

Terms of Reference for an Environmental Impact Statement (EIS)

Southern Lease Mining Project

Groote Eylandt Mining Company Pty Ltd (GEMCO)

Groote Eylandt – East Arnhem Local Government Area

August 2023

Proposal :	Southern Lease Mining Project
Proponent:	Groote Eylandt Mining Company Pty Ltd (GEMCO)
NT EPA Reference:	EP2023/024
Location:	Groote Eylandt, East Arnhem Region, Northern Territory
Local Government Area:	East Arnhem Regional Council
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Further information and guidance on the environmental impact assessment process is available on the NT EPA website at: www.ntepa.nt.gov.au

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Contents

1. Introduction	5
1.1. Overview.....	5
1.2. Assessment under the bilateral agreement.....	5
1.3. Assessment period.....	6
2. Matters to be addressed in the EIS	6
2.1. Executive Summary of the draft EIS	6
2.2. Proposal description.....	6
2.2.1. Overview	6
2.2.2. Proponent	7
2.2.3. Objectives of the proposal.....	7
2.2.4. Statutory framework.....	7
2.2.5. Site selection and design.....	7
2.2.6. Construction and operation.....	8
2.2.7. Rehabilitation and closure.....	11
2.2.8. Changes or amendments to proposal	12
2.3. Stakeholder engagement and consultation	13
2.3.1. Aboriginal stakeholders	13
2.4. Environment protection and management requirements.....	14
2.4.1. Principles of ecologically sustainable development.....	14
2.4.2. Management hierarchies.....	14
2.4.3. Ecosystem-based management	14
2.4.4. The impacts of a changing climate.....	14
2.5. Information requirements for environmental factors	15
2.5.1. Terrestrial environmental quality	16
2.5.2. Terrestrial ecosystems.....	18
2.5.3. Hydrological processes.....	20
2.5.4. Inland water environmental quality.....	22
2.5.5. Aquatic ecosystems.....	24
2.5.6. Air quality	26
2.5.7. Atmospheric processes.....	27
2.5.8. Community and economy	29
2.5.9. Culture and heritage.....	31
2.5.10. Human health	33
3. Other requirements	34
3.1. Other environmental factors or matters.....	34
3.1.1. Matters of national environmental significance (MNES).....	34
3.2. Offsets.....	35
3.3. Whole of the environment considerations.....	36
3.4. Consideration of the impacts of a changing climate	36

4. Public consultation requirements	36
4.1. Submission period.....	36
4.2. Manner in which to publish.....	36
4.3. Advertising.....	37
4.4. Public consultation locations	37
Appendix A – List of relevant guidance material	38

1. Introduction

1.1. Overview

The Southern Lease Mining Project (the proposal) proposed by Groote Eylandt Mining Company Pty Ltd (the proponent) is being assessed by the Northern Territory Environment Protection Authority (NT EPA) under the *Environment Protection Act 2019* (EP Act) at the level of an Environmental Impact Statement (EIS).

These Terms of Reference (TOR) set out the matters relating to the environment that are to be addressed in the EIS for this proposal, in accordance with regulations 98(1)(a) and 98(2) of the Environment Protection Regulations 2020 (EP Regulations). The EIS must also address all requirements in the [NT EPA guidance: Preparing an environmental impact statement](#).

A proponent initiated EIS referral was submitted to the NT EPA on 17 April 2023 for consideration under the EP Act. The proposal is to develop the Southern Lease Mining Project, located on Aboriginal freehold on NT Portion 1632, approximately 10 km south of Angurugu on Groote Eylandt in the East Arnhem Local Government Area. The Southern Lease Mining Project consists of:

- Clearing of approximately 1,620 ha
- Open cut mining of approximately 15 Mt of manganese ore and hauling to the existing GEMCO Mine for processing
- Construction of supporting infrastructure (e.g. water dams, water treatment plant, refuelling station, sewage treatment plant, heavy vehicle parking, crib hut and haul roads)
- Progressive rehabilitation of disturbed areas.

The proposed action is related to the GEMCO Manganese Mine, which has operated on Groote Eylandt for approximately 60 years.

Further details of the proposal, and the notice of decision and statement of reasons for the NT EPA's decision are on the [NT EPA's website](#).

1.2. Assessment under the bilateral agreement

On 28 April 2023, the Commonwealth Minister's delegate paused the statutory clock on the Assessment Approach decision, pending a decision on whether the proposed action required assessment by the NT EPA, and if so, whether the bilateral agreement applies.

On 4 May 2023, the delegate of the Commonwealth Minister for the Environment and Water determined that the proposal is a controlled action for matters protected under Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Referral EPBC 2023/09457) and, as such, requires assessment and an approval decision due to the potential for significant impact on:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (s20 and s20A)

The proposal is being assessed by the NT EPA in accordance with the bilateral agreement made under section 45 of the EPBC Act as referenced in section 45 of the EP Act. These TOR have been prepared to meet the requirements of both government jurisdictions.

Information on the EPBC Act and protected matters can be obtained from the [Australian Government Department of Climate Change, Energy, the Environment and Water \(DCCEEW\) website](#).

1.3. Assessment period

The draft EIS is to be submitted to the NT EPA within two years from the date these TOR were issued (in line with regulation 99 of the EP Regulations and in consideration of the matters listed under EP Regulation 99(3)).

2. Matters to be addressed in the EIS

2.1. Executive Summary of the draft EIS

A summary of the draft EIS is required as part of the EIS documentation. The summary must be written as a stand-alone document, able to be provided on request to interested parties who may not wish to read the full draft EIS.

The summary must provide the following at a minimum:

- a clear and concise overview of the proposal including its lifespan, and information about the proponent
- an explanation of the relationship between the proposal, the previously assessed mining project and the wider GEMCO mining operation
- an explanation of the environmental approvals process and function of the EIS
- a summary of the mine site planning and layout design options considered including justification for selection of the preferred option
- an overview of the existing environment including climate, location and significance of sensitive receptors that may be impacted by the proposal
- a summary of the environmental impacts and benefits of the proposal and cumulative impacts of the proposal in consideration of existing and proposed activities in the GEMCO leases.
- a summary of measures to avoid, mitigate and offset (if applicable) potential significant impacts and enhance benefits of the proposal, with clear and measurable outcomes and commitments for environment protection and benefits
- a summary of closure outcomes and the intended future use of the site
- a summary of stakeholder participation and future commitments
- a summary of approval requirements including a description of any licences, permits or consents.

2.2. Proposal description

2.2.1. Overview

Provide a clear description of the proposal and the full scope of works for which approval is sought. The proposal description must include:

- a summary table listing the key physical components, proposal development stages and associated activities

- distinction between the proposal and the previously assessed and existing mine components, and how they interact
- a description of the proposal footprint and potentially affected area
- maps, figures, images, diagrams and flow charts
- any variations or modifications to the proposal since the referral information was submitted
- any constraints that may impact approval or implementation
- where there is uncertainty in the detailed design, footprint, capacity or life of the proposal, a clear explanation of the approach to resolving this uncertainty and the maximum extent for each parameter provided.

2.2.2. Proponent

Provide background to the proponent including but not limited to:

- information on the environmental history of the proponent including, but not limited to, notification/ disclosure of offences, or any non-compliances with state/ territory or Commonwealth environmental approval conditions
- partnerships with other organisations or industries as part of the proposal.

2.2.3. Objectives of the proposal

State the rationale and justification for the proposal, considering social, economic and other environmental benefits and costs to the NT, in particular to local and regional communities, during the life of the proposal and post development.

List the key objectives of the proposal and include a description of how the proposal meets these objectives.

Demonstrate how the objects in section 3 of the EP Act can be met, and address the specific requirements of sections 42 (purpose of environmental assessment) and 43 (general duty of proponents) of the EP Act.

Demonstrate the application of the principles of ecologically sustainable development to decision-making processes as set out in Part 2 Division 1 of the EP Act.

2.2.4. Statutory framework

The EIS must provide information on the statutory framework for the proposal, including a description of any permits, consents, or other approvals that have been granted/obtained and any that will be required from NT and Australian government authorities e.g. titles under the *Mineral Titles Act 2010*, authorisation under the *Mining Management Act 2001*, *Work Health and Safety (National Uniform Legislation) Act 2011*, *Water Act 1992*, *Aboriginal Land Rights (Northern Territory) Act 1976*.

2.2.5. Site selection and design

Describe mine site planning and layout design options considered, reasons for selection of the preferred site and design, and how this avoids and/or mitigates potential impacts and risks to the surrounding environment and its users.

Provide details of the suitability of the design with regard to:

- potential impacts on environmental values

- current site climatic conditions (e.g. wind, rainfall, evaporation)
- how the design provides for adaptation to a changing climate, e.g. wetter climate, increased storm intensity
- the extent, detail and outcomes of investigations undertaken to determine the suitability of alternative options including, but not limited to:
 - geochemical characterisation investigations undertaken to determine the physical and chemical characteristics of the materials to be mined and processed (e.g. ore, tailings and waste rock), ensuring investigations are consistent with the Global Acid Rock Drainage (GARD) guidelines (INAP 2009) and the Commonwealth guidelines Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia 2016)
 - investigations into the availability of suitable construction and rehabilitation materials, and soil quality and integrity
- how the design delivers benefits to nearby communities
- any other reasons for selecting a preferred option.

Provide details of the design of key proposal components (e.g. run-of-mine (ROM) pad, pit/s, dam/s, haul roads), as prepared by suitably qualified engineers and referencing accepted engineering and design standards and leading practice guidelines that have been used to inform design, including:

- detailed diagrams and schematics
- design criteria, and impact and risk assessments undertaken, to inform the design requirements for key components (and any other mine components that pose a significant risk to the environment in the event of inadequate performance or failure) e.g. Australian National Committee On Large Dams (ANCOLD) guidelines (ANCOLD 2012).

2.2.6. Construction and operation

Provide a detailed description of all construction and operation aspects of the proposal as outlined in Table 1.

Table 1 Information requirements for the proposal description

Topic	Required information
Site layout maps	The description of the proposal must include site layout maps, graphs and illustrations that depict the proposed location and dimensions of the proposal components clearly identifying the areas of: <ul style="list-style-type: none"> • existing disturbance (including areas currently and previously impacted by the mining operation), infrastructure, roads/tracks, natural and modified landforms • new disturbance and infrastructure, including (where applicable): <ul style="list-style-type: none"> ○ all areas to be cleared and disturbed ○ pits (maximum footprint and depth) including a cross-section to depict bench heights and wall slopes ○ storage areas for overburden and stockpiles (including but not limited to topsoil and ROM ore) ○ laydown areas, vehicle park up areas, servicing and refueling areas,

Topic	Required information
	<ul style="list-style-type: none"> ○ borrow areas, and access and haul roads ○ service corridors and firebreaks ○ buildings and structures to be built ○ infrastructure related to water storage, water treatment (including potable water and wastewater) and electricity transmission ○ erosion and sediment controls ○ stormwater and drainage infrastructure ○ chemical and waste storage facilities ○ load in and load out facilities ○ any other features that would result from the proposal <ul style="list-style-type: none"> ● current land tenure, owner(s) and lease(s) of the land of which the proposal area covers and any other interests including agriculture, mining, petroleum, native title (claims or determined), and Aboriginal freehold land ● boundaries of mining tenures, granted or proposed, to which the proposal area is, or would be subject ● sensitive environment (including sensitive and/ or significant vegetation types identified in the NT Land Clearing Guidelines¹, turtle nesting habitat, permanent and seasonal residential communities, sites where cultural activities are undertaken, and no-go work areas/exclusion zones) overlying the proposal area and surrounds i.e. within the area potentially affected by the proposal. <p>Provide a high-quality contemporary aerial/satellite view of the proposal area and area of potential impact to describe current site conditions including existing disturbance.</p> <p>Provide high-quality plans / drawings of the proposed mining campaign stages (including progression of pit/s development, expansion of other mining components).</p>
Construction	<p>Describe all elements and stages of the construction phase including:</p> <ul style="list-style-type: none"> ● construction methodology ● equipment and machinery required ● construction materials required – major types, quantities, qualities, sources, storage requirements and potential hazards ● vegetation clearing and site preparation ● available and potential sources of fill / borrow material ● location, extent and nature of temporary stockpiles of borrow material ● erosion, sediment and drainage control ● any new ancillary infrastructure and upgrades required to service the proposal, including road access, and supply of electricity, water and sewerage ● waste management including classification of waste streams ● controls to avoid spills/discharges to the environment ● dust management and control ● noise management and control ● light pollution management and control

¹ In accordance with the [NT Land Clearing Guidelines](#).

Terms of Reference for an Environmental Impact Statement (EIS)

Topic	Required information
	<ul style="list-style-type: none"> • biosecurity management and control in relation to weeds and feral animals • fire management and control • exclusion/no-go work areas • timeframes for completion <p>Where multiple alternatives exist, the choice of the preferred option(s) must be clearly explained and a comparison provided against other options in terms of potential environmental impacts.</p>
Operation	<p>Describe all elements and stages of the operation phase including:</p> <ul style="list-style-type: none"> • the location, tonnage and quality of the mineral resources and/or reserves within the proposal area • infrastructure – location, size and type • materials and chemicals required - major types, quantities, qualities, sources, storage requirements and potential hazards • any limitations to the effective operation and management of the proposal e.g. ore grade, climatic conditions • timeframes for the commencement and completion of staged operations • ongoing maintenance and upgrades required to service any infrastructure including roads and erosion and sediment controls • applicable legislation, guidelines, standards and permits • location, shape, size and nature of temporary stockpiles • erosion and sediment control • weed management • dust management and control • noise management and control • light pollution management and control • fire management and control • controls to avoid spills/discharges to the environment • information on contaminated materials that will pose a risk to the environment • adequacy and likely effectiveness of mitigation measures and controls for all operational environmental management aspects. • details on incident reporting and emergency response measures to be undertaken in the event of a hazardous material spill.
Non-mining waste	<p>Describe all waste (i.e. type and quantity) that will be generated during the proposal life, including construction and operation phases. Classify waste in accordance with NSW Waste Classification Guidelines.</p> <p>Describe how each waste stream will be managed and demonstrate application of the waste management hierarchy.</p> <p>Outline nominated recycling and/or landfill facilities licensed for the waste type, and whether there is sufficient capacity and indicative agreement from those facilities to accept the waste from the proposal.</p>
Mining waste	<p>Use the outcomes of geochemical characterisation to identify the occurrence and risks of acid and metalliferous drainage (AMD) including circum-neutral saline drainage, from existing and proposed infrastructure / landforms including temporary</p>

Topic	Required information
	<p>ore and waste stockpiles.</p> <p>Assess the potential quality of runoff and seepage from the mining operations. Ensure that the assessment considers acid base accounting, and contaminants including (but not limited to) metals, major ions, turbidity, salinity, nutrients and hydrocarbons.</p> <p>Describe how each mining waste will be managed including, if applicable, treatment methodology (including any necessary reagents and storage requirements), disposal locations and monitoring/ maintenance details.</p>
Water requirements	Describe all water requirements relevant to each proposal phase. Provide detailed information on demand/volume required, sources, storage, treatment and management of water aspects (provide a water balance).
Transport and traffic	<p>Describe traffic and transport activities during construction and operation, including but not limited to:</p> <ul style="list-style-type: none"> • details of the proposed transport routes including proposed haul roads, access tracks and public roads (including any proposed realignments) • existing transport baseline information including current traffic numbers and movement patterns • vehicle movements for the proposal including type, size, number and frequency of movements to and from site • hours of operation • details on access and transport routes including proximity to sensitive receptors (e.g. waterways, townships or communities / outstations, sensitive and/or significant vegetation and culturally sensitive sites) • details on traffic management aspects, incident reporting and emergency response measures to be undertaken in the event of a hazardous material spill • details on changes or restrictions to local traffic due to development of new roads and construction vehicles resulting in delays or inconvenience to local communities and other road users.
Energy	<p>Provide relevant information with respect to energy during construction and operation, including but not limited to:</p> <ul style="list-style-type: none"> • energy requirements and sources • options for sourcing energy from renewable and non-renewable sources, with a preferred option and justification for the selected option
Workforce	<p>For each phase of the proposal, provide a summary of the:</p> <ul style="list-style-type: none"> • estimated number of people to be employed • skills base required • likely sources (local, regional, overseas) • on-site facilities provided.

2.2.7. Rehabilitation and closure

Provide details for the proposed decommissioning, closure and rehabilitation of the proposal, with consideration of section 42 of the EP Act. Describe best practices for progressive rehabilitation and closure (ensuring consistency with relevant guidelines including [ICMM Integrated Mine Closure: Good](#)

[Practice Guide, CRC-TiME Integrated Mine Transitions Framework \(IMTF\) for mine closure planning](#)) that restores the proposal area to a safe and stable condition, does not cause environmental harm and can sustain a post-development land use. It must detail:

- the proposed lifespan of the proposal
- options for progressive rehabilitation, decommissioning of infrastructure, removal and disposal of infrastructure at the end of the proposal's life including unplanned and final closure, in consideration of biological, cultural, economic and social environmental aspects (this should be informed or supported by any land rehabilitation practices that may have been successful across Groote Eylandt, particularly the Eastern Leases area)
- where consistent with the agreed post-development land use, revegetation to original state (to the maximum extent practicable) and blending of disturbed surfaces into surrounding vegetation and topography. Where the area cannot be rehabilitated to a natural and/or a stable condition, state the reasons and the proposed methodology (e.g. where the final backfilled pit landforms extends above the natural ground level, describe the erosion potential and proposed erosion controls) to achieve the best ecological outcomes
- existing condition and amenity, previous and current land use, and agreed post-development land use (after closure) including alternatives defined by the outcomes of consultations undertaken with key stakeholders
- any legacy benefits of the proposal to the community
- final site design identifying the locations of post-development land use and the areas where rehabilitation is not proposed (if applicable)
- rehabilitation objectives and closure criteria consistent with the agreed post-development land use.
- rehabilitation and closure actions including time-based milestones consistent with SMART² principles
- performance indicators, monitoring and reporting schedule
- environmental constraints, including social and economic, to achieving rehabilitation objectives and milestones.

Identify and quantify the available resources for rehabilitation based on an assessment of the suitability for reuse in mine rehabilitation activities. Where there are deficiencies in the volumes of material required, for example soil deficit, describe how potential material deficits will be addressed and managed to ensure appropriate closure outcomes.

2.2.8. Changes or amendments to proposal

Describe any changes, amendments or refinements to the proposal since submission of the referral, noting that the NT EPA must be formally notified of any significant variations under section 51 of the EP Act.

² SMART milestones are:

Specific – it is clear what must be done

Measurable – it must be possible to know when it has been achieved

Achievable – it is capable of being achieved

Reasonable/relevant – there is a reasonable and clear connection between the milestone and the desired outcomes

Time-specific – it is clear when the milestone will be completed.

2.3. Stakeholder engagement and consultation

Proponents have a general duty under section 43 of the EP Act to provide stakeholders that may be affected by a proposal with an opportunity for consultation to assist understanding of the proposed action and its potential impacts and benefits.

The EIS is to document the following:

- the proponent's approach to stakeholder engagement and consultation for the life of the proposal, including demonstration that this is consistent with the NT EPA's guidance for proponents: [Stakeholder Engagement and Consultation](#) and DCCEE's [Interim Engaging with First Nations People and Communities on Assessments and Approvals under the Environment Protection and Biodiversity Conservation Act 1999](#), and aligns with best practice guidance³
- a summary of information presented in the referral on consultation undertaken, including the identified stakeholder groups (e.g. Anindilyakwa Land Council, East Arnhem Regional Council, DCCEE, Northern Territory Government authorities), key issues raised, and adjustments made to the proposal as a result of consultation
- details of further stakeholder engagement and consultation⁴ undertaken on the proposal, including with Aboriginal stakeholders as outlined in section 2.3.1 below, with detail on:
 - additional identified stakeholders
 - the manner in which information has been disseminated and communicated to stakeholders, and how stakeholder input was invited and incorporated
 - key issues raised in consultations
 - any adjustments to the proposal as a result of consultation.

2.3.1. Aboriginal stakeholders

The EIS is to be informed by consultation with Aboriginal stakeholders. The EIS should set out the processes applied to identifying and determining Aboriginal stakeholders.

Aboriginal stakeholders must include (but may not be limited to):

- relevant Aboriginal Corporations
- traditional Aboriginal owners whose lands are within and adjacent to the area of potential impact, through their representative body, the Anindilyakwa Land Council
- other people or organisations who have been identified as Aboriginal stakeholders.

The EIS is to demonstrate that the proponent has:

³ For example: [Social Impact Assessment Guideline \(nsw.gov.au\)](#) (2023)

⁴ As defined in the [NT EPA Guidance for Proponents - Stakeholder engagement and consultation](#) (NT EPA 2021)

- recognised the role that Aboriginal people have as stewards of their country⁵, and the importance of participation of Aboriginal people in environmental decision-making processes in relation to the proposal
- engaged with Aboriginal stakeholders in a culturally appropriate manner, using specialist expertise where required
- provided Aboriginal stakeholders with information in appropriate detail, language and format for understanding of the proposal and its potential impacts and benefits
- promoted the cooperative use of Aboriginal knowledge of biodiversity and Aboriginal culture in environmental decision-making
- treated the views of Aboriginal stakeholders as the primary source of information on Aboriginal cultural values
- discussed options with, and obtained the views of, Aboriginal stakeholders in regards to environmental management
- adopted measures to protect the rights and interests of Aboriginal people in relation to the areas that may be impacted.

2.4. Environment protection and management requirements

Provide information that demonstrates, in accordance with section 42(b) of the EP Act, that the proposal is assessed, planned and will be carried out taking into account the following:

2.4.1. Principles of ecologically sustainable development

Substantiate predicted outcomes in relation to the principles of ecologically sustainable development as set out in Part 2, Division 1, of the EP Act.

2.4.2. Management hierarchies

Summarise how the environmental decision-making hierarchy (section 26 of the EP Act) and the waste management hierarchy (section 27 of the EP Act) have been applied in the design of the proposal and will continue to be applied in the development and operation of the proposed action. Draw on details reported in response to Table 1, and in the assessment of environmental factors in section 2.5, of these TOR.

2.4.3. Ecosystem-based management

Describe how ecosystem-based management⁶ has been taken into account in the design of all components of the proposal and the proposed mitigation and management measures. Include consideration of residual impacts (section 2.5) and justification for whether they are acceptable.

2.4.4. The impacts of a changing climate

Provide a summary of the projected climate changes in the region, referring to relevant publications.

⁵ In accordance with section 3(e) of the EP Act, and in recognition of the rights and interests of Aboriginal people in the area of potential impact

⁶ As defined in section 4 of the EP Act

Describe how adaptation to a changing climate has been considered in the design of the proposal.

In assessing the environmental factors (section 2.5 of these TOR, and applying relevant references – see Appendix A), include the cumulative effect of projected climate changes on identified environmental values, and on mitigation measures.

2.5. Information requirements for environmental factors

The NT EPA identified ten environmental factors in its referral decision that have the potential to be significantly impacted by implementing the proposal (Table 2), identified from the NT EPA’s [Environmental factors and objectives - Environmental impact assessment guidance](#).

Table 2 Preliminary environmental factors that must be addressed in the draft EIS

THEME	FACTOR	ENVIRONMENTAL OBJECTIVE
Land	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
	Terrestrial ecosystems	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
Water	Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.
	Aquatic ecosystems	Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
Air	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.
	Atmospheric processes	Minimise greenhouse gas emissions so as to contribute to the NT Government’s target of achieving net zero greenhouse gas emissions by 2050.
People	Community and economy	Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.
	Culture and heritage	Protect culture and heritage.
	Human health	Protect the health of the Northern Territory population.

For each of the factors listed in Table 2, the draft EIS must consider the significance of the identified potential impacts with reference to section 11 of the EP Act and [Significant Impact Guidelines](#) for protected matters under the EPBC Act, where applicable. The EIS must identify and consider the proposal footprint and the area of potential impact, and cumulative impacts in consideration of other known or proposed activities in the region (including the existing mine), to identify the environmental aspects (under each environmental factor) and their specific values that could be impacted by the proposal. Where relevant, the assessment of potential environmental impacts must consider unusual operations, unplanned and emergency shutdowns of part or all of the operations.

The draft EIS is to provide an assessment of how the NT EPA's environmental objective for each factor would be met, as outlined in the NT EPA's [Preparing an environmental impact statement – environmental impact assessment guidance for proponents](#).

If additional potential environmental impacts are identified through the environmental impact assessment process, they must also be included in the draft EIS, even if this requires addressing additional environmental factors not specified in Table 2.

The following sections and tables outline the information to be addressed for each environmental factor. The below information requirements must be addressed in an appropriate format within the draft EIS, with technical assessment reports appended to the EIS as applicable. Detailed maps and figures must be included to support the descriptions and findings for each of the relevant environmental factors.

2.5.1. Terrestrial environmental quality

Table 3 Information required for the assessment of Terrestrial environmental quality

Aspect	Specific information required
NT EPA objective: Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1,620 ha • Mining operations • Excavation and stockpiling of borrow materials • Construction of mine infrastructure and haul roads • Vehicle movements for construction and operational purposes including ancillary use and vehicles accessing and leaving the site.
Environmental values	<p>Characterise the soil qualities within the proposal area based on:</p> <ul style="list-style-type: none"> • a desktop study of relevant soil reports and documentation and analysis of remote sensing data • field based, detailed soil mapping to identify and describe soils within the proposal area. <p>Soil types must be classified and mapped in accordance with relevant guidelines and in consideration of feedback received during consultation with government stakeholders.</p>
Potential significant impacts and risks	<p>Identify potential significant impacts and risks to the terrestrial environment and:</p> <ul style="list-style-type: none"> • describe the pathways by which terrestrial environmental quality could potentially be significantly impacted by the proposal, and undertake a risk assessment addressing the area of disturbance proposed, soil erosion/ compaction, dispersive soils, potential acid sulfate soils, surface hydrology, sediment transport and sources of contamination which could significantly

Terms of Reference for an Environmental Impact Statement (EIS)

Aspect	Specific information required
	<p>impact soil quality</p> <ul style="list-style-type: none"> using appropriate studies, investigations and relevant information, quantify the potential direct, indirect and cumulative impacts of the proposal on terrestrial environmental quality, and assess and justify the significance of those impacts. <p>Provide results and interpretation of geotechnical and soil investigations and surveys of the proposed area, and an assessment of the suitability of proposed locations for mine components with regards to the chemical and physical properties of the soil.</p> <p>The EIS must identify, quantify and map potential significant impacts on terrestrial environmental quality based on relevant guidelines and standards.</p>
Avoidance, mitigation and management	<p>Outline the measures for avoiding or mitigating potential significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Consider measures to enhance or restore environmental quality.</p> <p>Outline the key management plans that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>The EIS must demonstrate, at a minimum, that:</p> <ul style="list-style-type: none"> mitigation measures are in accordance with best practice, including advice from relevant Government authorities infrastructure has been appropriately sited and has taken into consideration the minimum requirements outlined in the NT Land Clearing Guidelines topsoil and overburden management and/ or amelioration measures are appropriate to ensure suitability for mine rehabilitation erosion and sediment controls are sited where necessary to appropriately manage erosion impacts and soil mobilisation.
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks to land and soils, and mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction, operations, closure or post-development.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Residual impact	<p>Identify any potential significant residual impact or risk of the proposal to identified values and the level of certainty underpinning the predicted residual impacts.</p>
Offsets	<p>Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.</p>

2.5.2. Terrestrial ecosystems

Table 4 Information required for the assessment of Terrestrial ecosystems

Aspect	Specific information required
NT EPA objective: Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1,620 ha • Mining operations • Excavation and stockpiling of borrow materials • Construction of mine infrastructure and haul roads • Vehicle movements for construction and operational purposes including ancillary use and vehicles accessing and leaving the site.
Environmental values	<p>Provide a description of all terrestrial ecological values present or likely to be present within the proposal footprint and area of potential impact including:</p> <ul style="list-style-type: none"> • a map and description of groundwater dependent ecosystems • relevant threatened flora and fauna species • a description and map of the extent of vegetation communities using the vegetation mapping units developed by the Department of Environment, Parks and Water Security (DEPWS) as part of its island-wide vegetation mapping of Groote Eylandt • a description and map of sensitive and/or significant vegetation (including, but not limited to, riparian and wetland vegetation) as per the NT Land Clearing Guidelines (DEPWS, 2021) • a description and map of general habitats and significant habitat requirements for relevant threatened species (including, but not limited to, roosting sites for ghost bats, known or possible nesting sites for masked owls) • assessment of the likelihood of occurrence for threatened species listed under the <i>Territory Parks and Wildlife Conservation Act 1976</i> (TPWC Act) and the EPBC Act using database searches (including NR Maps and the EPBC Act Protected Matters Search Tool), and survey results • a description of the existing condition of vegetation communities, including the presence of introduced or invasive species, including weed species declared under the <i>Weeds Management Act 2001</i> • a description of any existing threatening processes <p>Where surveys are required for listed species, consult with relevant government authorities regarding the survey design and methodology. For any surveys undertaken, the results must be presented in the draft EIS including survey effort and species records.</p>
Potential significant impacts and risks	<p>Identify, describe and assess potential direct and indirect significant impacts and risks of implementing the proposal, and cumulative impacts, on terrestrial ecosystems and identified environmental values including:</p> <ul style="list-style-type: none"> • direct loss of flora/ vegetation communities from vegetation clearing, including loss of sensitive and/or significant vegetation⁷, and potential habitats for threatened species • assessment of the proposal's contribution to local and regional loss of

⁷ Refer to [NT Land Clearing Guidelines](#)

Terms of Reference for an Environmental Impact Statement (EIS)

Aspect	Specific information required
	<p>vegetation communities and potential habitat for threatened species, ensuring that all historically disturbed areas are considered, and how the proposal contributes to cumulative impacts on biodiversity values</p> <ul style="list-style-type: none"> • indirect disturbance or modification of flora/ecological communities from groundwater drawdown, erosion, dust, weeds/pathogens, pests, disturbance or acidification of soils, changes in bushfire risk (fire frequency and intensity) • impacts to terrestrial ecosystems, including groundwater dependent ecosystems from spills of hazardous materials. <p>Determine the areas that could feasibly experience those impacts including uncertainty associated with the impact predictions.</p> <p>Assess the potential impacts of a changing climate to terrestrial ecosystems in the context of cumulative impacts from the proposal and other activities in the region.</p> <p>Using appropriate studies, investigations and relevant information, quantify the extent of potential impacts and their significance at the proposal level and in regional settings.</p>
Avoidance, mitigation and management	<p>Outline the measures for avoiding, or mitigating potential significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Consider measures to enhance or restore environmental quality.</p> <p>Outline the key management plans that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>Demonstrate that mitigation measures are in accordance with best practice, including advice from relevant Government authorities and species experts.</p> <p>The EIS must demonstrate that the proposal has been appropriately sited and has taken into consideration the minimum requirements outlined in the NT Land Clearing Guidelines.</p>
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks to terrestrial ecological values, and mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction, operations, closure or post-development.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant government authorities.</p>
Residual impact	<p>Identify any potential significant residual impact or risk of the proposal to identified values and the level of certainty underpinning the predicted residual impacts.</p>
Offsets	<p>Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.</p>

2.5.3. Hydrological processes

Table 5 Information required for the assessment of Hydrological processes

Aspect	Specific information required
<p>NT EPA objective: Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.</p>	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1,620 ha • Mining operations • Construction and operation of mine and ancillary infrastructure • Extraction of groundwater
Environmental values	<p>Describe the following for the proposal footprint and the area of potential impact:</p> <ul style="list-style-type: none"> • climate and meteorological conditions in the proposal area, the frequency and severity of extreme weather conditions • hydrogeology including groundwater systems, storage properties (specific yield and storativity), transmissivity, water movement, connection with other aquifers, recharge rates, recharge/discharge pathways and quantitative water balance • baseline groundwater-surface water interactions, watercourse characteristics and the distribution of watercourse alluvium • the surface water setting, ensuring sufficient detail to enable the incremental and cumulative effects of the proposal on the surface water setting to be identified, described and assessed quantitatively. This is to involve: <ul style="list-style-type: none"> ○ a flood study, including hydrological and hydraulic modelling of a range of flood events ○ analysis of available information to produce maps and descriptions of: <ul style="list-style-type: none"> ▪ regional and local catchments ▪ local drainage characteristics ▪ relevant environmental values • declared beneficial uses, existing users, water quality objectives and environmental values including sacred sites and sites of cultural significance • current and potential (future) water use potentially affected by the proposed water abstraction <p>Provide detailed maps to support the above descriptions. Outline studies used in the assessment, including their results, limitations and uncertainties.</p>
Potential significant impacts and risks	<p>Identify, describe and assess potential direct and indirect significant impacts and risks of the proposal, and cumulative impacts, on hydrological processes including:</p> <ul style="list-style-type: none"> • the natural catchment and surface and groundwater hydrology • surface water flows including: <ul style="list-style-type: none"> ○ an alteration to the volume, speed or direction of flow, or likely flow of a waterway ○ an alteration to the stability of bed or banks of a waterway, including the removal of vegetation ○ impacts on other and current likely future users and the environment.

Aspect	Specific information required
	<ul style="list-style-type: none"> • drawdown of water table, with likely effects to groundwater dependent ecosystems (e.g. springs, wetlands,) and connected surface water and groundwater systems • impacts from the proposal on declared beneficial uses, water quality objectives and environmental values, associated with interception of or abstraction from the groundwater system and connected water systems • impacts to other groundwater users. <p>The assessment of potential significant impacts must use the outcomes of relevant studies and information. As a minimum, the assessment must include:</p> <ul style="list-style-type: none"> • predictions based on modelling (class 2 model⁸) for relevant characteristics such as: <ul style="list-style-type: none"> ○ alterations to recharge ○ groundwater drawdown levels, spatial extent and recovery time ○ impacts to declared beneficial uses. • description of groundwater quality including potential risk of saltwater intrusion • overall water balance of the target groundwater system, including inputs and outputs, and feasibility assessment to illustrate the availability of a sustainable water supply for optimal abstraction of groundwater to achieve the desired abstraction volume while minimising adverse impacts to the environment, and current and future groundwater users. <p>Describe any uncertainties and further work required to increase understanding of potential significant impacts and reduce uncertainty. Quantify the significance and extent of impacts, at the project level and cumulatively, using relevant guideline thresholds.</p>
<p>Avoidance, mitigation and management</p>	<p>Outline the measures for avoiding or mitigating significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Consider measures to enhance or restore environmental quality.</p> <p>Avoidance, mitigation and offset measures must be developed with consideration given to the following:</p> <ul style="list-style-type: none"> • proposal design and layout • construction methodology • compliance with any legislation, standards and policies relevant to the proposed measures • environmental management requirements associated with seasonal weather, extreme weather conditions such as floods, storms and cyclones for the 10%, 5%, 2%, 1% and 0.1% annual exceedance probability (AEP) design events. <p>Outline the key management plans that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>Demonstrate that mitigation measures are in accordance with best practice,</p>

⁸ Barnett et al, 2012, [Australian groundwater modelling guidelines](#), Waterlines report, National Water Commission, Canberra.

Aspect	Specific information required
	including advice from relevant NT Government authorities.
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks, mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>Demonstrate that proposed monitoring locations (including bores) are appropriately sited to monitor relevant impacts.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction, operations, closure or post-development.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Residual impact	Identify any potential significant residual impact or risk of the proposal to identified values.
Offsets	Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.

2.5.4. Inland water environmental quality

Table 6 Information required for the assessment of Inland water environmental quality

Aspect	Specific information required
NT EPA objective: Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1,620 ha • mining operations • Excavation and stockpiling of borrow materials • Construction and operation of mine and ancillary infrastructure including haul roads • Vehicle movements for construction and operational purposes including ancillary use and vehicles accessing and leaving the site. • Extraction of groundwater
Environmental values	<p>Describe the water quality (chemical, physical and biological) of surface water and groundwater in the proposal footprint and the area of potential impact.</p> <p>Provide detailed maps to support the above descriptions. Outline studies used in the assessment, including their results, limitations and uncertainties.</p>
Potential significant impacts and risks	<p>Identify, describe and assess potential direct and indirect significant impacts and risks of the proposal, including cumulative impacts, on water quality including:</p> <ul style="list-style-type: none"> • changes to surface water quality from sediment, topsoil and overburden management and ore stockpiling and transport • contamination from hazardous materials <p>Determine the proposal footprint and area that could feasibly experience those potential significant impacts.</p>

Aspect	Specific information required
	<p>Describe the risks of the proposal to the existing mining operations, including:</p> <ul style="list-style-type: none"> • capacity of any mine waste management infrastructure (e.g. tailings storage facilities) • capacity of the existing mining operation to manage surplus water generated at the Southern Lease <p>The assessment of impacts must use the outcomes of relevant studies and information. As a minimum, the assessment must include:</p> <ul style="list-style-type: none"> • methods, equipment, timing and frequency • potential contaminants / pollutants • cumulative impacts with the existing mining operation, other industries or proposals • the physical and chemical characteristics, volume, timing and location of any discharges • the reversibility of potential impacts (including timeframe) <p>The assessment must take into account all construction and operation activities of the proposal.</p> <p>The assessment must identify potential impacts and risks to inland water environmental quality and quantify their significance:</p> <ul style="list-style-type: none"> • against site specific water quality data and any relevant guideline thresholds including Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG (2018)) • on the beneficial uses, water quality objectives and identified environmental values. <p>Quantify the extent of potential significant impacts on inland water environmental quality relating to a changing climate, and how these have been considered cumulatively to proposal impacts.</p>
<p>Avoidance, mitigation and management</p>	<p>Outline the measures for avoiding or mitigating potential significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Consider measures to enhance or restore environmental quality.</p> <p>Avoidance and mitigation measures must be developed with consideration given to the following:</p> <ul style="list-style-type: none"> • proposal design and layout • construction methodology • water management and efficiency, including stormwater, wastewater and mine-affected water management • waste management including a detailed description of management methods for all types of wastes • erosion, sediment and drainage controls • chemical and fuel spill management • compliance with any legislation, standards and policies relevant to the proposed measures. <p>Outline the key management plans that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>Demonstrate that mitigation measures are in accordance with best practice, including advice from relevant NT Government authorities.</p>

Aspect	Specific information required
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks, mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction, operations, closure or post-development.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Residual impact	Identify any potential significant residual impact or risk of the proposal to identified values.
Offsets	Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.

2.5.5. Aquatic ecosystems

Table 7 Information required for the assessment of Aquatic ecosystems

Aspect	Specific information required
NT EPA objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1,620 ha • Mining operations • Excavation and stockpiling of borrow materials • Construction and operation of mine and ancillary infrastructure including haul roads.
Environmental values	<p>Describe the aquatic ecosystems and groundwater dependent ecosystems in the proposal footprint and the area of potential impact.</p> <p>Provide detailed maps to support the above descriptions. Outline studies used in the assessment, including their results, limitations and uncertainties.</p>
Potential significant impacts and risks	<p>Identify, describe and assess potential direct and indirect significant impacts and risks of the proposal, including cumulative impacts, on aquatic ecosystems including:</p> <ul style="list-style-type: none"> • direct and indirect disturbance to waterways and / or wetlands and associated ecological and hydrological values during proposal construction and operation, including but not limited to: <ul style="list-style-type: none"> ○ pit development and mine waste storage ○ mining and construction infrastructure, where in proximity to waterways/ wetlands, e.g. sedimentation, erosion, uncontrolled run off ○ processing infrastructure, where in proximity to waterways/ wetlands <p>Determine the proposal footprint and area that could feasibly experience those potential significant impacts.</p> <p>As a minimum, the assessment must include:</p>

Terms of Reference for an Environmental Impact Statement (EIS)

Aspect	Specific information required
	<ul style="list-style-type: none"> methods, equipment, timing and frequency cumulative impacts with other industries or proposals the reversibility of potential significant impacts (including timeframe). <p>The assessment must take into account all construction and operation activities of the proposal.</p> <p>Describe any uncertainties and further work required to increase understanding of potential impacts and reduce uncertainty. Quantify the significance and extent of impacts at the project level and cumulatively.</p> <p>Quantify the significance of impacts:</p> <ul style="list-style-type: none"> against relevant guideline thresholds on the beneficial uses, water quality objectives and identified environmental values including groundwater dependent ecosystems and existing ground and surface water users relating to a changing climate and how these impacts have been considered cumulatively with proposal impacts.
Avoidance, mitigation and management	<p>Outline the measures for avoiding or mitigating potential significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Consider measures to enhance or restore environmental quality.</p> <p>Avoidance, mitigation and offset measures must be developed with consideration given to the following:</p> <ul style="list-style-type: none"> proposal design and layout construction methodology compliance with any legislation, standards and policies relevant to the proposed measures. <p>Describe the measures for mitigating the introduction and spread of aquatic weeds.</p> <p>Outline the key management plans that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>Demonstrate that mitigation measures are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks, mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction, operations, closure or post-development.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Residual impact	<p>Identify any potential significant residual impact or risk of the proposal to identified values.</p>
Offsets	<p>Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets</p>

Aspect	Specific information required
	policy.

2.5.6. Air quality

Table 8: Information required for assessment of Air quality.

Aspect	Specific information required
NT EPA objective: Protect air quality and minimise emissions and their impact so that environmental values are maintained.	
Relevant activities	<ul style="list-style-type: none"> • Clearing of 1620 ha • Mining Operations • Excavation and stockpiling of borrow materials • Construction and operation of mine infrastructure and haul roads • Handling, processing, transport and storage of materials • Power generation • Rehabilitation and closure.
Environmental values	<ul style="list-style-type: none"> • Describe the sensitive receptors, including areas of current and predicted public use (including cultural use), within the proposal footprint and area of potential impact • Describe the existing air environment • Provide maps and figures to support descriptions as appropriate.
Potential significant impacts and risks	<p>Describe and assess the potential significant impacts on air quality, including cumulative impacts, using outcomes of investigations and/or other relevant information, and identify:</p> <ul style="list-style-type: none"> • methods, equipment, timing and frequency • the likely types, sources, scale and extent of emissions that could impact air quality • nature and location of sensitive receptors • the potential impacts on local air quality and sensitive receptors during all phases of the proposal • the duration, magnitude and extent of potential impacts • the proposal footprint and area of potential impact that could feasibly experience those impacts. <p>The assessment must identify and quantify potential significant impacts on air quality in accordance with the NSW EPA document "Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales". Ensure that emitted pollutants do not prejudice compliance with the National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) as amended and account for anticipated amendments to the AAQ NEPM in 2025.</p>
Avoidance, mitigation and management	<p>Outline the measures for avoiding or mitigating potential significant impacts identified above, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act. Also consider measures to enhance or restore environmental quality.</p> <p>Avoidance, mitigation and management measures must be developed with consideration</p>

Aspect	Specific information required
	<p>given to the following:</p> <ul style="list-style-type: none"> design and layout of the proposal construction methods emission avoidance, mitigation or management measures where relevant air quality thresholds are exceeded compliance with any statutory or policy basis for the proposed measures. <p>All mitigation measures must be substantiated and in accordance with best practice, including advice from relevant government advisory agencies.</p>
Monitoring and reporting	<p>Outline any proposed monitoring and reporting activities related to potential significant impacts (including cumulative impacts) and risks, and mitigation and management measures.</p> <p>The proposed monitoring and reporting must specify which project phase it relates to, i.e. construction or operations.</p> <p>All monitoring activities must be substantiated and in accordance with best practice advice from relevant government advisory agencies.</p>
Residual impact	<p>Identify any potential significant residual impact of the proposal on environmental values.</p>
Offsets	<p>Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.</p>

2.5.7. Atmospheric processes

Table 9 Information required for the assessment of atmospheric processes

Aspect	Specific information required
<p>NT EPA objective: Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.</p>	
Relevant activities	<ul style="list-style-type: none"> Land clearing Fuel combustion for the operation of machinery and vehicles during construction and operations Power generation
Environmental values	<p>Describe the current emissions profile for the NT by industry/sector. Describe greenhouse gas emissions trajectories for the NT by industry/sector.</p>
Potential significant impacts and risks	<p>Describe/estimate the proposal's:</p> <ul style="list-style-type: none"> direct GHG emissions due to Scope 1 (e.g. land clearing, diesel combustion during construction and operation) and Scope 2 emissions (e.g. during construction and operation) annual and total Scope 3 emissions over the life of the proposal cumulative emissions in conjunction with the current mine comparison with NT and national emissions. <p>Provide a breakdown of Scope 1, 2 and 3 emissions according to the emission sources and source locations (i.e. within the NT, elsewhere in Australia or outside of Australia).</p>

Terms of Reference for an Environmental Impact Statement (EIS)

Aspect	Specific information required
	<p>Provide an inventory of projected annual emissions for each relevant greenhouse gas, with total emissions expressed in tonnes 'CO₂ equivalent' terms. Provide justification for the suitability of methodologies or surveys used to calculate greenhouse gas emissions. Where any information gaps or uncertainty remains, adopt the precautionary principle.</p> <p>Identify the sources for generation of GHG emissions, and quantify GHG emissions from each source for each financial year, including total GHG emissions for the life of the project.</p> <p>Estimate emissions from upstream activities associated with the proposal, including electricity to be used during construction, operation and decommissioning and briefly describe the methods used to make the estimates.</p>
Avoidance, mitigation and management	<p>Outline the measures for avoiding or mitigating projected Scope 1 and Scope 2 emissions, with consideration of sections 26 (Environmental decision-making hierarchy) and section 27 (Waste management hierarchy) of the EP Act.</p> <p>Include a description of:</p> <ul style="list-style-type: none"> • improvements in the supply of renewable energy and meeting NT renewable energy targets • any energy efficiency and mitigation and management measures to reduce or minimise greenhouse gas emissions over the life of the proposal including a commitment to continuous improvement measures • how proposed measures to maximise energy efficiency and avoid and/or reduce/abate greenhouse gas emissions will meaningfully contribute to the NT Government's target of achieving net zero greenhouse gas emissions by 2050 • if applicable, how the proposal's requirements under the Australian Government's Safeguard Mechanism will affect greenhouse gas emissions reductions over the life of the proposal. <p>Demonstrate that proposed mitigation measures are in accordance with best practice and capable of achieving stated emissions reductions, including identification of any local conditions or circumstances that might influence the choice of technologies or measures to mitigate emissions.</p> <p>Outline the key management plan/s that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>Identify uncertainties that may impact the proposal's ability to reduce emissions in line with the NT and Australian Government targets and how uncertainties would be addressed.</p>
Monitoring and reporting	<p>Provide proposed monitoring and reporting activities related to potential significant impacts and risks to atmospheric processes, and mitigation and management measures. Describe clear and measurable outcomes and commitments that will ensure the environmental objective is met and impacts of implementing the proposal will be acceptable.</p> <p>The proposed monitoring and reporting must specify which proposal phase it relates to i.e., construction or operations.</p> <p>Demonstrate that monitoring activities are in accordance with best practice, including advice from relevant NT Government authorities.</p>
Residual impact	Identify any potential significant residual impact or risk of the proposal to the current

Aspect	Specific information required
	emissions profile and the greenhouse gas emissions trajectory for the NT. Describe the net contribution to the NT's greenhouse gas emissions over the life of the proposal.
Offsets	Where a significant residual impact may remain after applying the environmental decision-making hierarchy, identify offsets and describe how any proposed offset is consistent with the NT Offsets Framework and EPBC Act environmental offsets policy.

2.5.8. Community and economy

Table 10: Information required for assessment of Community and economy.

Aspect	Specific information required
NT EPA objective: Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	
Relevant activities	<ul style="list-style-type: none"> Construction and mining operations, rehabilitation and closure, handling and processing manganese ore (cumulative impacts) Generating employment and social and economic opportunity for local communities
Environmental values	<p>Describe the existing social and economic profile of the proposal footprint and area of potential impact, including reference to:</p> <ul style="list-style-type: none"> key landowners/custodians/stakeholders/communities, and other persons with overlapping or intersecting interests social, cultural and economic values of affected stakeholders social area of influence, including demographic characteristics and trends, governance and institutions the local labour market including participation, skills gaps, Aboriginal employment local business capacity and economic sectors level of disadvantage against relevant indicators current land uses compatibility of the proposal with current land use including, residential, commercial, industrial, recreational/leisure, tourism, and traditional land use profile of infrastructure and services such as roads, utilities, fuel, water telecommunications relevant contextual factors including history of other projects, community values and aspirations, government policies and legislation.
Potential significant impacts and risks	<p>Utilising modelling, outcomes of investigations, and/or other relevant information, describe and assess potential benefits to, and impacts on, the community and the economy including:</p> <ul style="list-style-type: none"> potential significant impacts on community health, wellbeing and cohesion including those resulting from changes in amenity (e.g. noise, odour, dust, vibration and aesthetics) potential disturbance of social and economic values including on recreational and cultural activities, such as the use of outstations, hunting, gathering,

Aspect	Specific information required
	<p>fishing and valued species</p> <ul style="list-style-type: none"> • impacts and opportunities for jobs, economic sectors and livelihoods including the availability of appropriately skilled labour resources for the proposal and competing industries and impacts on the housing market, community and social services, infrastructure and economy • equitable distribution of economic benefits and harms within affected communities • economic assessment of the proposal's impact on the NT economy including the total contribution to Gross Territory Product and Gross Domestic Product over the economic life of the proposal • estimated capital and annual operational expenditure • value of residual infrastructure at end-of-life of the proposal. <p>The assessment must quantify the significance of potential impacts and risks to local and NT communities and the economy.</p> <p>The assessment of each aspect must consider cumulative impacts and benefits and the reversibility of potential impacts and benefits.</p> <p>Quantify extent of impacts on the community and economy relating to a changing climate, and how these have been considered cumulatively to proposal impacts.</p> <p>Demonstrate that the assessment of the impacts and benefits of the proposal on potentially affected community is informed by an inclusive and collaborative community and stakeholder engagement and consultation process that is iterative throughout preparation of the EIS.</p>
<p>Avoidance, mitigation and management</p>	<p>Outline the measures for systematically avoiding and mitigating potential significant social impacts, and maximising benefits.</p> <p>Identify and discuss frameworks and management strategies that would be implemented to address:</p> <ul style="list-style-type: none"> • protection of community values • ongoing community and stakeholder engagement • workforce management (including local Aboriginal employment) • local business and industry procurement • distribution of community benefits • community wellbeing. <p>Outline the key management plan/s that would be implemented, and the associated performance indicators, timeframes for implementation, and the roles and responsibilities of the personnel involved.</p> <p>All mitigation measures must be substantiated and in accordance with best practice, including advice from relevant government advisory agencies.</p>
<p>Monitoring and reporting</p>	<p>Outline proposed monitoring and reporting activities related to potential significant impacts, risks and benefits and mitigation and management measures to community and economy.</p> <p>The proposed monitoring and reporting must specify which project phases it relates to.</p>

Aspect	Specific information required
	Demonstrate that monitoring activities align with community expectations and are in accordance with best practice, including advice from relevant NT Government authorities.
Residual impact	Identify the significance of any residual impact or risk of the proposal to identified values.

2.5.9. Culture and heritage

Table 10: Information required for assessment of Culture and heritage.

Aspect	Specific information required
NT EPA objective: Protect culture and heritage.	
Relevant activities	<ul style="list-style-type: none"> • Extraction of groundwater including pit dewatering • Mining activities (including cumulative impacts) • Re-alignment of roads and tracks • Activities with the potential for direct and indirect disturbance of sacred sites, heritage sites and sites of cultural significance including cultural landscapes.
Environmental values	<p>Identify the Aboriginal communities and traditional owners within (or in proximity to) the proposal area, including the area of potential impact.</p> <p>Describe the characteristics and current condition of sacred sites, cultural and heritage values and the current landscape within the proposal area, including the area of potential impact, which could be impacted. This must include (at a minimum) descriptive and spatial information for the following:</p> <ul style="list-style-type: none"> • Aboriginal and non-Aboriginal sites, places or objects of natural, historic or cultural heritage significance, current use and spiritual significance e.g. songlines, and sites used for maintaining cultural traditions. • Heritage places or objects protected under the <i>Heritage Act 2011</i> includes both the automatic protection of Aboriginal and Macassan archaeological sites and the protection of other declared places • traditional land use or industry within or in proximity to the proposal area • importance of amenity (e.g. noise, odour, dust, vibration and aesthetics) to maintaining cultural values • registered or recorded sacred sites under the <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> (Sacred Sites Act) taking into account confidentiality requirements. <p>Information sources must include published archaeological and anthropological information, site surveys, respective registers, consultations and other research.</p> <p>Advice must be sought from the Anindilyakwa Land Council about sacred sites (including those not recorded or registered under the Sacred Sites Act) and cultural values requiring protection across the proposal's area of potential impact.</p> <p>Presentation of information must accord with the wishes of Aboriginal stakeholders regarding the confidentiality of cultural information, noting that the proponent may request that identified information not be made public in accordance with section</p>

Aspect	Specific information required
	<p>281(2)(b) of the EP Act.</p> <p>Justify the suitability of the methodologies, surveys or processes used to provide information about sacred sites, culture and heritage.</p> <p>Detail any information gaps or uncertainties in relation to sacred sites, culture and heritage, including any further studies or measures required to address these gaps.</p>
<p>Potential significant impacts and risks</p>	<p>Describe potential significant impacts on cultural and heritage values, including:</p> <ul style="list-style-type: none"> • disturbance to sites of cultural significance during construction, operation, and maintenance activities • disturbance to traditional and/or contemporary Aboriginal values (including, sacred sites) or uses of land (e.g. hunting and ceremonial use) or amenity due to construction and operation activities • temporary or permanent land access or use restrictions • cumulative impacts from the proposal and the existing mine. <p>Determine the proposal footprint and area that could feasibly experience those potential significant impacts.</p> <p>The assessment must:</p> <ul style="list-style-type: none"> • quantify the significance of potential impacts and risks to sacred sites and cultural heritage • identify any effect on intergenerational transmission of cultural traditions • consider cumulative impacts and the reversibility of potential impacts. <p>Assess the potential significant impacts of a changing climate on cultural and heritage values in the context of cumulative impacts from the proposal and other activities in the region.</p> <p>Identify the uncertainties and provide a detailed description of how uncertainties would be addressed, such as through an adaptive management approach incorporating baseline studies, monitoring and staging. Where uncertainty remains, adopt the precautionary principle and demonstrate how it has been met (section 19 of EP Act).</p>
<p>Avoidance, mitigation and management</p>	<p>Describe the measures for avoiding and mitigating impacts on cultural heritage values and the practice and transmission of cultural traditions</p> <p>Avoidance and mitigation measures must be developed with consideration given to the following:</p> <ul style="list-style-type: none"> • substantial initial and ongoing consultation and engagement with native title holders, traditional owners and their representatives. • appropriate independent surveys and consultation to identify and characterise any sites, places or objects of cultural significance • an Authority Certificate that covers all areas of the proposal, in accordance with the Sacred Sites Act • appropriate Aboriginal culture and heritage awareness training for the workforce. <p>Demonstrate the application of the mitigation hierarchy to avoid and minimise impacts on cultural heritage values, including any considerations for rehabilitation and</p>

Aspect	Specific information required
	<p>closure.</p> <p>Identify and address the potential impacts on potentially affected Aboriginal people and communities, landholders, tourism and operators as stakeholders.</p> <p>All mitigation measures must be substantiated and in accordance with best practice, including advice from relevant government advisory agencies, native title holders, traditional owners and/or their representatives.</p>
Monitoring and reporting	<p>Outline proposed monitoring and reporting activities related to potential significant impacts and risks and mitigation and management measures to culture and heritage and the practice and transmission of cultural traditions.</p> <p>The proposed monitoring and reporting must specify which project phases it relates to.</p> <p>All monitoring activities must be substantiated and in accordance with best practice advice from relevant government advisory agencies, native title holders, traditional owners and/or their representatives.</p>
Residual impact	<p>Identify any potential significant residual impact or risk of the proposal to identified Aboriginal values and the acceptability of the residual impact, to Aboriginal stakeholders.</p>

2.5.10. Human health

Table 11: Information required for assessment of Human health.

Aspect	Specific information required
NT EPA objective: Protect the health of the Northern Territory population.	
Relevant activities	Construction and mining operations, rehabilitation, closure and post-development activities.
Environmental values	Identify and map the location of human sensitive receptors in proximity to the proposal.
Potential significant impacts and risks	<p>Describe and assess potential significant impacts associated with the proposed construction, operation, rehabilitation, closure and post-development activities, including:</p> <ul style="list-style-type: none"> Human exposure to particulate matter (PM₁₀ and PM_{2.5}) and air emissions such as manganese and potential airborne contaminants of concern) <p>The assessment must:</p> <ul style="list-style-type: none"> be based on outcomes of investigations and/or other relevant information quantify the significance of potential impacts and risks against relevant guideline thresholds consider cumulative impacts and the reversibility of potential significant impacts.

Aspect	Specific information required
	<p>Assess the potential significant impacts of a changing climate on human health values in the context of cumulative impacts from the proposal and other activities in the region.</p> <p>Identify the uncertainties and provide a detailed description of how uncertainties would be addressed, such as through an adaptive management approach incorporating baseline studies, monitoring and staging. Where uncertainty remains, adopt the precautionary principle and demonstrate how it has been met (section 19 of EP Act).</p>
Avoidance, mitigation and management	<p>Demonstrate the application of the mitigation hierarchy to avoid and minimise impacts on human health values, including any considerations for rehabilitation and closure.</p> <p>All mitigation measures must be substantiated and in accordance with best practice, including advice from relevant government advisory agencies, native title holders, traditional owners and/or their representatives.</p>
Monitoring and reporting	<p>Outline proposed monitoring and reporting activities related to potential significant impacts and risks and mitigation and management measures to human health values.</p> <p>The proposed monitoring and reporting must specify which project phases it relates to.</p> <p>All monitoring activities must be substantiated and in accordance with best practice advice from relevant government advisory agencies, native title holders, traditional owners and/or their representatives.</p>
Residual impact	<p>Identify the significance of any residual impact or risk of the proposal to identified values.</p>

3. Other requirements

3.1. Other environmental factors or matters

3.1.1. Matters of national environmental significance (MNES)

The proposal is a controlled action under the EPBC Act where the relevant controlling provisions are:

- Listed threatened species and communities (section 18 and 18A), and
- Listed migratory species (sections 20 and 20A).

The proposal is being assessed in accordance with the bilateral agreement between the NT and the Commonwealth. The EIS must address matters outlined in Schedule 4 of the EPBC Regulations and explain how the Conservation Advice for each EPBC Act listed species (that is known or likely to be impacted) has been adequately considered.

The draft EIS must address all relevant MNES, and explain how they have adequately regarded the Conservation Advices of each EPBC Act listed species that are known or likely to be impacted, and

Australia's obligations under international conventions and agreements. Moreover, the draft EIS must explain how the proposal is consistent with any Guidelines, Threat Abatement Plans, Bioregional Plans or Recovery Plans, including but not limited to:

- DCCEEW's [Significant Impact Guidelines 1.1](#)
- EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species:
<https://www.environment.gov.au/epbc/publications/shorebirds-guidelines>
- [EPBC Act referral guideline for the endangered northern quoll *Dasyurus hallucatus* \(Commonwealth of Australia, 2016\)](#).
- Conservation Advices for:
 - [Brush-tailed rabbit rat \(*Conilurus penicillatus*\)](#)
 - [Ghost Bat \(*Macroderma gigas*\)](#)
 - [Masked owl \(northern\) \(*Tyto novaehollandiae kimberli*\)](#)
 - [Northern brushtail possum \(*Trichosurus vulpecula arnhemensis*\)](#)
 - [Northern hopping-mouse \(*Notomys aquilo*\)](#)
- Recovery Plans for:
 - [Northern Quoll \(*Dasyurus hallucatus*\)](#)
 - [Brush-tailed Rabbit-rat \(*Conilurus penicillatus*\)](#)
 - [Marine turtles in Australia](#)
- Threat Abatement Plans for:
 - [Predation by feral cats](#)
 - [The biological effects, including lethal toxic ingestion, caused by cane toads](#)
 - [Reducing the impacts on northern Australia's biodiversity by the five listed grasses](#)
- The following survey guidelines:
 - [Survey guidelines for Australia's threatened mammals](#) (DCCEEW, 2011)
 - [Survey guidelines for Australia's threatened birds](#) (DCCEEW, 2010)
- [Review of ghost bat ecology, threats and survey requirements](#) (DCCEEW, 2021)
- [National Light Pollution Guidelines for Wildlife](#) (DCCEEW, 2023)

The draft EIS must include a discussion of how the proposal meets the principles of ecologically sustainable development, as defined under section 3A of the EPBC Act.

3.2. Offsets

Provide details of an overall offset strategy for the significant residual impacts of the proposal on the terrestrial environment. Offsets may be required as a condition of any approval under the EPBC Act. Offsets must be consistent with the NT Offsets Framework, and the EPBC Act environmental offsets policy.

3.3. Whole of the environment considerations

Provide a holistic assessment of the impacts of the proposal on the whole of the environment, including a consistent description of the proposal, connections and interactions between the environmental factors, and cumulative impacts. Succinctly discuss predicted outcomes in relation to the principles of environment protection and management (as set out in Part 2 of the EP Act), and the NT EPA's environmental objectives.

3.4. Consideration of the impacts of a changing climate

The draft EIS must assess how adaptation to a changing climate has been considered in the proposal, with reference to the NT policy *Northern Territory Climate Change Response: Towards 2050* (DENR 2020)⁹ and [Climate Change in the Northern Territory: State of the science and climate change impacts](#) (NESP ESCC Hub 2020).

Assess the extent to which the outcomes and commitments proposed address any significant vulnerabilities of the proposal and the environmental values in and adjacent to the proposal area under the most current, down-scaled climate projections for the region.

4. Public consultation requirements

The public consultation requirements for the draft EIS are outlined in Part 5 Division 6 of the EP Regulations. Additional specific details are provided below. Terms of the proponent's stakeholder engagement requirements for the draft EIS are outlined in section 2.3 above.

4.1. Submission period

The submission period under the EP Act during which feedback can be given on the draft EIS is between 30 and 60 business days. The duration of the period will be confirmed during the draft EIS pre-lodgement phase.

4.2. Manner in which to publish

The draft EIS must be provided as:

- accessible PDF files that do not exceed 20MB
- seven (7) printed copies for display at the locations in section 4.4 below.

The draft EIS must:

- be divided into two parts:
 - a main report (with executive summary available as separate document)
 - appendices to the main report
- have a navigable table of contents
- present information in format that is easy to follow

⁹ DENR, 2020. Northern Territory Climate Change Response: Towards 2050. Department of Environment and Natural Resources, Darwin.

- use hyperlinks to assist with navigation through the document
- generally conform with the Web Content Accessibility Guidelines (WCAG) 2.0 Level AA and material relevant to creating accessible documents on the [NT Government website](#).

4.3. Advertising

An advertisement must be placed in the NT News and a nationally distributed newspaper indicating that the draft EIS is available for comment, the locations where it can be inspected and obtained, the period in which comments/submissions can be made and where they can be made, and contact details for obtaining further information.

4.4. Public consultation locations

The draft EIS must be made available for public viewing at:

1. NT EPA, Level 1, Arnhemica House, 16 Parap Road, Parap, NT 0820
2. Department of Industry, Tourism and Trade, Level 3, Paspalis Centrepoint Building, 48-50 Smith Street, Darwin
3. Anindilyakwa Land Council, main office, 30 Bougainvillia Drive, Alyangula, NT
4. East Arnhem Regional Council, Angurugu, NT
5. Angurugu Community Postal Agent, Lot 550 Angurugu Street, Angurugu, NT
6. Environment Centre Northern Territory, Unit 3, 98 Woods Street, Darwin
7. Northern Territory Library, Parliament House, Darwin, NT

Appendix A – List of relevant guidance material

The following guidance material, in addition to the guidance material referenced in section [3.1.1. Matters of national environmental significance \(MNES\)](#), is considered relevant to the TOR. This list is not exhaustive, but captures key guidance used in the preparation of these TOR and to inform the preparation of the EIS. The proponent must draw on further relevant industry and best practice guidance as part of developing the EIS.

- Australian National Committee on Large Dams (ANCOLD) guidelines. <https://ancold.org.au>
- Barnett et al, 2012, Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra.
<https://www.groundwater.com.au/media/W1siZiIsIjIwMTIvMTAvMTcvMjFfNDFFMzZfOTYwX0F1c3RyYWxpYW5fZ3JvdW5kd2FOZXJfbW9kZWxsaW5nX2d1aWRlIGluZXMucGRmI1d/Australian-groundwater-modelling-guidelines.pdf>
- Commonwealth of Australia 2008. Threat Abatement Plan for predation by feral cats. Department of Agriculture, Water and the Environment.
<https://www.dcceew.gov.au/sites/default/files/documents/tap-cat-report.pdf>
- Commonwealth of Australia, 2013. Significant Impact Guidelines 1.1: Matters of National Environmental Significance. Department of Agriculture, Water and the Environment:
<https://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance>
- Commonwealth of Australia 2016. Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry. Department of Industry, Science and Resources. <https://www.industry.gov.au/publications/leading-practice-handbooks-sustainable-mining/preventing-acid-and-metalliferous-drainage>
- Department of Sustainability, Environment, Water, Population and Communities 2012. Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.:
<https://www.dcceew.gov.au/environment/epbc/publications/epbc-act-environmental-offsets-policy>
- DEPWS 2021. Northern Territory Offsets Framework. Northern Territory Government:
<https://depws.nt.gov.au/environment-information/northern-territory-offsets-framework/northern-territory-offsets-framework>
- DENR, 2020. Land clearing guidelines. Department of Environment and Natural Resources:
<https://nt.gov.au/property/land-clearing>
- DENR, 2020. Northern Territory Climate Change Response: Towards 2050. Department of Environment and Natural Resources:
https://depws.nt.gov.au/_data/assets/pdf_file/0005/904775/northern-territory-climate-change-response-towards-2050.pdf
- International Network for Acid Prevention (2009) Global Acid Rock Drainage (GARD) guide.
<http://www.gardguide.com>
- National Environmental Protection (Ambient Air Quality) Measure (NEPM) 2021:
<https://www.nepc.gov.au/nepms/ambient-air-quality>
- NESP Earth Systems and Climate Change Hub, 2020. Climate change in the Northern Territory: state of the science and climate change impacts. National Environment Science Programme, Earth Systems and Climate Change Hub: <http://nespclimate.com.au/building-understanding-of-climate-change-in-the-northern-territory/>

- Northern Territory Government, 2017. Preventing weed spread guide, Weed Management Branch: <https://nt.gov.au/environment/weeds/how-to-manage-weeds/prevent-weed-spread-industry-and-recreation>
- NSW DPIE, 2022. Cumulative Impact Assessment Guideline for State Significant Projects. NSW Department of Planning, Industry and Environment: <https://www.planning.nsw.gov.au/sites/default/files/2023-03/cumulative-impact-assessment-guidelines-for-ssp.pdf>
- NSW DPIE, 2023. Social Impact Assessment Guideline. NSW Department of Planning, Industry and Environment: https://www.planningportal.nsw.gov.au/sites/default/files/documents/2023/GD1944%20SIA%20Guideline_NEW%20VI_14_02_23.pdf
- NSW EPA (2022) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales: <https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/air/22p3963-approved-methods-for-modelling-and-assessment-of-air-pollutants.pdf?la=en&hash=79991C3AD2F7A1FAEC34EBAA857E7DOCCDDD1B24>
- NSW Waste classification guidelines at <https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classification-guidelines>
- NT EPA, 2013. Guidelines for Assessment of Impacts on Terrestrial Biodiversity. Northern Territory Environment Protection Authority: <https://ntepa.nt.gov.au/publications-and-advice/environmental-management>
- NT EPA, 2021. Guidelines for the Preparation of an Economic and Social Impact Assessment. Northern Territory Environment Protection Authority: <https://ntepa.nt.gov.au/publications-and-advice/environmental-management>
- NT EPA, 2020. Environmental impact assessment guidance: NT EPA Environmental Factors and Objectives. Northern Territory Environment Protection Authority: <https://ntepa.nt.gov.au/publications-and-advice/environmental-management>
- NT EPA, 2020. Environmental impact assessment guidance for proponents: Stakeholder Engagement and Consultation. Northern Territory Environment Protection Authority: <https://ntepa.nt.gov.au/publications-and-advice/environmental-management>
- NT EPA, 2021. Environmental impact assessment guidance for proponents: Preparing an environmental impact statement. Northern Territory Environment Protection Authority: https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/818217/preparing-an-environmental-impact-statements.pdf