination in the vicinity of the Site that that alters soil characteristics but with no measurable impact to environmental values that rely on good soil quality, and can be remediated	Localised impact to flora, vegetation or fauna that alters the quality, abundance or distribution but with no measurable impact on biodiversity and/ or ecological integrity within months of the Project concluding	Localised reduction in surface water flow volumes, and/ or timing of flows/ discharges with no impact on ecological health, beneficial uses and/ or amenity. Localised drawdown of ground water throughout operations that recovers rapidly post-Project	Localised exceedances of baseline water quality that occurs throughout operations but ceases within months of the Project concluding	Localised exceedances of baseline marine water quality that occurs throughout operations but ceases within months of the Project concluding	Localised impact to benthic habitat or community that alters the quality, abundance or distribution but with no measurable impact on biodiversity and/ or ecological integrity within months of the Project concluding	Localised impact to marine flora or fauna that alters the quality, abundance or distribution but with no measurable impact on biodiversity and/ or ecological integrity within months of the Project concluding	Localised increase in exceedances of air quality regulations	Impact that is felt by a small number of people during the Project, ceasing within months of the Project concluding Unauthorised activity but with no physical impact to a heritage item, or minor physical impact such that integrity is not lost	No fatalities No permanent disabilities 5-10 injuries requiring hospitalisation
Minor A Minor impact has two or more of the following characteristics: Limited - Impact limited to the Site Very Low - Impact does not significantly alter the quality, distribution or abundance of environmental values Short term - Impact that is felt up to completion of construction	2	Short term soil disturbance, erosion or contamination in the vicinity of the Site that is reversible without significant remedial works	Impacts on flora, vegetation or fauna that do not measurably alter environmental values outside of the Site after construction concluding	Reduction in surface water flow volumes, groundwater levels and/ or timing of flows/ discharges at the Site with no impact on ecological health, beneficial uses and/ or amenity. Limited drawdown of ground water throughout operations that recovers post-construction.	Exceedances of baseline water quality at the Site ceasing within months of construction concluding	Exceedances of baseline marine water quality at the Site ceasing within months of construction concluding	Impacts on benthic habitat or community that do not measurably alter environmental values outside of the Site after construction concluding	Impacts on marine flora or fauna that do not measurably alter environmental values outside of the Site after construction concluding	Increase in exceedances of air quality regulations at the Site	Impact felt by a small number of people at the Site during construction Unauthorised activity but with no physical impact to a heritage item	No fatalities No permanent disabilities Less than 5 injuries requiring hospitalisation

Consequence or severity of Impacts	Score	Terrestrial Environmental Quality	Terrestrial Flora and Fauna	Hydrological Processes	Inland Water Environmental Quality	Marine Environmental Quality	Benthic Habitat and Communities	Marine Fauna	Air Quality and Greenhouse Gases	Social, Economic and Cultural Surroundings	Human Health
Insignificant No noticeable/ measurable impact to values	1	No measurable soil disturbance, erosion or contamination	No measurable impact on terrestrial flora, vegetation or fauna	No measurable change to hydrology	No significant change to baseline water quality	No significant change to baseline marine water quality	No measurable impact on benthic habitat or communities	No measurable impact on marine flora or fauna	No measurable GHG emissions or air quality impacts	No noticeable impact to stakeholder or community values No impact to Aboriginal Sacred or other heritage sites	No fatalities No permanent disability No injuries requiring hospitalisation

Table 5: Risk Matrix Adopted in Risk Assessment

			Consequence				
			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Severe
Likelihood	5	Almost Certain	Medium	Medium	High	Very High	Very High
	4	Likely	Medium	Medium	High	Very High	Very High
	3	Possible	Low	Medium	Medium	High	Very High
	2	Unlikely	Low	Low	Medium	Medium	High
	1	Low	Low	Low	Low	Medium	High

1.2.3.1 Inherent Risk Assessment

For each potential impact, an inherent risk rating was assigned by ranking the likelihood and consequence of the impact in the absence of any mitigation (i.e. the worst-case scenario). The inherent risk rating considered the location and design of the Project, existing environmental conditions, impact sources and pathways, and the presence/ absence of important and/ or sensitive values and receptors.

1.2.3.2 Responses to Inherent Risk Levels

Each inherent risk rating was evaluated with reference to the risk level and response matrix in Table 6 to determine the level of mitigation required. The higher the inherent risk level, the less tolerable/ acceptable the risk is likely to be to stakeholders and regulators, and the greater the requirement for impact mitigation.

Table 6: Risk Level and Mitigation Response Matrix

Risk level	Response
Very High	Risk is unacceptable. Specific action plans required to reduce risk to an acceptable level. Director/ CEO level management attention required.
High	Risk is generally unacceptable without action. Specific action plans required to reduce risk as low as is reasonably practicable (ALARP). Senior management attention required.
Medium	Risk is generally acceptable. Proactive action is required to reduce risk to ALARP. Requires routine monitoring and adaptive management in accordance with Environmental Management Plan. Line management attention required.
Low	Risk is acceptable. Management by routine policies and procedures.

1.2.3.3 Development of Impact Mitigation Measures

Practicable impact mitigation measures were developed for impacts with Very High, High, or Medium risk levels. Impacts with a Low level of inherent risk were still considered for further mitigation where specifically required by the TOR or where routine controls would further contribute to risk minimisation. Mitigation measures were developed with reference to environmental guidelines, professional and/ or academic experience of technical specialists engaged to work on the EIS and supporting studies, and personnel designing and developing the Project.

Mitigation measures were developed with the objective of reducing all risks to a level that is 'as low as reasonably practicable' (ALARP). This is defined as the level at which the resources involved in reducing the risk further would be grossly disproportionate to the benefit gained.

Each EIS chapter for the Environmental Factors assessed includes a summary of impact mitigation measures and monitoring programs that will be implemented. Details of how the proposed measures will be implemented over each phase of the Project are provided in the Environment Management Plan (**EMP**) submitted with the EIS, or other specialist Management Plans. The purpose of these plans is to:

- Provide more detailed guidance to the Proponent and contractors on implementation of the mitigation measures in a manner that will be effective in reducing risk to an acceptable level; and
- Provide regulators with a level of confidence that the controls will be effective and are likely to be implemented.

The EMP will be reviewed annually and updated as required for the duration of the Project.

1.2.3.4 Residual Risk Assessment

Practicable mitigation measures were developed for the risk/pathway of each environmental impact with Very High, High, or Medium risk levels. Each of these risks/pathways was reassessed assuming implementation of proposed mitigation measures to determine a residual risk rating. The residual risk rating of each potential environmental impact represents the level of environmental risk associated with the Project. Where the residual risk of an impact was ranked as medium, high or very high, the potential for cumulative impacts from other current and future land uses was considered based on the information summarised in section 1.4 below.

1.2.3.5 Level of Certainty

For each potential impact, any information gaps/ uncertainties that could reduce reliability of the risk assessment, or certainty about the effectiveness of proposed controls, were identified. Each risk rating was assigned a level of certainty using the categories in Table 7.

Table 7: Level of certainty categories used to evaluate reliability of risk assessment

Level of Certainty	Description
High	Risk rating is based on testing, modelling or experiments. Baseline information is complete and an appropriate level of analysis has been undertaken. Proposed mitigation measures were recommended by technical specialists and are well developed with demonstrated efficacy. Minimal further work is required to adequately manage risk.
Medium	Risk rating is based on similar conditions being observed previously on a similar project and/ or in a similar environment. Baseline information has some gaps that are considered minor, and further work is unlikely to significantly alter the risk rating. While the efficacy of proposed mitigation measures has been demonstrated, some further work is required to provide details of implementation prior to commencement of the Project.
Low	Risk rating is based on professional opinion. Limitations in baseline information require that some assumptions are made, which introduces a level of uncertainty. Effectiveness of proposed controls and/ or the likelihood of implementation cannot be reliably assessed at this point in time. A substantial amount of further work is required to adequately manage risk prior to commencement of the Project.

1.2.4 Residual Impact Assessment

For each environmental factor, residual risk ratings assigned through the risk assessment process were used as the basis for assessing the significance of residual impacts. Impacts with a low residual risk rating, with a moderate to high level of certainty, are likely to have limited to no effect on the NT EPA's Environmental Objectives. Impacts assigned a residual impact rating of medium or higher are more likely to have an effect the NT EPA's Environmental Objectives, either because the mitigation measures require further work to demonstrate their efficacy, or because it is not practicable to avoid some level of impact.

The significance of residual impacts was assessed with regard to the likelihood of an effect on an Environmental Objective, and the following matters:

- Objects of the EA Act, Environmental AAP or other NT environmental legislation;
- Values (e.g. effects to environmental factors and objectives), sensitivity and quality of the environment which is likely to be impacted;
- Extent (intensity, duration, magnitude, frequency and geographic footprint) of likely impacts;
- Consequence of likely impacts (or change);
- Resilience of the environment to cope with the impacts or change;
- Cumulative impact with other projects;
- Connections and interactions between parts of the environment to inform a holistic view of impacts to the environment;
- Level of confidence in the prediction of impacts and the success of proposed mitigation; and
- Public interest about the likely effect of the proposed Project on the environment and public information that informs the NT EPA's assessment.

A statement of residual impacts on each Environmental Factor is provided in the relevant EIS chapter.

The outcomes of the impact and risk assessment processes are documented in the Darwin Processing Facility Environmental Risk Register, appearing as Table 8.

Table 8: Darwin Processing Facility Environmental Risk Register

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Environmental Factor: Terrestrial Environmental Quality										
Metal contamination from historical quarrying and fly-tipping	Dermal contact between site users and areas of gross contamination Lateral migration of surface water/runoff Vertical infiltration of contaminants of particular concern (**COPC's**) from the surface to groundwater Lateral migration of COPC's via groundwater	Adverse health impacts to site personnel Pollution of Elizabeth River and Upper Darwin Harbour Estuary, with adverse impacts to flora and fauna Adverse health impacts to recreational users and consumers of fish from Elizabeth River and Upper Darwin Harbour Estuary	3	3	Medium	Removal of fly-tipped waste from the site using accredited waste specialists. All stormwater areas shall be diverted to a retention ponds for monitoring and treatment (if required). pH, water level, Electrical Conductivity, total iron and aluminium concentrations to be monitored within any pond of retained water in current operation. Monitoring of wastewater conducted prior to discharge must indicate parameters comply with the performance indicators. Implementation of the Contaminated Sites Procedure (EP-16) within the EMP (Appendix D).	1	3	Low	High
Petroleum hydrocarbon contamination from historical quarrying and fly-tipping	Inhalation of derived vapours Dermal contact between site users and areas of gross contamination Lateral migration of surface water/runoff Vertical infiltration of COPC's from the surface to groundwater Lateral migration of COPC's via groundwater	Adverse health impacts to site personnel Pollution of Elizabeth River and Upper Darwin Harbour Estuary, with adverse impacts to flora and fauna Adverse health impacts to recreational users and consumers of fish from Elizabeth River and Upper Darwin Harbour Estuary	3	3	Medium	Removal of fly-tipped waste from the site using accredited waste specialists All stormwater areas shall be diverted to a retention ponds for monitoring and treatment (if required). pH, water level, Electrical Conductivity, total iron and aluminium concentrations to be monitored within any pond of retained water in current operation. Monitoring of wastewater conducted prior to discharge must indicate parameters comply with the performance indicators. Implementation of the Contaminated Sites Procedure (EP-16) within the EMP (Appendix D).	1	3	Low	High
Asbestos contamination from historical quarrying and fly-tipping	Presence of friable asbestos, fibrous asbestos, or asbestos fines that may become airborne	Inhalation of asbestos fibres by site users (including workers engaged in site clearance and construction works).	2	3	Medium	Inspection of disturbed areas and fly-tipped waste for the presence of asbestos; removal, transport and disposal of asbestos using licensed specialists. Implementation of the Contaminated Sites Procedure (EP-16) within the EMP (Appendix D).	1	3	Low	High
Site excavation during Project construction phase	Liberation of Acid Sulfate Soils (ASS), or Potentially Acid Sulfate Soils (PASS)	Adverse changes to the quality of soil and water Degradation of wetlands, water-dependent ecosystems and ecosystem services Loss of habitat ecosystem complexity and biodiversity Invasion and dominance of wetlands and waterways by acid-tolerant water plants and plankton species Reduction of soil stability and fertility	5	4	Very High	Implementation of the Acid Sulfate Soils Management Plan (Appendix J). In addition, the following measures will be taken: • Undertake a geotechnical assessment prior to construction to identify areas of occurrence of ASS. • Disturbance of ASS to be avoided where possible, including constructing infrastructure on piles above ground level. • Excavated ASS to be treated during construction in accordance with requirements of the ASS Management Plan to prevent acidic fluids leaching into surface water or groundwater.	2	4	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
		Deterioration in water quality sources for stock, irrigation and human use by increasing acidity and heavy metal concentrations Acidification of surface water bodies increasing mosquito breeding, which may increase the prevalence of mosquito-borne diseases such as Ross River virus Loss of visual amenity due to rust coloured stains from iron precipitates at the soil surface Long term infrastructure damage through acidic water corroding metallic and concrete structures Leaching of toxic metals due to acidification of soil due to acid drainage				• Material free of ASS will be used to construct any bunds that may be required. • Preparation of compliant ASS treatment pads. The area will be fully contained/constructed such that drainage/runoff water from the pad is directed to an appropriate receptacle for testing and treatment (if required). • Any spilled ASS material is to be transferred to the treatment pad immediately. • Awareness training of ASS handling requirements will be provided to personnel involved with the movement of soils, particularly during the construction phase • ASS treatment pads will have a guard layer of agricultural lime applied at a nominal rate of 10kg/m^2. • ASS material will be transferred to the treatment pad and placed on top of the guard layer. If ASS is to be treated in more than one layer, enough time will be allowed for validation testing and compliance of a layer before addition of extra material. • ASS material is to be spread out in windrows of 300 mm loose thickness for drying. Once dry, fine agricultural lime will be applied evenly over the surface and thoroughly mixed into the soil. • Treated ASS shall not be removed from the site until validation monitoring indicates that performance indicators have been met. • All stormwater or ASS leachate from stockpiles or other exposed areas shall be diverted to a retention ponds for monitoring and treatment (if required). Implementation of the Erosion and Sediment Control Plan (ESCP, contained within Appendix O) and Water Management Procedure (EP-10) in the EMP (Appendix D) to avoid erosion.				
Hazardous substances used in operations phase	Spills/leaks of petrol, oils, lubricants, hazardous materials, paints, thinners, and litter.	Adverse health impacts to site personnel Pollution of Elizabeth River and Upper Darwin Harbour Estuary, with adverse impacts to flora and fauna Adverse health impacts to recreational users and consumers of fish from Elizabeth River and Upper Darwin Harbour Estuary	3	4	High	Implement the Hazardous Material Management Procedure (EP-13) including the following: • Ensure stockpiles of bulk materials are located well clear of any waterway or drainage systems. • Construct bunds around fuel and chemical storage areas according to Australian Standards 1940: *2017 – The Storage and Handling of Flammable and Combustible Liquids* (unless quantity of the liquid stored is within that allowable as minor storage), environmental protection licence or Major Hazard Facility licence requirements.	2	4	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Train personnel in implementation of safe work practices to minimise risks and impacts of spillage of fuels, chemicals and other contaminants. • Train personnel in incident reporting and emergency management procedures and encourage the reporting of issues and near misses. • Record and report all POL, chemical and hazardous substance spills • In the event of a chemical or hazardous substance spill, containment measures should be enacted and Material Safety Data Sheet (**MSDS**) requirements complied with. • Ensure personnel have access to spill kits that contain an absorbent material, clearly marked oily waste disposal drum and a shovel. • In the event of a POL spill less than 20L on soil, remove the soil and dispose of in oily waste disposal drum. • In the event of a POL spill of between 20 and 80L, soak up as much as possible using absorbent, and turn/aerate the soil to allow natural processes (i.e. aeration and microbial systems) to breakdown the organic compounds (i.e. hydrocarbons). Remove contaminated soil if the spill occurs in the vicinity of drainage lines and waterways. If on a hard surface such as road or concrete, use absorbent and dispose in the oily waste disposal drum. • In the event of a POL spill greater than 80L, all contaminated soil is to be removed, and disposed of in a clearly marked oily waste disposal drum. • Undertake validation sampling of soil if the spill, or combined record of spills, is greater than 80L to confirm all contaminated soil has been removed • All contaminated soil and absorbent in the oily waste disposal drum should be disposed of by a licenced waste contractor. • If pooled water becomes contaminated, e.g. through a diesel spill, ensure it is contained and removed (and not discharged to sewerage system or natural water courses) • MSDSs are to be located within storage areas, as well as centrally located and readily available to staff for use in case of an emergency. MSDSs are to remain current at all times. • Any spillage of wastes, contaminants or other materials shall be cleaned up as quickly as practicable using procedures that prevent				

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						contaminants or material being transferred to the stormwater drainage system; • The stormwater system for the site shall be inspected regularly to identify any failures and, if necessary, repairs shall be undertaken; • Chemical storage and handling areas shall be bunded and shall have drainage lines separate from the stormwater drainage, to reduce the likelihood of chemical contamination of stormwater. • Ensure stockpiles of bulk materials are located well clear of any waterway or drainage systems; • Train operators in incident reporting and emergency management procedures and encourage the reporting of issues and near misses; • Construct bunds around fuel and chemical storage areas according to *Australian Standards 1940:2017* (unless quantity of the liquid stored is within that allowable as minor storage). In addition, management will include: • pH, water level, Electrical Conductivity, total iron and aluminium concentrations to be monitored within any pond of retained water in current operation. • Hydrated lime to be available for pH adjustment of water if required. • Monitoring of wastewater conducted prior to discharge must indicate parameters comply with the performance indicators. • Appropriate weatherproof storage of hydrated lime. • MSDSs are to be located within storage areas, as well as centrally located and readily available to staff for use in case of an emergency. MSDSs are to remain current at all times. • Undertake validation sampling of soil if the spill, or combinwed record of spills, is greater than 80L to confirm all contaminated soil has been removed. • All contaminated soil and absorbent in the oily/chemical waste disposal drum should be disposed of at a designated waste disposal site approved by Darwin authorities. • Keep sites free from build-up of waste materials by directing regular clean ups; • Avoid storing large volumes of materials on site; • Ensure equipment and vehicles have been washed down and inspected for POL leaks, prior to being transported to work sites;				

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Ensure herbicides used for weed control are registered and only applied by appropriately trained personnel. Implementation of the Hazardous Material Management Procedure (EP-13) within the EMP (Appendix D).				
Environmental Factor: Terrestrial Flora										
Construction of processing facility	Vegetation clearing	Unnecessary loss of biodiversity, and ecosystem functioning	4	3	High	Implement the Ground Disturbance and Vegetation Clearing Procedure (EP-05) contained within the EMP (Appendix D), including: • Vegetation clearing is undertaken only in approved areas. • Development and implementation of an internal Ground Disturbance Permit system whereby no land clearing is undertaken without completing a series of checks to ensure: o The proposed clearing has been approved; o Conditions in relation to soil and subsoil recovery, weed management, fauna clearing and other requirements have been assigned; and o Approved permits are assessed for compliance with permit conditions. o Proposed area of clearing is demarcated prior to clearing to avoid excessive or prohibited clearing. • Recover topsoil and utilise the seed bank to conduct rehabilitation of disturbed areas as they become available.	1	3	Low	High
Construction of processing facility	Project design resulting in disturbance of conservation significant flora and vegetation	Loss of important vegetation types (mangroves, riparian vegetation and large habitat trees) Loss of conservation significant flora species	3	3	Medium	Prior to commencement of construction review the development envelope of the Project to ensure populations of the following flora species are excluded where possible: • *Cycas armstrongii* (VU); • *Tricoryne elatior* (NT); • *Polymeria pusila* (DD); and • *Buchnera* sp. ciliate bracts (DD). Ensure vegetation clearing occurs only in approved areas in accordance with a Ground Disturbance and Vegetation Clearing Procedure (EP-05) contained within the EMP.	2	3	Medium	High
Site earthworks and addition of infrastructure	Alteration and sedimentation of surface water flows and water quality from erosion.	Scour from runoff velocity Terrestrial erosion Smothering of aquatic flora and fauna Loss of aquatic habitat	3	3	Medium	Implementation of the ESCP (Contained within Appendix O) and Implementation of the Water Management Procedure (EP-10) contained within the EMP (Appendix D) including: • Use of swales and sediment basins where required; • Use of minor diversions where required; and	2	3	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Maintain natural flow paths wherever possible.				
Construction and operations activities (especially vehicle movement, and workshop activities).	Uncontrolled fire	Loss of fire sensitive species or vegetation.	3	3	Medium	Implementation of the Fire Management Plan (Appendix L) including: • Mine personnel will be trained in fire protection; • The site will be equipped with fire suppression equipment; • A hot work permit system will be implemented; and • Grassy weeds will be controlled.	1	3	Low	High
Vehicle movement and earthworks during construction and operations	Increase in weed infestations or invasion by new weed species.	Reduced vegetation quality by competitively excluding native species. Weed infestations providing high fuel loads for fire	3	2	Medium	Implementation of the Weed Management Procedure (EP-08) contained in the EMP (Appendix D) including: • Review existing weed mapping and signpost areas of significant weed infestation; • Educate mine personnel on the identification and management of key weed species; • Implement weed hygiene procedures; • Use the Ground Disturbance Permit System in the Ground Disturbance and Vegetation Clearing Procedure (EP-05) as specified in the EMP to assess the risk of spreading weeds when undertaking land clearing; and • Routinely undertake site infestation control measures and monitoring of infestations.	2	2	Low	High
Construction and operations activities	Dust generated from vehicle movements, cleared surfaces, loading/unloading and material stockpiles.	Reduced photosynthetic potential of vegetation covered in dust.	5	2	Medium	Implementation of the Dust Emission Management Procedure (EP-11) contained within the EMP (Appendix D) including: • Regular watering of active potentially dust generating areas and stockpiles areas; • Efficient and effective machinery operation; • Limit vegetation and soil clearing; and • Maintain the concentrate at Dust Extinction Moisture level; • Use of water sprays or misting nozzles during stacking operations; • Misting sprays on reclaim feeders; • Fogging sprays at transfer points; • Physical enclosure of transfer points and operating equipment; • Select operational procedures to take place inside sheds; • Open areas not required for vehicle access for operations will be sprayed with hydro mulch or sealed through the application of dust suppressant chemicals; and • Active road surfaces sealed, treated with a dust suppressant chemical or sprayed with water.	2	2	Low	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Construction and operations activities	Saline or contaminated water used for dust control or water that has leaked from pipelines or water storage facilities contaminating soil and impacting vegetation.	Loss of vegetation due to salinity or contamination of soil	3	2	Medium	Water storage facilities and /or hazardous materials will be restricted to designated impermeable storage areas located at least 50m from any vegetation. Storage areas will be bunded and have appropriate drainage systems designed to capture any potential spills or leaks. Water used for dust suppression will be of a quality that does not negatively impact flora and vegetation. Implementation of the Water Management Procedure (EP-10) within the EMP (Appendix D).	2	2	Low	High
Environmental Factor: Terrestrial Fauna										
Construction of processing facility	Vegetation clearing	Direct killing of fauna during clearing operations Reduction in habitat available for fauna	5	3	High	Ensure habitat to be cleared is well represented elsewhere on the Middle Arm Peninsula, and in the region. Implement the Ground Disturbance and Vegetation Clearing Procedure (EP-05) within the EMP (Appendix D) and BMP, including: • Pre-clearance fauna trapping and translocation. Development and implementation of an internal Ground Disturbance Permit system, whereby no land clearing is undertaken without completing a series of checks to ensure: • The proposed clearing has been approved; • Conditions in relation to fauna clearing and other requirements have been assigned. • Approved permits are assessed for compliance with permit conditions.	3	3	Medium	High
Construction and operations activities	Habitat fragmentation	Increased predation pressure on native species as predators target patch edges Creation of meta-populations due to lack of habitat connectivity Increased roadkill as animals move due to patch size being too small to support permanent residence.	5	3	High	Site layout design to be compact and reduce areas of habitat fragmentation where possible.	3	3	Medium	High
Construction and operations activities	Uncontrolled fire	Reduction in habitat quality due to inappropriate fire frequency, or death of individuals.	3	3	Medium	Implementation of the Fire Management Plan (Appendix L) including: • Mine personnel will be trained in fire protection; • The site will be equipped with fire extinguishers and other fire prevention measures; • A hot work permit system will be implemented; and • Grassy weeds will be controlled.	1	3	Low	High
Construction and processing activities, and associated human use and waste production	Increase in abundance of introduced species	Increased predation pressure applied upon native fauna	3	3	Medium	Ensure all putrescible waste is securely stored until removed from site	1	3	Low	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						Implementation of the Domestic and Industrial Waste Management Procedure (EP-14) within the EMP (Appendix D). Monitor sightings of feral fauna and undertake control measures in consultation with stakeholders				
Construction and operations activities	Impact to fauna through the use of lighting, noise, vibration, or human movement	Avoidance of habitat surrounding Project by sensitive species (effective habitat loss)	4	3	High	All light sources will be aimed towards work areas and away from surrounding habitat, using light shields as necessary to minimise light spill. Implement the Noise Management Procedure (EP-21) within the EMP (Appendix D).	3	3	Medium	Medium
Earthworks and infrastructure construction and operation.	Fauna entrapment in infrastructure	Death or injury of fauna	4	2	Medium	Install fauna egress points in water storage dams and / or sumps Ensure vegetation around barbed wire fences is kept to a minimum Avoid the use of barbed wire in fences where possible. Barbed wire fences will be regularly inspected for trapped animals (particularly bats), and mitigation measures explored, including: • Covering top strand of barbed wire with a PVC pipe shroud; and • Tying flag tape to barbed wire. Implement the Biodiversity Management Plan (Appendix M) and the Terrestrial Fauna Procedure (EP-07) within the EMP (Appendix D).	3	2	Medium	High
Construction and operations activities	Vehicle strike	Death or injury of fauna	2	2	Low	Maintain suitable speed limits. Erect warning signs in any locations where fauna are regularly sighted. Ensure employee and local contractor awareness of local fauna and encourage reporting of sightings and any incidents of vehicle strike. Implement the Biodiversity Management Plan (Appendix M) and the Terrestrial Fauna Procedure (EP-07) within the EMP (Appendix D).	1	2	Low	High
Environmental Factor: Hydrological Processes										
Site earthworks and addition of infrastructure	Alteration of surface hydrology – stormwater management, sedimentation, contaminants, flooding	Scour from runoff velocity Terrestrial erosion Smothering of aquatic flora and fauna Loss of aquatic habitat	3	3	Medium	Utilise appropriate drainage infrastructure (drains, culverts) to maintain existing surface water flowpaths where possible. Stormwater within the development envelope will be contained and directed to the wastewater treatment plant prior to discharge. Implementation of the ESCP (Contained within Appendix O) and Water Management Procedure (EP-10) in the EMP (Appendix D) to avoid erosion.	1	3	Low	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Tertiary storm surge (1 in 10,000 AEP) event	Inundation during storm surges	Contamination of surface water due to breaching of process or wastewater treatment ponds.	2	5	High	Locate primary infrastructure in areas above the 1 % AEP flood levels. Model 0.1% AEP inundation and flood levels and locate processing plant infrastructure above these levels. Implementation of the ESCP (Contained within Appendix O), including: • Construct a diversion bund around site infrastructure.	1	5	High	Medium
Vegetation clearing, soil compaction, and development of sealed or impervious surfaces	Reduced aquifer recharge from impermeable surfaces	Reduced recharge of groundwater Reduced discharge to tributaries and the Elizabeth River	3	2	Medium	Retain as much of Lot 1817 in a condition that will assist recharge of aquifer, including retaining existing vegetation and soils outside of the Development Envelope.	2	2	Low	High
Development of site infrastructure altering aquifer characteristics	Altered porosity, permeability, and structure of shallow unconfined aquifers	Altered groundwater flow, levels and gradients	2	2	Low	Retain as much of the existing laterite substrate (potential aquifer) as possible within the Project area Rehabilitate sites at the completion of construction where they are not required for operations, including replacement of subsoils and topsoils as appropriate and undertake ripping and seeding with local provenance native taxa to enhance potential infiltration.	1	2	Low	High
Environmental Factor: Inland Water Environmental Quality										
Site construction works, including excavation, dewatering and surface disturbance	Contamination resulting from disturbance of AASS during construction.	Acidification and degradation of inland groundwater quality. Acidic discharge with elevated metal concentrations	3	4	High	Implementation of the Acid Sulfate Soils Management Plan (Appendix J). Additional ASS management measures are outlined in the Environmental Factor: Terrestrial Environmental Quality	2	4	Medium	High
Leaks and spills of chemicals/reagents/concentrates/fuel during construction and processing activities	Contamination of surface and groundwater from spills and leaks	Altered chemical properties of surface water and groundwater	3	4	High	Implement the Hazardous Material Management Procedure (EP-13), as summarised previously in Environmental Factor: Terrestrial Environmental Quality	2	4	Medium	Medium
Surface runoff from uncontrolled stormwater causing erosion	Contamination of surface and groundwater from erosion and sedimentation	Scour from runoff velocity Terrestrial erosion Smothering of aquatic flora and fauna Loss of aquatic habitat	4	3	High	Implementation of the ESCP (contained within Appendix O) and Implementation of the Water Management Procedure (EP-10) contained within the EMP (Appendix D) including: • Use of swales and sediment basins where required; and • Use of minor diversions where required. Implement the Hazardous Material Management Procedure (EP-13) including the following: • Ensure stockpiles of bulk materials are located well clear of any waterway or drainage systems; • The stormwater system for the site shall be inspected regularly to identify any failures and, if necessary, repairs shall be undertaken	1	3	Low	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						In addition, the following measures will be implemented: • Utilise appropriate drainage infrastructure (drains, culverts) to maintain existing surface water flowpaths where possible. • Stormwater within the development envelope will be contained and directed to the wastewater treatment plant prior to discharge.				
Environmental Factor: Marine Environmental Quality										
Discharge of wastewater generated by the Processing facility	Discharge of treated wastewater to the marine environment	Degradation of marine water quality within the Darwin Harbour system. Contamination of marine sediments within the Darwin Harbour system	5	4	Very High	Design wastewater treatment plant to achieve discharge water of desired quality. Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R) In addition, the following management actions will be taken: • Outfall location to be selected based upon dispersion modelling to ensure dilutions are adequate to reduce concentrations within small mixing zone • Develop wastewater treatment plans and quality control processes to support operation of the Processing Facility • Obtain and comply with Mixing Zone Licence Conditions • Obtain and comply with Waste Discharge Licence Conditions	2	4	Medium	Low
Construction and processing activities, and associated human use and waste production	Non-process waste (litter) entering waterways	Reduction in visual amenity Reduced water quality	4	2	Medium	Implement the Domestic and Industrial Waste Management Procedure (EP-14), in the EMP (Appendix D): • Recyclable materials, including cardboard, paper, glass, batteries, waste hydrocarbon drums and scrap metal, will be recycled wherever possible; • Housekeeping inspections of all work areas will be undertaken weekly; • Littering on site is prohibited and work and office sites are to be kept clean and tidy; • Rubbish containers are to be carried in all vehicles and provided at all work area; • Waste management will be addressed in the site induction.	2	2	Low	High
Leaks and spills of chemicals/reagents/concentrates/fuel during construction and processing activities	Terrestrial based chemical spills entering marine environment through soil and groundwater pathways	Degradation of marine water quality within the Darwin Harbour system (and resulting impacts to marine fauna) Contamination of marine sediments within the Darwin Harbour system	3	4	High	Implement the Hazardous Material Management Procedure (EP-13), as summarised previously in Environmental Factor: Terrestrial Environmental Quality Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R)	1	4	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
		(and resulting impacts to marine fauna)								
Clearing of vegetation exposing underlying soil surface	Sedimentation of marine environment via windblown or stormwater transportation	Degradation of marine water quality within the Darwin Harbour system. Contamination of marine sediments within the Darwin Harbour system	3	2	Medium	Implement the Ground Disturbance and Vegetation Clearing Procedure (EP-05) contained within the EMP, summarized in Environmental Factor: Terrestrial Flora. Limit clearing of mangrove areas to the minimal requirements.	2	2	Low	High
Disturbance of AASS during pipeline construction	Contamination of marine environment resulting from disturbance of AASS	Acidification of soil, groundwater and stormwater, resulting in contamination of the marine environment	4	4	Very High	Implementation of the Acid Sulfate Soils Management Plan (Appendix J). Additional ASS management measures are outlined in the Environmental Factor: Terrestrial Environmental Quality Minimise excavation of ASS as part of the installation of the outfall pipeline.	1	4	Medium	High
Environmental Factor: Benthic Habitat and Communities										
Construction of discharge pipeline	Disturbance or removal of benthic habitat and communities	Reduced quality of benthic habitat and communities Disturbance of sensitive subtidal mixed community and filter feeder BHC	4	3	Medium	Undertake a survey of the pipeline route prior to installation. Detailed high resolution BHC validation mapping of pipeline corridor to ensure avoidance of higher value BHC. Utilise existing disturbed areas to locate pipeline. Locate pipeline in area of least sensitive benthic habitat and communities. Implementation of the EMP to minimise risk of unplanned disturbance on BHC during pipeline installation.	1	3	Low	Medium
Discharge of process wastewater	Altered physio-chemical, nutrient and toxicant levels in water	Reduced productivity of benthic habitat and communities systems Suspended solids reducing light infiltration Changes in water temperature causing changes in fauna community assemblage Alteration of pH causing changes in bioavailability of metals, inhibited shell growth, and physical damage to gills, skin and eyes of fish Metal accumulation in benthic habitats and communities causing impairment of metabolic function, resulting in changes in morphology, physiology, biochemistry, behaviour and reproduction or mortality.	4	4	Very High	Design wastewater treatment plant to achieve discharge water of desired quality. Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R). Additional management cations are outlined in Environmental Factor: Marine Environmental Quality. Detailed high resolution BHC mapping of proposed outfall location, mixing zone and surrounding sensitive areas. Outfall location to be selected based upon suitable void of 250 m minimum to the nearest sensitive hard substrate communities.	2	4	Medium	Low
Leaks and spills of chemicals/reagents/concentrates/fuel during construction and processing activities	Contamination from chemical leaks or spills	Pollution of benthic habitat and communities with foreign hazardous materials.	3	4	High	Implement the Hazardous Material Management Procedure (EP-13), as summarised previously in Environmental Factor: Terrestrial Environmental Quality.	2	4	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Construction and processing activities, and associated human use and waste production	Non-process waste (litter) entering waterways	Smother or inhibit photosynthesis of sensitive benthic habitat and communities	3	3	Medium	Implement the Domestic and Industrial Waste Management Procedure (EP-14), in the EMP (Appendix D), as summarised in Environmental Factor: Marine Environmental Quality.	1	3	Low	High
Altered stormwater and runoff regimes, causing uncontrolled stormwater flows.	Stormwater runoff entering marine environment	Decline in benthic habitat and community health or potential fatalities of species Erosion of coastal and intertidal environment directly removing benthic habitat and communities or causing an overall decline in health	3	3	Medium	Implementation of the ESCP (Contained within Appendix O) and Implementation of the Water Management Procedure (EP-10) contained within the EMP (Appendix D) including: • Use of swales and sediment basins where required; and • Use of minor diversions where required. Additional management measures will include: • Vegetation clearing to be undertaken in stages and in dry season conditions wherever possible. • Erosion protection measures (bunding, spoon drains, silt fencing and sediment ponds) will be installed to contain any erosion.	1	3	Low	High
Environmental Factor: Marine Fauna										
Construction and processing activities, and associated human use and waste production	Non-process waste (litter) entering waterways	Entanglement and strangulation of dolphins, dugongs, turtle, crocodiles, and sawfish, causing injury or death Ingestion of waste by fauna, causing injury or death	3	3	Medium	Implement the Domestic and Industrial Waste Management Procedure (EP-14), in the EMP (Appendix D), as summarised in Environmental Factor: Marine Environmental Quality.	1	3	Low	Medium
Clearing of vegetation exposing underlying soil surface	Sedimentation of marine environment (increased turbidity) via windblown or stormwater transportation	Smothering of benthic habitat used by fauna for foraging	3	3	Medium	Implementation of the ESCP (Contained within Appendix O) and Implementation of the Water Management Procedure (EP-10) contained within the EMP (Appendix D) including: • Use of swales and sediment basins where required; and • Use of minor diversions where required. Additional management measures will include: • Vegetation clearing to be undertaken in stages and in dry season conditions wherever possible. • Erosion protection measures (bunding, spoon drains, silt fencing and sediment ponds) will be installed to contain any erosion.	1	3	Low	High
Leaks and spills of chemicals/reagents/concentrates/fuel during construction and processing activities	Contamination from chemical leaks or spills	Ingestion and coating of skin by hydrocarbons causing injury or death of airbreathing animals (i.e. cetaceans, sea snakes) Pollution causing immunosuppression, hepatoxicity, carcinogenesis, reproductive and development toxicity, dermal	3	4	High	Implement the Hazardous Material Management Procedure (EP-13) within the EMP (Appendix D). In addition: • Construct containment areas compliant with appropriate standards well clear of any waterway or drainage system	2	4	Medium	High

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
		toxicity and neurotoxicity of marine fauna				• Educate workforce on reporting and management of spillages. • Actively manage all spillages and recover contaminated material. • Construct bunding and pipelines with spill protection • Erosion protection measures (bunding, spoon drains, silt fencing and sediment ponds) will be installed to contain any erosion. • Rehabilitation of disturbed areas not required for infrastructure • Undertake regular inspections • Remediate contaminated soils in accordance with applicable regulations.				
Construction of discharge pipeline	Disturbance or removal of benthic habitat and communities	Reduction in survivability of sawfish, that use mangroves for nursery areas and foraging Reduction in food availability for dolphins and the green turtle, that forage in mangroves.	3	4	High	Undertake a survey of the pipeline route prior to installation. Utilise existing disturbed areas to locate pipeline. f Detailed high resolution BHC mapping survey of pipeline corridor and outfall area is required to ensure avoidance of higher value benthic habitats and communities that may be of significance to marine fauna.	1	4	Medium	Medium
Discharge of process wastewater	Altered physio-chemical, nutrient and toxicant levels in water	Reduced water quality resulting in altered feeding or spawning Increased salinity causing mangrove decline, resulting in habitat loss for sawfish Increased water temperature resulting in altered dissolved oxygen, and increased metabolic rates of sawfish. Increased water temperature resulting in an altered thermal environment for sea snakes and turtles. Increased water temperature resulting modified habitat for fish, and therefore changes to food availability for dolphins. Increased water temperature effecting seagrass habitats, changing the food availability for dugongs.	5	4	Very High	Design wastewater treatment plant to achieve discharge water of desired quality. Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R) In addition, the following management actions will be taken: • Outfall location to be selected based upon dispersion modelling to ensure dilutions are adequate to reduce concentrations within small mixing zone • Develop wastewater treatment plans and quality control processes to support operation of the Processing Facility • Obtain and comply with Mixing Zone Licence Conditions • Obtain and comply with Waste Discharge Licence Conditions	2	4	Medium	Low

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Environmental Factor: Air Quality and Greenhouse Gases										
Construction activities, earthmoving, and vehicle movement on unsealed surfaces.	Fugitive dust	Dust deposition on vegetation reducing photosynthetic potential Dust deposition in the marine environment Adverse impacts to human health through dust inhalation	5	2	Medium	Implement the Dust Emission Management Procedures (EP-11) within the EMP (Appendix D), including: • Regular watering of active areas and stockpiles areas; • Use of dust control equipment and housekeeping practices within the Processing Facility; • Enclosing a significant portion of the Facility into purpose built sheds; and • Vehicle speeds on site roads will be restricted.	3	2	Medium	High
Processing operations	Particulate emissions	Adverse impacts to human health through particulate inhalation	2	2	Low	No mitigation required	2	2	Low	Medium
Vehicle/mobile plant use during construction and operations	Carbon emissions from mobile plant	Contribution of carbon emissions (i.e. greenhouse gases) to global climate change	4	1	Medium	Implement the Greenhouse Gas Emissions Procedures (EP-12) within the EMP (Appendix D). Minimise use of vehicles where possible.	3	1	Low	High
Processing operations	Stack gaseous emissions	Adverse impacts to nearby receptors through inhalation of carbon monoxide, nitrogen dioxide, sulphur dioxide, chlorine, or hydrogen chloride	2	3	Medium	Use scrubbers for the control of atmospheric emissions from the Project stack sources, including stacks in the following process areas: • Oxide roasting; • Acid regeneration; and • Tail gas scrubber. Key process vessels and equipment should be insulated to minimise energy loss.	1	3	Low	Medium
Processing operations	Indirect carbon emissions from use of electricity	Contribution of carbon emissions (i.e. greenhouse gases), contributing to global climate change	3	2	Medium	Implement the Greenhouse Gas Emissions Procedures (EP-12) within the EMP (Appendix D), including: • Energy saving devices will be used where possible and based on the energy star ranking standard • Rehabilitate disturbed areas as soon as possible • Utilise lowest GHG emitting fuel / energy sources that are feasible. Consideration will be given to the use of alternative energy sources such as solar panels where feasible, as the Project progresses. Key process vessels and equipment should be insulated to minimise energy loss.	2	2	Low	Medium
Projected impacts of climate change resulting in an increased frequency of extreme storm surge events	Inundation from extreme storm surge	Contamination of surface water due to breaching of processing or wastewater treatment ponds.	2	5	High	Locate primary infrastructure in areas above the 1 % AEP flood levels. Model 0.1% AEP inundation and flood levels and locate processing plant infrastructure above these levels. Implementation of the ESCP (Contained within Appendix O), including: • Construct a diversion bund around site infrastructure.	1	5	High	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Environmental Factor: Social, Economic and Cultural Surroundings										
Construction and operations activities	Water outfall and visible project infrastructure	Contamination or restriction of use of the Elizabeth River and the Darwin Harbour may occur	4	4	Very High	Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R) In addition, the following management actions will be taken: • Outfall location selected based upon dispersion modelling to ensure dilutions are adequate to reduce concentrations within small mixing zone • Develop wastewater treatment plans and quality control processes to support operation of the Processing Facility • Obtain and comply with Mixing Zone Licence Conditions • Obtain and comply with Waste Discharge Licence Conditions Ensure Elizabeth River Boat Ramp access is maintained at all times Develop a Community and Stakeholder Engagement Plan, including mechanisms for providing information on Project activities and for identifying and addressing ongoing concerns throughout the life of the Project Implement a Complaints and Grievance Protocol, incorporating prompt mitigation of concerns as appropriate.	2	4	Medium	Medium
Increased local workforce during construction and operations	Increased demand for local housing	Reduction in housing availability and affordability for low-income and vulnerable groups	3	3	Medium	Establish partnerships with Litchfield and Palmerston Councils to collaborate on local housing issues. Investigate options for entering into partnerships and share-value agreements with local temporary accommodation providers to house construction and operational staff. Maximise local employment and minimise fly-in/fly-out personnel by implementing the following strategies: • Develop an Employment Strategy and Local Recruitment Policy. • Employ local personnel, wherever possible and where necessary skills are available. • Develop employee relocation incentives to encourage a greater residential workforce. • Utilise local businesses wherever possible to increase indirect local employment opportunities • Establish a skills training scheme. • Liaise with local institutions to ensure skills required for the Project are catered for in education programs. • Establish partnerships with local businesses, such as food catering companies, transport companies and a range of other service providers.	1	3	Low	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Initiate early engagement with potential local businesses to ensure Project requirements are understood and businesses have an opportunity to review capabilities as required to be able to service Project needs.				
Historic and current use of the site for recreational vehicle use	Unexpected public access to the site during construction works	Vehicle collisions Vehicle-pedestrian/pet collisions Injury to public resulting from illegal use of site	2	3	Medium	Install a boundary fence, entry gate, gate house and signage to deter unauthorised access to the site Develop a Supply Chain Management Plan covering a wide range of transportation and supply chain matters, including public safety along transport routes and managing third party personnel conduct at work. Ensure emergency exit points are situated at strategic locations around the site, for use in an emergency. Ensure sufficient lighting and signage is installed to avoid injury to public within the vicinity of the site.	1	3	Low	Medium
Construction and operations activities	Construction, operations, and rail noise	Reduced amenity for nearby residents	3	2	Medium	Implement the Noise Management Procedure (EP-21) within the EMP (Appendix D). In addition, the following strategies will be implemented to manage the impacts of noise: • Provide an induction to construction personnel (including sub-contractors) addressing responsibilities with regard to noise management. • Ensure truck drivers are informed of designated vehicle routes, parking locations, delivery hours and minimising engine braking and idling. • Provide education of supervisors, operators and sub-contractors on the need to minimise noise through toolbox meetings. • Select appropriately sized equipment for the task, such as earthmoving/excavation equipment. • Avoid noisy plant working simultaneously where possible. • Ensure all equipment is equipped with appropriate noise controls (e.g. mufflers, silenced exhausts, acoustic enclosures, flashing lights as an alternative to revising beepers) and equipment is shut down and not left idling when not in use. • Ensure equipment is operated in the correct manner and adequately maintained - including replacement of engine covers, tightening of rattling components, repair of leakages in air lines and shutting down equipment not in use. • Consider the use of temporary solid screens for noise mitigation of noisy stationary equipment.	2	2	Low	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Consider the use alternatives to 'beeper' style reversing alarms, such as broadband style alarms (or quacker alarms). • Establish a Complaints and Grievance Protocol to address noise complaints.				
Construction and operations activities	Construction traffic, operational traffic, rail movement	Traffic delays due to congestion along Channel Island Road Increased road safety risk due to increased use of Channel Island Road Delays at level crossings at Channel Island Road and Jenkins Road	4	2	Medium	Implementation of the Traffic Management Plan (Appendix Y) In addition, the following mitigation strategies will be implemented: • Design site access and egress to ensure safety is maintained for TNG staff and public road users. • Liaise with appropriate regulators to ensure adequate signage is installed to notify public road users of trucks entering and exiting the site. • Provide a bus service to and from the site for staff, reducing traffic volumes on roads in the vicinity of the Project. • Investigate options of utilising existing infrastructure for 'Park and Ride' locations. • Review the potential for cyclist infrastructure to provide a safe link for staff travelling to and from the site by bicycle. • Develop safe and efficient parking on the site. • Maximise the length of the proposed rail siding line to minimise the potential for delay at the level crossings. • Liaise with rail providers to review timing of rail movements to minimise impact on road traffic as much as practicable.	2	2	Low	Medium
Site infrastructure	Construction of multi-storey buildings and stacks	Reduced visual amenity from public recreation areas, such as Elizabeth River	4	3	High	Ensure core Processing Plant infrastructure is constructed on the southern peninsula of the site, reducing visual impacts from Palmerston and the Elizabeth River Boat Ramp. Maintain the mangrove belt around the boundary of the site. Maintain screening vegetation along Channel Island Road wherever possible. Establish landscaping around the site to improve amenity	1	3	Low	Medium
Site infrastructure	Outdoor lighting of plant infrastructure	Nuisance and distracting lighting of nearby properties and roads	4	2	Medium	Design lighting in accordance with *Australian Standard 4282:1997 'Control of the obtrusive effects of Outdoor Lighting'* Install directional lighting wherever possible to reduce 'light spill' effects. Establish a Complaints and Grievance Protocol to capture any issues related to light impacts from the Project.	2	2	Low	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
Construction activities	Site earthworks	Disturbance of culturally significant sites, including burial sites	2	3	Medium	Implement the Aboriginal and Cultural Heritage Procedure (EP-04) within the EMP (Appendix D), including: • Develop a Code of Conduct for workers and inductions that cover awareness and protection of heritage values. In addition, the following strategies will be implemented: • Any previously unrecorded archaeological sites encountered will be reported to the Northern Territory Heritage Branch for advice on how to respond • Ensure soil material originating from the site remains within the site and is not disposed off-site. • Comply with the conditions and requests of the Authority Certificate obtained from AAPA. • Establish a process of stakeholder engagement and participatory planning with the Larrakia people. • Engage with relevant Indigenous stakeholders to ensure traditional activities in nearby areas are understood and not impacted. • In the event that any skeletal remains are unearthed TNG will stop work and immediately report such disturbance to the Northern Territory police, and to the Director Heritage Branch, Department of Tourism and Culture. • Implement mitigating strategies for environmental factors applicable to the Project to ensure no downstream impacts occur to heritage items and values as a result of Project activities.	1	3	Low	Medium
Environmental Factor: Human Health and Safety										
Unloading, loading and movement of trains and vehicles	Release of hazardous materials due to vehicle or rail accident	Injury or harm to employees, contractors, or general public	2	4	Medium	Engage specialist third party contractors to conduct road and rail transport requirements for the Project, in line with the Contractor Management Procedure (EP-18) within the EMP (Appendix D). Implement the Hazardous Material Management Procedure (EP-11), as summarised previously in Environmental Factor: Terrestrial Environmental Quality. In addition, the following strategies will be implemented to manage the risk and mitigate the impacts of release of hazardous materials: • Ensure all vehicles are licensed and carry appropriate equipment to respond to a spill, including PPE. • *Apply Australia Dangerous Goods Code (ADG Code) for Transport by Road and Rail* requirements to all transport activities.	1	4	Medium	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Ensure loads are appropriately secured prior to leaving the site. • Establish designated transport routes to avoid local residential areas. • Establish collaborative relationships with local emergency services, ensuring they are aware of the Project activities, including transport of materials via road and rail. • Identify all major incidents and hazards that could result from Project operation. • Conduct and document a safety assessment in relation to the operation of the facility, which involves a comprehensive and systematic investigation and analysis of all aspects of risks to health and safety that could occur in the operation of the Major Hazard Facility. • Implement control measures that eliminate or minimise the risk of a major incident occurring at the Project. • Establish a Safety Management System (SMS) for the operation of the Project. • Prepare a Safety Case for the Facility that demonstrates that the Project SMS will control risks arising from major incidents and hazards that could cause a significant impact. The Safety Case must demonstrate the adequacy of the measures to be implemented by the operator to control risks associated with the occurrence of major incidents.				
Construction and operations activities	Release of hazardous materials within the Project area.	Injury or harm to employees, contractors, or general public, particularly inhalation or irritation of skin	2	3	Medium	Implement the Hazardous Material Management Procedure (EP-13), as summarised previously in Environmental Factor: Terrestrial Environmental Quality. In addition, the following strategies will be implemented to manage the risk and mitigate the impacts of release of hazardous materials: • Staff will be provided with sufficient training to competently and safely handle hazardous materials. • Appropriate PPE will be provided to all staff working with hazardous materials on site. • Change management protocols will be established to ensure requirements of any new materials brought to site are understood and additional measures can be implemented, where required. • *Australian Dangerous Goods Code* requirements for storage compatibility will be adhered to.	1	3	Low	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• Spill response procedures and equipment will be available and understood by employees and contractors at the site.				
Operations activities	Explosion on site.	Injury or harm to employees, contractors, or general public	2	4	Medium	Design and construction of the Facility in accordance with Australian and International Standards, Building Codes and Licence requirements. Control of emission of flammable vapours, gases and mists (e.g. through the use of enclosed container and transfer systems, vapour recovery connections, sufficient ventilation). Elimination of ignition sources from hazardous areas. Installation of leak detection systems. Storing the minimum required quantities of flammable / explosive materials. Control of 'hot work' through an established permitting system. Good housekeeping practices on site. Implement the ERP, as required.	1	4	Medium	Medium
Construction and operations activities	Significant fire resulting from Project activities.	Injury or harm to employees, contractors, or general public	2	3	Medium	Implement the Fire Management Plan (Appendix L). In addition, the following management strategies will be implemented: • Ensure fire response equipment (e.g. extinguishers, fire reels) is available, operational and maintained. Fire extinguishers to be used in accordance with *Australian Standard 1841.1-2007 (Portable Fire Extinguishers – General Requirements).* • Fire hydrants will be connected on a ring main throughout the Facility, designed as per *Australia Standard 2419.1-2005 (Fire Hydrant Installations)*. Fire water will be sourced from the fire water surge tank. • A foam injection and deluge system will be required for the solvent extraction mixer settling units where the organic solution is used. The foam deluge system shall be designed as per *Australian Standard 2118.3-2010 (Automatic Fire Sprinkler Systems – Deluge Systems).* • Use of firewalls between high risk units where appropriate. • Personnel trained in the use of fire response equipment.	1	3	Low	Medium

Environmental Aspect	Risk Pathways	Impacts	Likelihood	Consequence	Risk Rating	Risk Treatment/Management/Mitigation Strategy	Likelihood	Consequence	Residual Risk Rating	Level of Certainty
						• 'Hot work' permit system in operation. Where there is a perceived high risk (e.g. on Total Fire Ban days), ensure trained personnel are on standby when hot work is carried out on site. • Deliberate lighting of fires on site to be prohibited. Implement the Emergency Response Plan (Appendix Y), as required.				
Discharge of process wastewater	Bioaccumulation from wastewater discharge	Adverse human health impacts through consumption of fish and bivalves	4	4	Very High	Design wastewater treatment plant to achieve discharge water of desired quality. Implementation of the Marine Environmental Quality Monitoring and Management Plan (MEQMMP) (Appendix R) In addition, the following management actions will be taken: • Outfall location to be selected based upon dispersion modelling to ensure dilutions are adequate to reduce concentrations within small mixing zone • Develop wastewater treatment plans and quality control processes to support operation of the Processing Facility • Obtain and comply with Mixing Zone Licence Conditions • Obtain and comply with Waste Discharge Licence Conditions	2	4	Medium	Low
Personnel working outside	Environmental exposure of workers (e.g. climatic conditions)	Sunburn and heat stress of personnel Injury due to building damage during cyclone Injury due to flooding	4	3	Medium	All personnel (including contractors and office workers) will be trained in the risks associated with climate exposure, the signs and symptoms of over-exposure to heat and its effects (e.g. dehydration) and what to do in case of an emergency. First-aid facilities will be equipped to provide at least an initial response to incidents of this type. Drinking water will be available across the site at clearly signposted locations. To reduce sun exposure, appropriate PPE (e.g. long-sleeved shirts, trousers, hats and/or helmets) and sunscreen will be made available and their use made compulsory. Develop and implement a Cyclone Response Plan.	1	3	Low	High
Personnel working outside	Animal attacks and biting insects	Injury due to bites from venomous snakes, crocodiles, and free roaming dogs Nuisance, pain, irritation and infection caused by biting midges and mosquitoes Transmission of viruses by biting midges and mosquitoes	2	3	Medium	Site induction and personnel training to address potential risks associated with biting animals, how to avoid them and what to do in case of a bite or emergency. Personnel provided PPE to provide protection from biting animals and deter biting insects e.g. boots, gloves, long sleeves, trousers. Implement Biting Insects Management Plan (Appendix Z).	1	3	Low	High

1.3 OUTCOMES

Overall, the risk assessment indicates that the potential impacts associated with the proposal are expected to pose a low to moderate risk to all of the NT EPA's environmental objectives. There are high residual risks associated with the following:

- Contamination of surface water due to breaching of processing or wastewater treatment ponds during storm surge inundation from a tertiary or 1 in 10,000 year event.

These risks are not expected to be unacceptable, but rather the high risk rating indicates that this would be a catastrophic event that can be mitigated to some extent by management and design, however it cannot be fully controlled or the risk eliminated.

The suite of management plans appended to the Draft EIS seek to mitigate and manage the risks presented above.

The technical studies and design detail available to inform the risk assessment were considered sufficient to allow for most risks to be assessed with a moderate to high level of certainty. The risks that were assigned a low level of certainty relate to discharge of treated wastewater from the Project. The further work required so that all risks can be assessed with a high degree of certainty, is identified in the Commitments Register.

2 CUMULATIVE IMPACT ASSESSMENT

The TOR (section 4.9) requires an assessment of cumulative impacts associated with the Project.

Cumulative impacts are the combined impacts of past, current and future activities. To consider the cumulative impacts, the residual impacts of the current proposal were assessed in the context of impacts associated with existing developments in the region, as well as reasonably foreseeable future developments.

2.1.1 Assessment Approach

Cumulative environmental impacts have been assessed where the Project has the potential to contribute significantly to a regional environmental impact – i.e. where the Project has a residual impact rated as medium or higher (section 1.2.4). Where the Project has the potential to contribute significantly to a regional environmental impact, the potential for cumulative impacts from other current and future land uses was considered based on the publicly available information summarised below.

Where potential cumulative impacts were identified, these are noted in the risk register and the risk rating was re-evaluated. The sections below provide further detail in relation to the past, currently proposed, and reasonably foreseeable future activities that were considered as part of the cumulative impact assessment.

2.1.2 Past and Current Land Uses

The Site is located on undeveloped Vacant Crown Land within the proposed Middle Arm Industrial Precinct. Surrounding land uses include extractive industries, heavy industrial, infrastructure (rail, road, utilities), conservation, port/ wharves, and recreation. Lot 1817 is currently used for extractive industries.

Major developments in the vicinity of the site include:

- INPEX Ichthys Liquid Natural Gas Plant;
- Darwin Liquid Natural Gas Plant;
- Weddel and Channel Island Road Power Stations; and
- Channel Island Road accommodation.

A proposed future development includes the construction of an ethanol plant at Middle Arm by Coogee chemicals.

There is potential for future residential development, however that is not in the direct vicinity of the Darwin Processing Facility.

Much of the surrounding area is used for recreation; the Elizabeth River for fishing and boating and vacant crown land for 4 wheel driving, dog walking.

The level of impact associated with past and current land-uses is summarised below:

- Review of satellite imagery indicates that land clearing and soil disturbance/erosion has occurred on a small to moderate scale on Middle Arm peninsula. Impacts are largely confined to the development areas identified above.
- Weed infestation appears to be concentrated in disturbance areas where there is discontinuous land use such as the extractive resources licence locations on Lot 1817.
- Clearing of terrestrial vegetation and potential disturbance of benthic habitat and communities under the Proposal would add to previous clearing in the locality for the INPEX and Darwin LNG Projects.

- Baseline surface water and groundwater quality monitoring undertaken in at the site indicates that the water quality has been minimally impacted by past or current land use. The Darwin Harbour Report Card 2018 states that 'water quality in Elizabeth River Estuary and East Arm is excellent' (DENR, 2019). INPEX and Darwin LNG processing plants currently have licences to discharge waste water into Darwin Harbour.
- INPEX and Darwin LNG both contribute greenhouse gas emissions as a result of the LNG processing activities.
- The Project area does receive frequent bushfires, which has somewhat degraded habitat values. The cause of this impact is likely to be a combination of current land-use (i.e. informal recreation and resources extraction) and lack of active fire management across the areas of Vacant Crown Land.
- There is a moderate level of road traffic associated with the existing land–uses, concentrated during shift changes at the LNG processing facilities.

2.1.3 Summary

Potential cumulative environmental impacts in the Middle Arm and Palmerston/ Weddell regions were considered in the context of the existing land uses and reasonably foreseeable future developments. Based on these observations, the main residual environmental impacts associated with the Proposal that could contribute to cumulative impacts are the following:

- Contribution of contaminant loads to Darwin Harbour through discharge water;
- Disturbance of terrestrial habitat and benthic habitat and communities;
- Contribution to Northern Territory's greenhouse gas emissions; and
- Contribution to increased road traffic in the vicinity of the Project.

Taking cumulative impacts into consideration did not alter any of the residual risk ratings for the Darwin Processing Facility when mitigation and best management measures are applied.