Ranger 3 Deeps Draft Environmental Impact Statement Executive Summary

Energy Resources of Australia Ltd

ERA

IMPORTANT NOTE

This Draft Environmental Impact Statement (Draft EIS) has been prepared by Energy Resources of Australia Ltd (ERA) for submission to the Australian Government Minister for the Environment for assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) and the Northern Territory Environment Protection Authority (NT EPA) for assessment under the Environmental Assessment Act in respect of the proposed Ranger 3 Deeps underground mine (the Project).

In this Draft EIS, ERA must provide to the Minister and the NT EPA information in relation to the Project, as set out in the Guidelines for the Preparation of an Environmental Impact Statement provided by the NT EPA and the Australian Government Department of the Environment to ERA in August 2013 (**Guidelines**). The information is provided for the purpose of assisting the Minister and the NT EPA to assess the possible environmental impacts of the Project (**Purpose**).

The information in this Draft EIS has been included having regard solely to the Purpose and the requirements of the Guidelines.

ERA has not made any decision about whether or not to proceed with the Project. ERA has submitted this Draft EIS so that ERA can make an informed decision about whether to proceed with the Project if and when statutory environmental approvals are in place. ERA is currently undertaking a Prefeasibility Study in relation to the Project, along with a related underground drilling program. The Prefeasibility Study and the drilling program are incomplete. Any decision to proceed with the Project will only be made once the Prefeasibility Study has been finalised.

No information in this Draft EIS should be relied upon for the purpose of making a decision whether to buy or sell ERA securities. Nor should it be taken as a representation by any of ERA or its related bodies corporate or any of their respective directors, employees or advisers in relation to the future performance of the Project or the likelihood of the Project proceeding, or of the future financial performance of ERA. Nothing in this Draft EIS should be construed as investment advice.

Information material to the price or value of ERA's securities is disclosed by ERA to the Australian Securities Exchange, in accordance with its disclosure obligations under the ASX Listing Rules and the *Corporations Act 2001* (Cth).

FORWARD-LOOKING STATEMENTS

This Draft EIS contains forward-looking statements. All statements other than statements of historical facts included in the Draft EIS, including, without limitation, production forecasts, market prices, operating costs, operational problems, political uncertainty, economic conditions and reserve and resource positions, are forward-looking statements. Such forward-looking statements involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of ERA or the Project (or the likelihood of the Project proceeding) to be materially different from any future results, performance or achievements expressed or implied by such forward looking statements.

DISCLAIMER

This Draft EIS has been prepared for the Purpose only and no one other than the Minister and the NT EPA should rely on the information contained in this Draft EIS for any purpose.

In preparing this Draft EIS, ERA has relied on information provided by specialist consultants, government agencies and other third parties available during preparation. Whilst ERA has no reason to doubt the accuracy or completeness of that information, ERA has not sought to verify the accuracy or completeness of that information, except where expressly acknowledged in the Draft EIS.

To the full extent permitted by law, none of ERA or its related bodies corporate or any of their respective directors, employees or advisers, in respect of all persons other than the Minister and the NT EPA, makes any representation or gives any warranty or undertaking, express or implied, in respect of the information contained in this Draft EIS and none of them accepts responsibility and is not liable for any loss or liability whatsoever arising as a result of any person acting or refraining from acting on any information contained in this Draft EIS.

COMPETENT PERSONS

Information in this Draft EIS that relates to the Ranger 3 Deeps mineral resource is sourced from a release made by ERA to ASX on 20 June 2014 titled 'Ranger 3 Deeps Resource Update' which can be found at: http://www.asx.com.au/asxpdf/20140620/pdf/42qb2nbqhnynw1.pdf. The Competent Persons for the release were geologists Greg Rogers and Stephen Pevely. Neither the resource statement nor the underlying resource model has changed since the Ranger 3 Deeps mineral resource was disclosed to ASX. ERA is not aware of any new information or data beyond the updates already provided to ASX that materially affects the mineral resource estimate. All material assumptions and technical parameters underpinning the mineral resource estimate continue to apply and have not materially changed. ERA confirms that the form and context in which the Competent Persons findings are presented have not been materially modified.

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1 INTRODUCTION

This document is the Executive Summary for the **Ranger 3 Deeps underground mine project** (the Project) Draft Environmental Impact Statement (Draft EIS). It has been prepared by Energy Resources of Australia Ltd (ERA), as the owner and operator of the Project.

This Executive Summary outlines the proposed Project, the joint Australian and Northern Territory environmental impact assessment process to which it is subject, the natural and socio-economic environments in which it is set, and the potential risks and impacts associated with the Project. Importantly, it provides an overview of the existing management controls employed by ERA and new management controls proposed to reduce the risk of impacts to the surrounding environment associated with the Project.

The Draft EIS has been prepared to comply with the guidelines set by the Australian and Northern Territory Governments and has taken into account concerns and issues raised in community consultations undertaken in the Darwin and Alligator Rivers regions.

Further details associated with Project risks and impacts, proposed management controls (including environmental management plans), and a detailed list of management commitments are provided in the Draft EIS and its related technical appendices.

1.1 PROJECT OVERVIEW

ERA is seeking the approval of the Australian and Northern Territory Governments to develop the Project, to produce uranium bearing ore for processing at the existing plant at Ranger mine. The incremental product will be transported via existing routes and exported to Asia, Europe and North America for use in nuclear power facilities.

The Ranger 3 Deeps mineral resource is located adjacent to the existing Ranger mine on the Ranger Project Area[1], approximately 260 km east of Darwin and 11 km east of the regional centre of Jabiru (**Figure 1**). The Ranger Project Area is on Aboriginal land, surrounded by but separated from Kakadu National Park.

The Project will mine an underground uranium ore body that contains more than 32,000 tonnes of uranium oxide and is situated east of Pit 3, with most mining activity occurring between 200 and 500 metres below ground level.

ERA proposes to extend and develop the existing Ranger 3 Deeps exploration decline into a fully operational underground mine. The uranium bearing ore will be transported to the surface by truck and ore processing will take place in the existing processing facilities at the Ranger mine.

The construction and operation of the Project would cover a period of approximately five years and will cease, according to Ranger mine's current operating approval, on 8 January 2021.

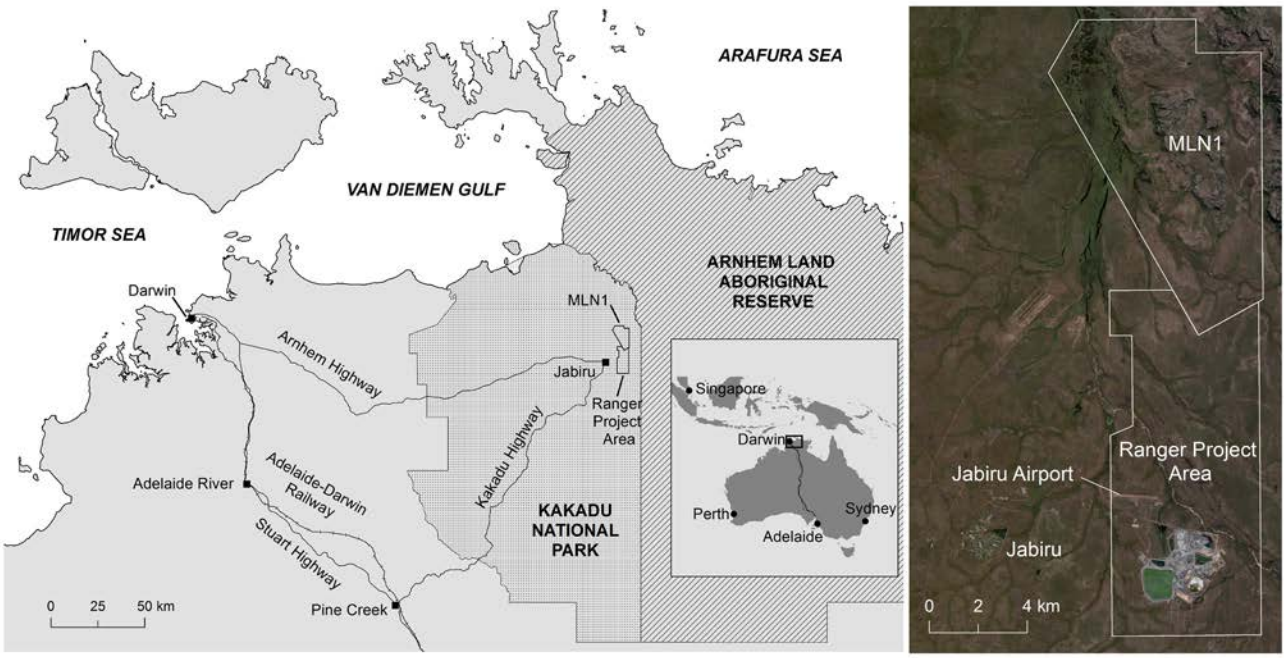

Figure 1: Location of the Ranger Project Area

1.2 PROJECT PROPONENT

ERA has been operating the Ranger mine for over three decades, since the commencement of open pit mining in May 1980, and the production of the first drum of uranium oxide (product) on 13 August 1981. Since then, Ranger mine has produced over 110,000 tonnes of product for use in overseas nuclear power stations.

In November 2008, ERA announced a significant mineral exploration target defined as Ranger 3 Deeps[2]. The identification of the Ranger 3 Deeps mineral resource, together with ERA's exploration achievements and innovations were recognised by the 2009 award of Explorer of the Year by *Australian Mining*.

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[1] The "Ranger Project Area" is an approximately 79 km^2 area of land equivalent to a "mining lease", and encompasses the existing Ranger operations. It should not be confused with the much smaller footprint of the proposed Project, which is referred to within this document as the Project area, or footprint.

[2] Refer ERA release to the ASX dated 17 November 2008: http://www.energyres.com.au/media/38_media_releases_2528.asp

Following on from this announcement, ERA submitted a referral and notice of intent under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Northern Territory *Environmental Assessment Act 1982*, respectively, for assessment of an exploration decline to further define the mineral target: *Ranger Uranium Mine Exploration Decline (EPBC 2009/4860)*. Both Governments determined that this project did not require further environmental assessment, under these Acts.

Construction of the exploration decline commenced on 1 May 2012, with the objective of extending 350 metres below the surface allowing up to 52,000 metres of exploration and resource definition drilling. As reported in a series of subsequent ASX announcements this exploration program is enhancing the geological model and structural interpretation for the Ranger 3 Deeps resource, providing a basis for detailed mine planning.

1.3 THE ENVIRONMENTAL ASSESSMENT PROCESS

On 16 January 2013, ERA submitted a referral and notice of intent under the Commonwealth EPBC Act and Northern Territory Environmental Assessment Act respectively, for the Project (EPBC 2013/6722).

The Project was assessed by the Commonwealth Department of the Environment[3] as having the potential to cause a significant impact on the following Matters of National Environmental Significance (MNES) that are protected under Part 3 of the EPBC Act:

- World heritage properties (sections 12 & 15A)
- National heritage places (sections 15B & 15C)
- Wetlands of international importance (sections 16 & 17B)
- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 and 20A)
- Nuclear actions (sections 21 & 22A)
- Commonwealth land (sections 26 & 27A)

Concurrent with the Commonwealth assessment, the Northern Territory Environment Protection Authority considered: *"... that there [was] a risk of significant impact to the environment from the proposal ...",* therefore requiring further studies and a more comprehensive assessment under the Environmental Assessment Act at the level of an EIS.

In order to ensure the potential environmental, social and economic impacts from the Project are adequately investigated, a set of guidelines *(Guidelines for preparation of a draft environmental impact statement: Ranger 3 Deeps underground mine)* were issued to direct ERA's production of a Draft EIS. The Draft EIS is designed to satisfy the requirements of both the Australian and Northern Territory Governments.

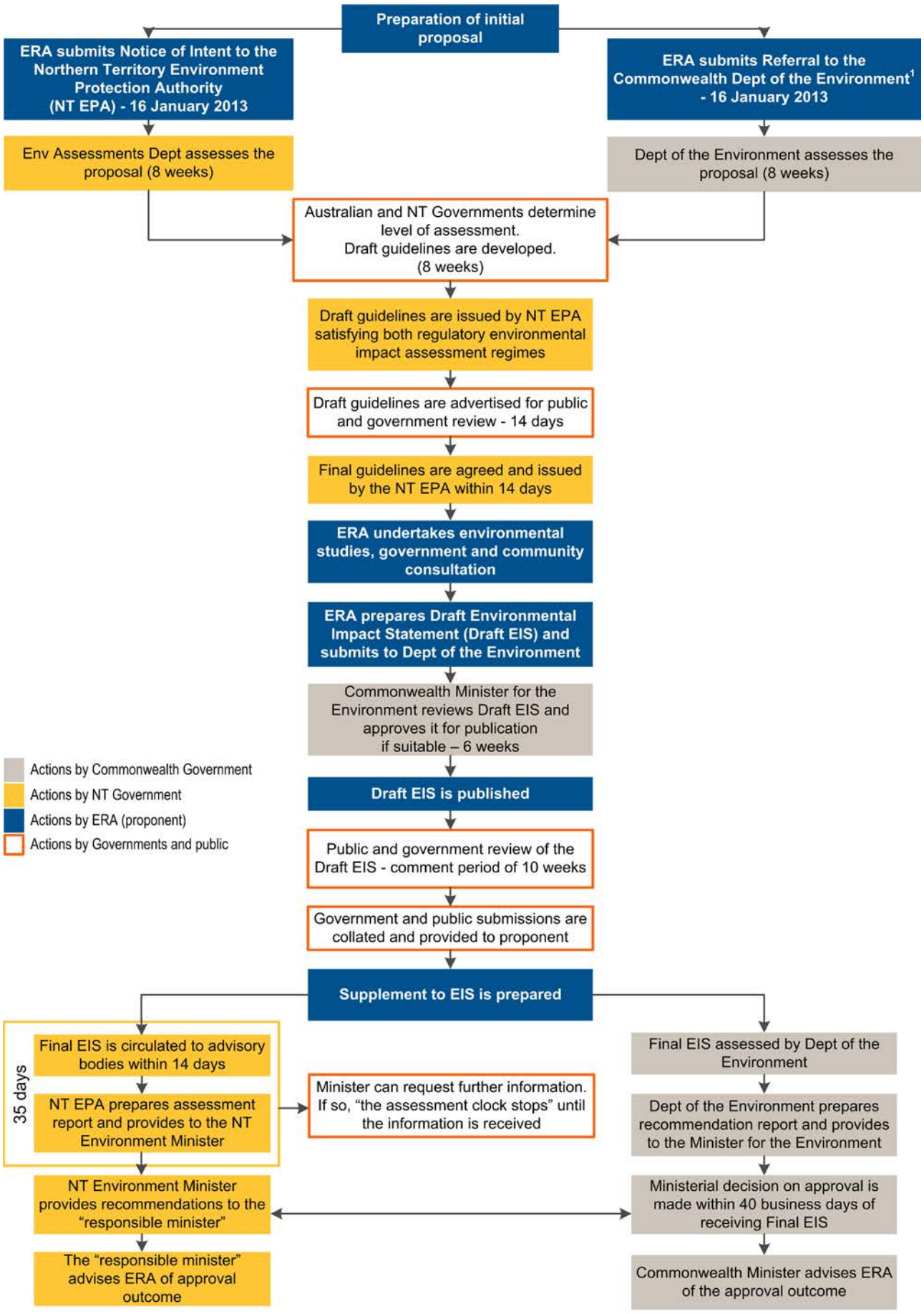
[3] Formerly the Department of Sustainability, Environment, Water, Population and Communities.

The Draft EIS aims to demonstrate that ERA has achieved the following:

- It has supplemented its current understanding of the existing environment with additional studies in sufficient detail to predict changes that could occur as a result of the Project activities.
- It has incorporated environmental management controls into the design and planning phases of the Project to avoid or minimise impacts on the environment through all phases of the Project (e.g. construction, operation, decommissioning, rehabilitation and closure).
- It has generated and documented sufficient details about the Project to allow public engagement and an opportunity for individuals, groups and organisations to express their views about the Project. Information about how to make a submission is provided at the end of the Executive Summary.
- It has generated and documented sufficient details about the Project to allow Australian and Northern Territory Governments to decide whether or not to approve the Project.

The Draft EIS provides a context for understanding and assessing potential local and regional impacts. Assessment of the Draft EIS will be in accordance with the Commonwealth EPBC Act and the Northern Territory Environmental Assessment Act, and follows the process outlined in **Figure 2**.

Contextual legislative and regulatory discussion relevant to the Ranger mine is provided in **Chapter 1**.



1. Formerly the Department of Sustainability, Environment, Water, Population and Communities

Figure 2: Environmental impact assessment process

2 THE PROJECT

This section of the Executive Summary outlines the major elements of the Project.

The Project is "brownfield", predominantly located within existing areas of disturbance adjoining the existing Ranger mine, and utilising substantial existing plant and associated infrastructure. The Project essentially represents a different method of acquiring uranium bearing ore from a location adjacent to, but deeper than, the recently exhausted open pit mine (Pit 3). The ore will be delivered to the existing Ranger plant, where it will be processed in combination with existing stockpiled ore to generate additional uranium oxide product. The Project can be considered to comprise two main components:

- The development and operation of an underground mine, where ore is extracted from a series of small stopes (mining blocks), loaded and transported to the surface in trucks.
- Supporting surface infrastructure, some of which is an extension of existing equipment (e.g. additional power generation facilities); and some which is specific to the new mining method (e.g. ventilation system and backfill plant).

Each of these major Project components is summarised below, and a detailed Project description is provided in **Chapter 3** of the Draft EIS.

2.1 UNDERGROUND MINE

The proposed mine will utilise the existing exploration "portal" (entrance) and "decline" (tunnel) to provide vehicular access to the underground mining areas. The underground mine will be divided into mining districts, from south to far north, and consist of different horizontal levels, each approximately 25 metres thick. Within each district and level, horizontal tunnels referred to as "lateral development" or "ore drives", provide access to the stopes. A ventilation system comprising

primary vertical air intake and exhaust shafts, toward the extremities of each district, and a secondary ducting system will maintain a safe working environment for personnel.

The mining method, is much more selective compared to open pit mining, with specific mineralised areas (meeting a threshold ore grade) targeted for extraction. This minimises the quantity of waste rock generated. As the mining progresses, the extracted stopes are backfilled to prevent subsidence and provide geotechnical stability for adjacent areas.

The mine will be progressively developed over a period of approximately five years, with lateral development prioritised in the initial period. The mining sequence will typically be "bottom-up", where the lowest stopes are mined first. Mining will retreat from the periphery of each mining district (south, central, north and far north) towards the centre, where the mine access and air intake shafts are located. This ensures that mining always retreats towards the source of fresh air. This strategy greatly reduces the exposure of personnel to air returning from active work areas, thereby minimising exposure to airborne dust and radiation.

Ore will be transported to the surface by truck to the existing Ranger mine processing facilities, where it will be refined into uranium oxide product and exported overseas for use in nuclear power plants.

The proposed underground mine and mine districts is shown in **Figure 3**. Stopes are shown in solid shading, development in yellow, exploration decline in grey, intake ventilation in blue and exhaust ventilation in red. In three dimensions, the deposit resembles a flattened cigar shape, trending north-northwest and plunging around 12 degrees to the south.

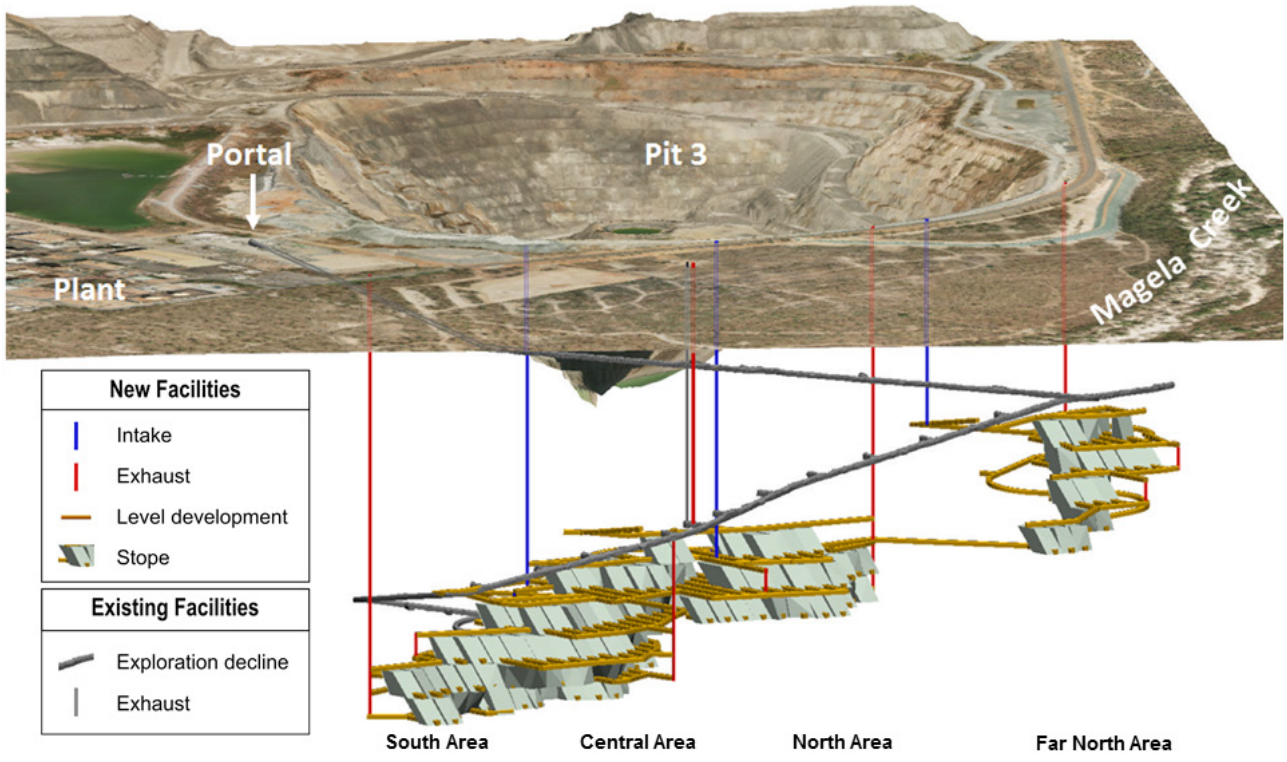


Figure 3: Provisional mining layout looking east to west

2.2 SURFACE INFRASTRUCTURE

In addition to the existing Ranger processing plant the following new infrastructure is proposed to support the underground mining activity:

- power plant (diesel power generation units);
- refrigerated air and mine ventilation infrastructure;
- backfill plant;
- mine dewatering facilities; and
- auxiliary infrastructure (e.g. consumables storage, office complex).

The majority of the infrastructure will be constructed within the existing operational footprint. **Figure 4** shows an indicative layout of the new facilities in relation to the existing plant. Almost all of the new equipment will be located within the current operational area. The exceptions will be a limited number of ventilation shafts, and associated refrigeration equipment, which will be located adjacent to the mine access road within a previously disturbed area known as the "Magela land application area". Vegetation clearing is anticipated to be less than 1 hectare.

An indicative layout of key infrastructure components is shown in **Figure 4**, and each major element is described below and numbered according to the figure.

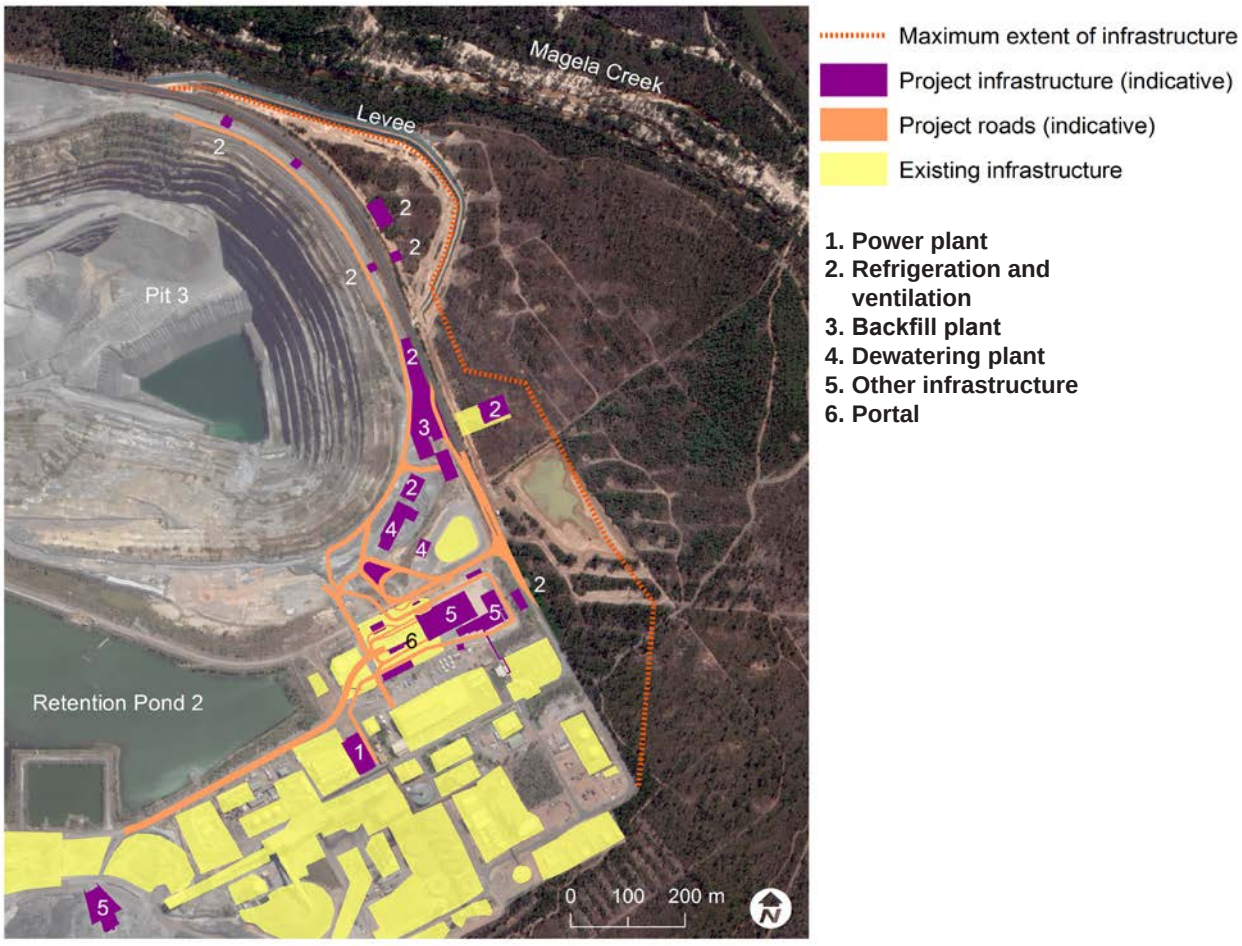


Figure 4: Indicative location of key Project infrastructure

The feasibility study and detailed engineering design phase will establish the final layout, equipment selection, configuration (such as reticulation corridors) and detailed construction process.

Power Plant (1)

The existing Ranger mine is powered by diesel generated electricity. In order to supply the additional requirement for the Project (both underground mine and surface infrastructure), additional diesel generator units will be placed adjacent to the current power plant and operated from the existing power station control room (**Figure 5**). The units will be integrated with the existing plant to maximise the efficiency of the system as power demand varies. Exhaust gases from each generator will be plumbed into a common stack. The refrigeration and ventilation system will utilise the largest portion of the additional power. The power generation capacity will be progressively installed with power generators No.1 and No.2 (shown in red) installed in Year 1 and power generators No.3 and No.4 (shown in grey) installed in Year 2. There is provision for two additional power generators if required later in the Project, with power generator No.5 currently scheduled for installation in the second half of the Project.

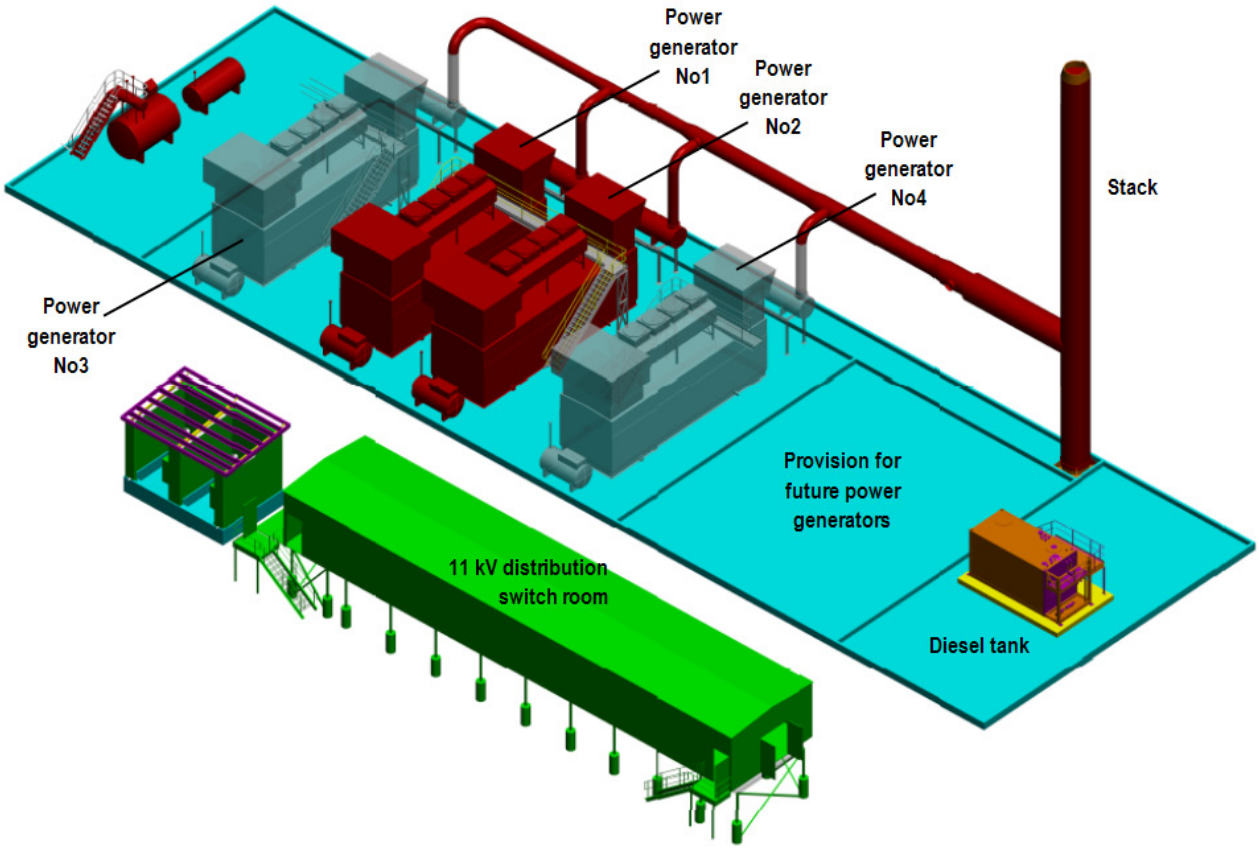


Figure 5: Indicative image of the Project power plant

An 11 kV distribution switch room will be located adjacent to the power plant, distributing power to a number of "kiosk" substations located adjacent to the major ventilation equipment and other surface infrastructure. The kiosk substations will transform the electricity to the appropriate voltage and distribute it to motor control centres next to each major piece of equipment. There will be an underground switch room similarly distributing power to active mining areas.

Refrigeration and Ventilation (2)

The underground mine will be ventilated to supply fresh air to personnel working in the mine. Fresh air is drawn in through intake vents and removed from the mine through exhaust vents. Each exhaust vent has a fan at the surface to move the air through the ventilation system. Ranger mine is located within a tropical climate zone. During the build-up and wet season when humidity is high, the fresh air will be cooled before it enters the mine. This will maintain suitable conditions for the health and safety of the workers. A schematic flow diagram of the ventilation system, including indicative images of the surface intake and exhaust infrastructure, is shown in **Figure 6**.

The equipment used in the Project mine ventilation system will be similar to that used at other underground mines around the world.

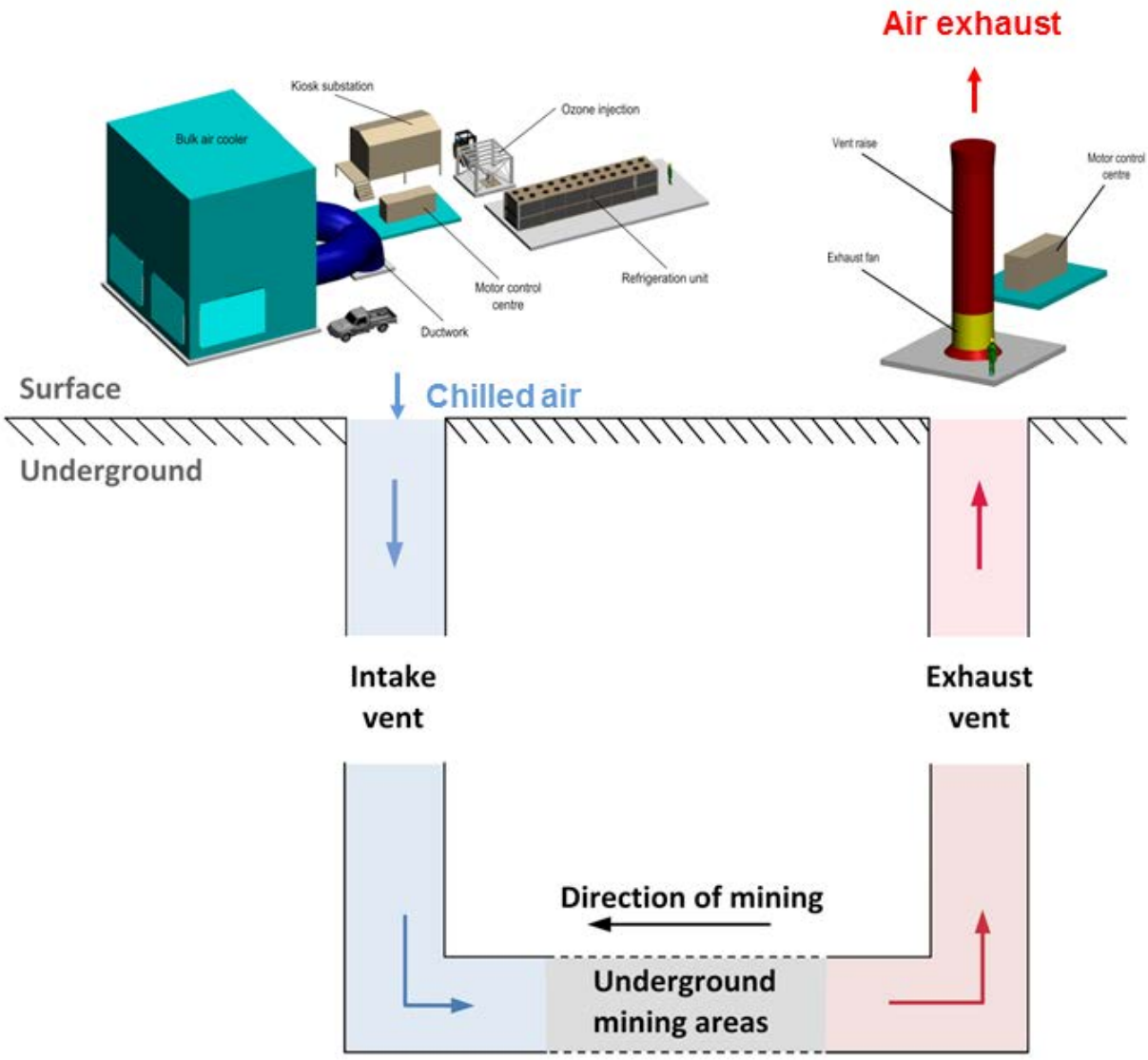


Figure 6: Schematic flow diagram of the mine ventilation system

Backfill Plant (3)

As ore is removed from the stopes, the underground mine will be progressively backfilled with a cemented paste. The backfill supports the surrounding rocks so that adjacent areas can be safely mined, and ultimately precludes the possibility of surface subsidence post mine closure and inhibits the movement of contaminants through the deep groundwater. The paste will typically comprise tailings, crushed low-grade ore or waste rock and cement binder.

The backfill plant (**Figure 7**) will include facilities to de-slime (remove the fine particles), dewater and wash tailings from the existing processing plant, as well as equipment to mix the paste components.

The paste will be reticulated underground via a pipe network in cased boreholes and the underground drives (tunnels).

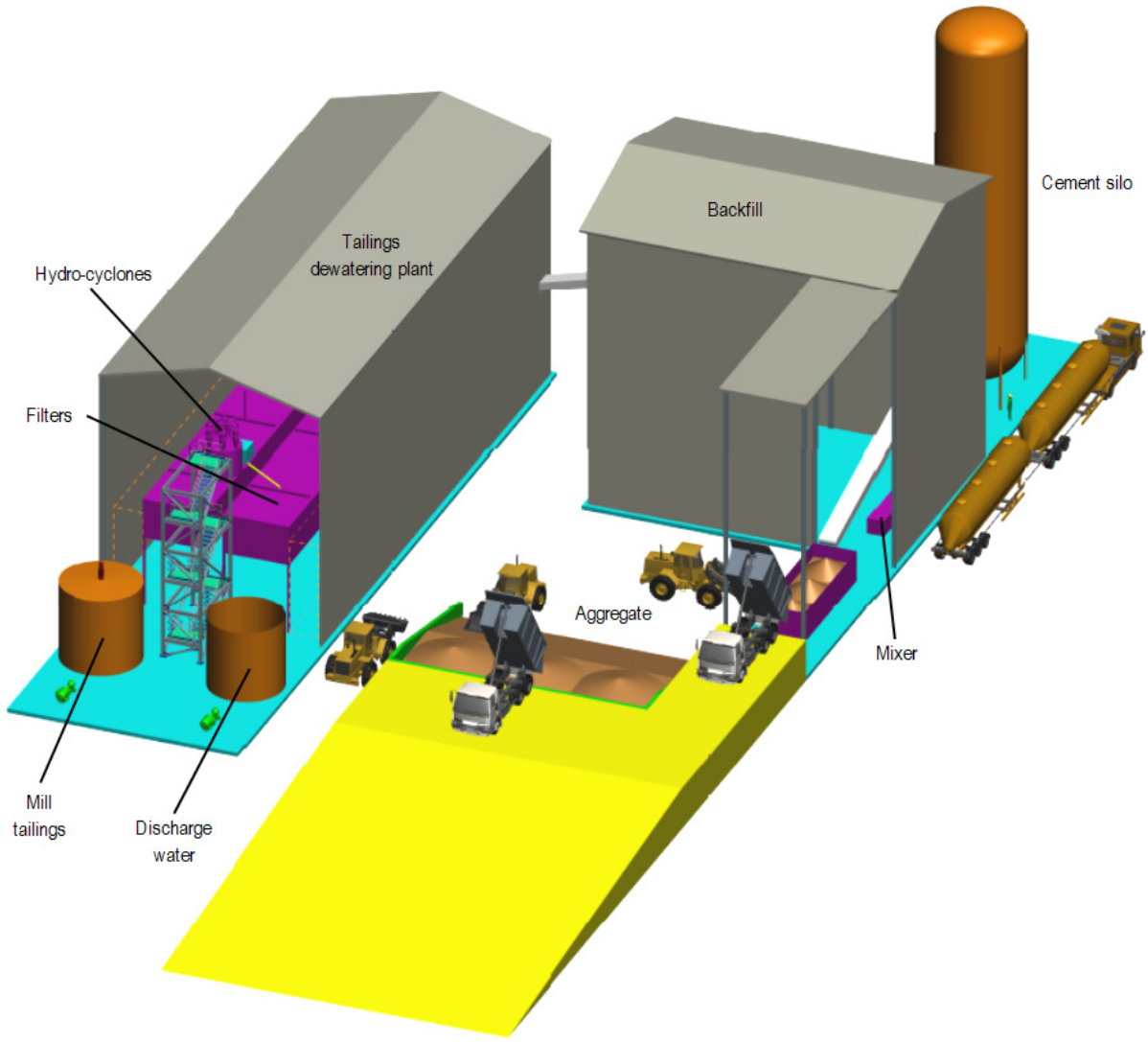


Figure 7: Indicative image of the backfill plant and tailings dewatering plant

Dewatering Facilities (4)

Mine water, originating from seepage of groundwater into the mine workings and water used for drilling and dust suppression will collect at two collection points or sumps: one for the far north area and one for the remaining areas. Mine water will require treatment as it contains fibres from the ground-supporting spray-on concrete (shotcrete), occasional traces of oil from operating equipment and fine rock particles from the mine itself. Mine water will be pumped from the sumps to the surface and into a silt trap, settling pond and oil/water separator before flowing into Retention Pond 2 where it enters the main water management system (**Figure 8**).

The existing water management system including water treatment plants has ample capacity to manage the anticipated volume of mine water.

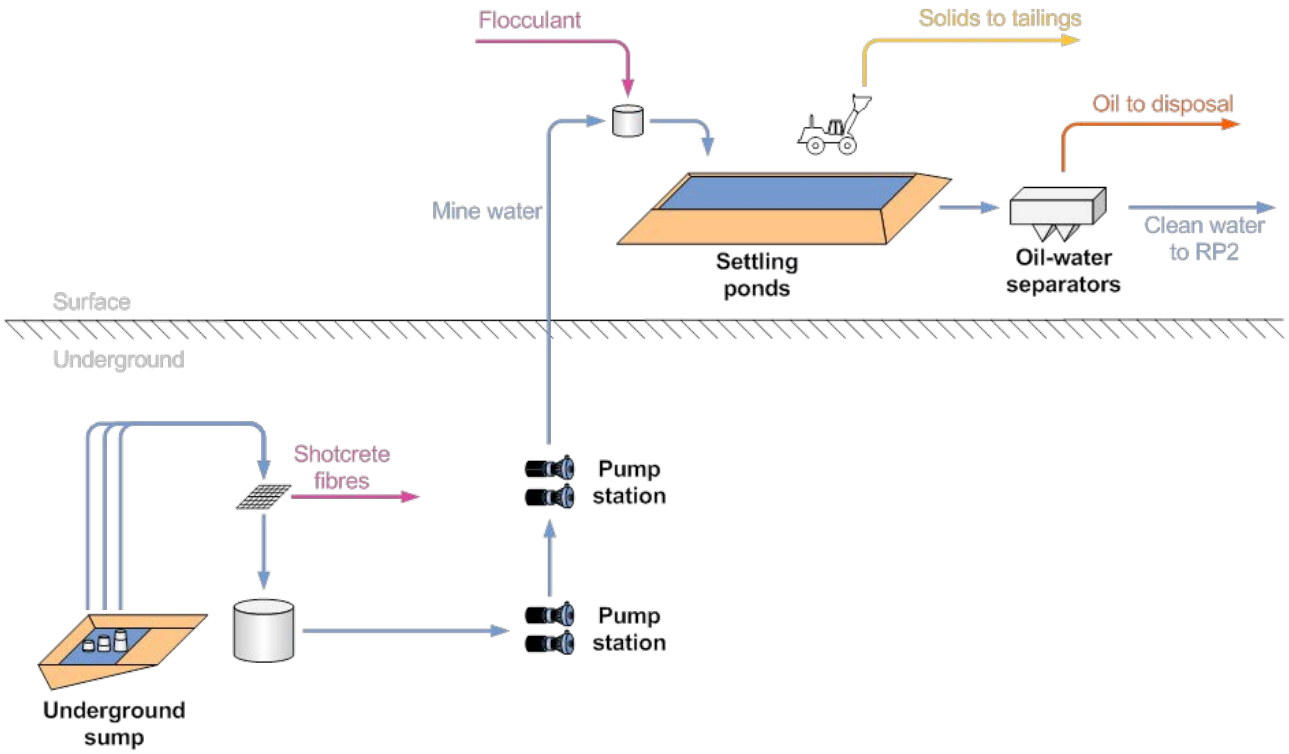


Figure 8: Schematic flow diagram of the mine dewatering system

Auxiliary Infrastructure (5)

In addition to the main infrastructure described above, a range of additional equipment, materials handling and service infrastructure will be required and established as part of the Project. Elements include diesel, water and compressed air supply, reticulation of materials and power, workshop and office complex, modifications and extensions to heavy and light vehicle roads within the current operational area and installation of a means of secondary emergency egress from the underground mine. Details of these elements are provided in **Chapter 3**.

2.3 SCHEDULE, WORKFORCE AND ACCOMMODATION

Project Schedule

An indicative development schedule for the Project is presented in **Figure 9**. Construction will occur over the first 2 years. The early stages of mine development will focus on installing lateral access and the mine ventilation system, with ore removal ramping up in 2016 and then continuing until 2020. The Project closure and rehabilitation activities will proceed during the period up until the currently authorised date of 8 January 2026. These activities will be fully integrated with the whole of site closure strategy.

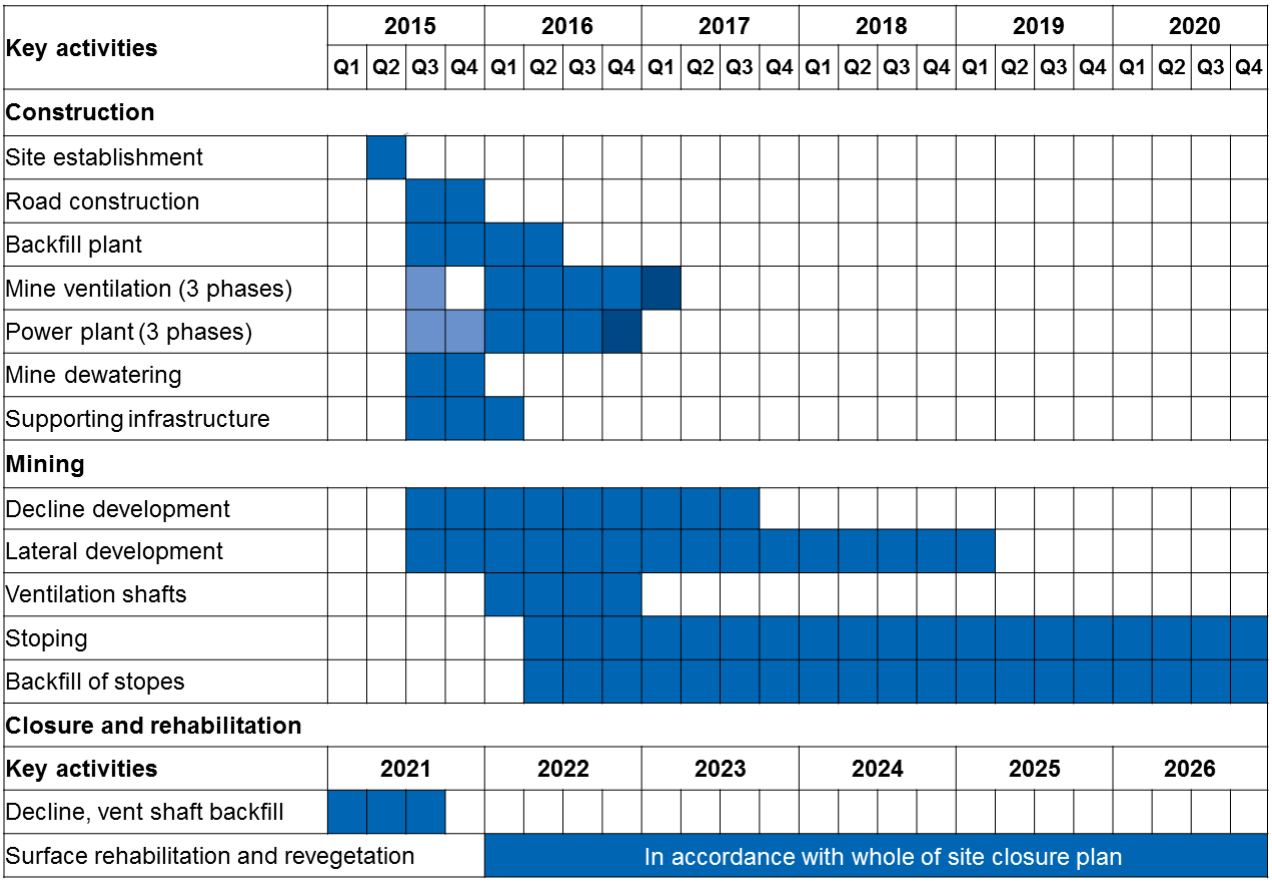


Figure 9: Indicative Project development schedule

Workforce and Accommodation

Project construction and operations will require between 180 and 280 new employees over the life of the operation. The construction and operation workforce will include both contractors and direct ERA employees. During operations, the new workforce will be employed in management, supervisory, engineering, technical, administrative, trade and operator roles. Most of the operational roles will be engaged in underground activities, with approximately 10 employees required to run the new surface facilities.

The underground mine will operate continuously, 7 days per week, on a roster of two, 12 hour shifts per day. The underground workforce will be predominantly a contract workforce and will ramp up over a two-year period, peaking in 2017 at around 295 employees.[4] For production positions requiring full coverage, four crews are required. The majority of the new workforce will require specialised skills in underground mining and will be supplied from both local and interstate sources. The net impact of the Project on the workforce requirements (comparing with existing operations) is provided in **Figure 10**. Based on workforce numbers, no new accommodation infrastructure is required.

[4] A limited number of Project roles will be filled through the transition of current employees into new roles. Thus the estimated peak workforce of 295 exceeds the number of new roles created (280) as the higher figure includes the transitioned roles.

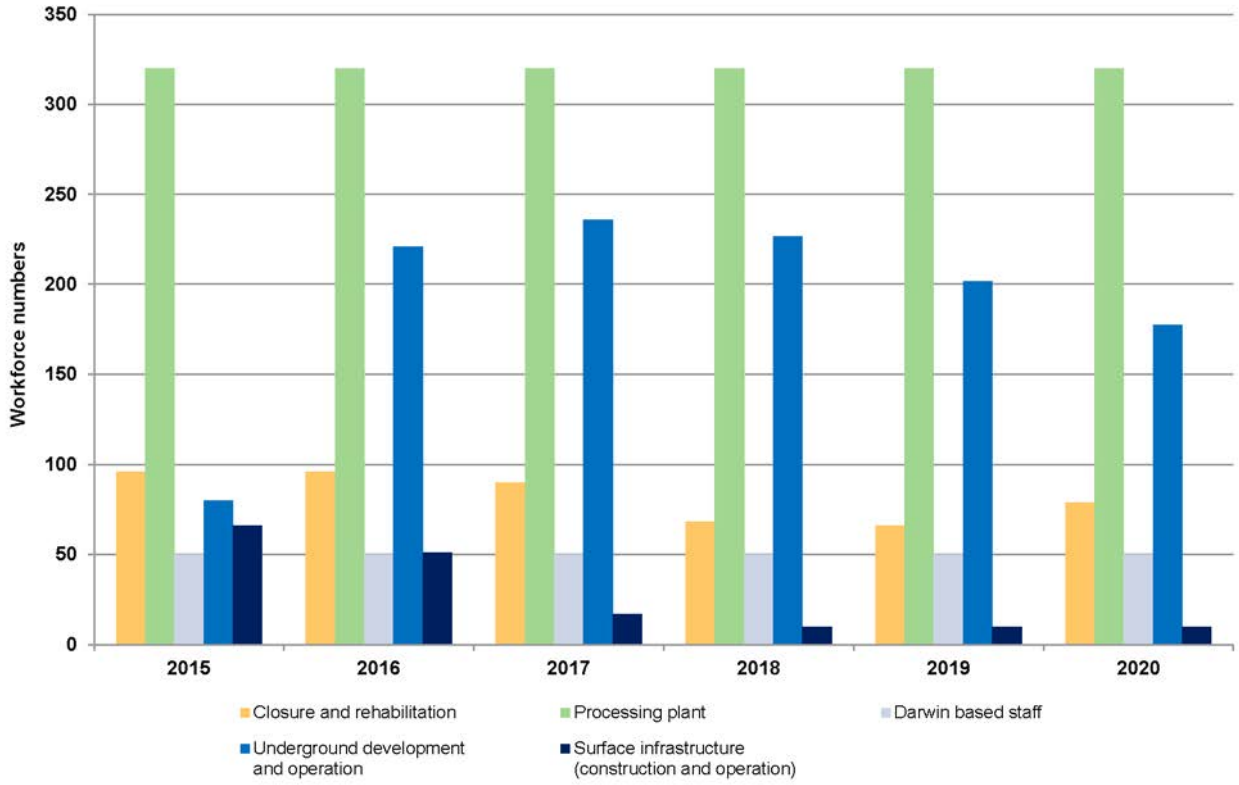


Figure 10: Combined workforce – Ranger 3 Deeps and existing operations

3 ALTERNATIVES

This section of the Executive Summary describes how alternatives were considered for the entire Project and during the selection of major elements. The alternatives are further discussed in **Chapter 4**, along with a description of the process used to assess options and establish the best practicable technology.

Project Scale Alternatives

At a project scale two possible alternatives to the proposed Project are to:

- mine the Ranger 3 Deeps orebody using an open pit mining method; or
- not proceed with the Project, referred to as the "No Proposed Action" option.

Open pit mining is not feasible. **Figure 11** shows the probable extent of an open pit required to access the Ranger 3 Deeps resource. The volumes of waste rock, the intrusion on existing plant infrastructure, and the significant surface disturbance in proximity to Magela Creek exclude this option.

Figure 11: Projected surface disturbance required under an open pit mining scenario

Given that the Project is a brownfield activity, the "No Proposed Action" option would involve the continuation of existing operations, processing previously stockpiled, low grade ore, leaving the Ranger 3 Deeps resource un-mined. Under this scenario:

- The regional employment benefit of between 180 and 280 new jobs for construction and operation of the Project over a five year period would not be realised;
- The economic benefit from the capital development of Project infrastructure and the increased production of uranium oxide would not be realised, with declining revenues impacting on ERA's capacity to continue its current level of community support; and
- There would be a similar level of potential environmental impact in either scenario (as studies demonstrate only small incremental changes to the cumulative impact if the Project does proceed).

The "no project" alternative is not supported due to these lost opportunities and an expectation that should the project proceed, there will be no significant change in environmental impact.

Feasible and Best Practicable Technology Options

At the scale of major sub-elements (such as underground mining and backfill methods, energy source, infrastructure location) ERA employed a best practicable technology assessment. Whilst a form of risk assessment, the process is fundamentally an options analysis technique which quantitatively ranks options through consideration of cultural, environmental, health and safety, technical aspects, cost and closure criteria. Those options found to represent best practicable technology for each significant project element form the basis of the Project. These were subsequently taken forward into the environmental risk assessment.

Workshops, with attendees (ERA and external) having relevant expertise across technical, environmental, social and cultural disciplines, supported by technical performance, impact studies and other data, considered 71 options across 17 elements of the Project. **Table 1** summarises the results. More details of the assessment method, criteria, and unfavourable options are described in **Chapter 4** and associated **Appendix 4**.

Table 1: Summary of best practicable technology assessment results

Project element	Highest ranked best practicable technology
Default Choices (only one viable option)	
Primary mining method	Underground mining
Access to mine	Current exploration decline
Mining development	Jumbo drill and blast techniques
Ore haulage to surface	Truck via existing decline
Source of aggregate	“Category 2” low grade ore / rock
Highest ranked options (where multiple viable options exist)	
Orebody access	Footwall (under and to west of orebody)
Mining method	Long hole stoping - entry
Truck type	Diesel
Ventilation raise construction	Raise bore with surface stabilisation
Emergency egress type	Plastic ladder way with climb assist, or winch and torpedo
Backfill type	Cemented paste aggregate fill (tailings)
Tailings source for backfill	Fresh tailings from the processing plant
Tailings preparation method following de-sliming	Vacuum filtration, or vibrating dewatering screen
Backfill plant location	Tailings preparation and backfill plant above underground mine
Aggregate preparation method	Mobile crushing and screening plant (existing)
Processing of high carbonate ore	Use current processing plant with beneficiation to remove carbonate
Beneficiation method	Ore sorting (existing)

4 EXISTING ENVIRONMENT

This section of the Executive Summary outlines the physical, biological, socio-economic and cultural environment in which the Project will operate and briefly describes the existing Ranger mine. Ranger mine has been operating for more than 30 years with extensive monitoring and research programs by the Supervising Scientist Division confirming that the environment has remained protected. A detailed description of these aspects is provided in **Chapter 2** of the Draft EIS.

The Project will, in increasing spatial order, be located within the Ranger Project Area, which is within the Magela Creek catchment and surrounded by Kakadu National Park, within the Alligator Rivers Region, as shown in **Figure 12**. The Magela Creek catchment contains several land use types, including national park, the mining leases and native title lands. The catchment is largely within Kakadu, a world heritage listed area and Ramsar site.

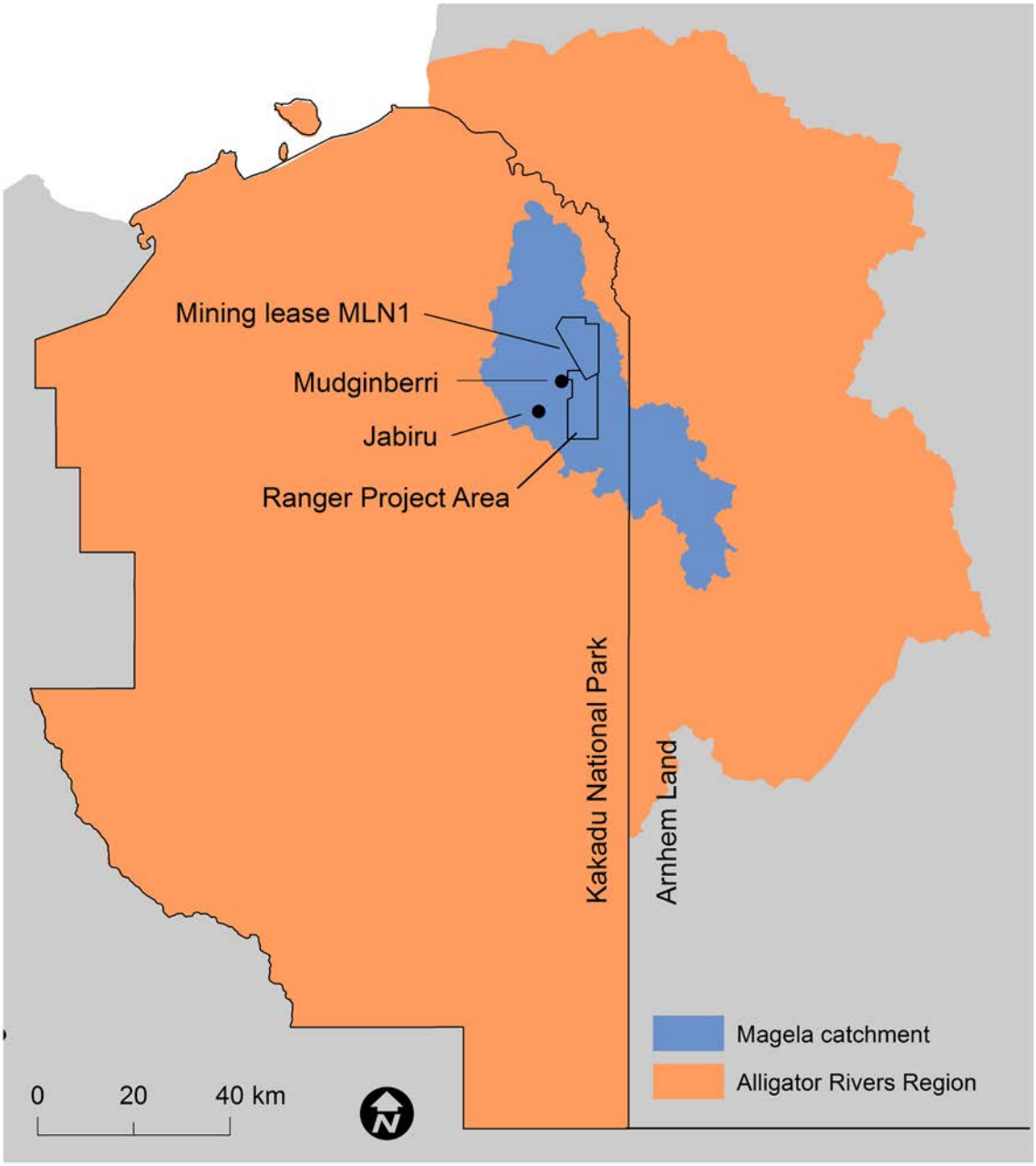


Figure 12: Geographic context for the Project

4.1 PHYSICAL ENVIRONMENT

Climate

The Alligator Rivers Region is dominated by a distinctly seasonal, wet-dry monsoon cycle. The wet season generally extends from late October to early April and experiences predominantly westerly winds, while the dry season is dominated by easterly to south-easterly winds and extends from May to September. Average annual rainfall is approximately 1,540 mm, of which 90% falls within the months of November to March. Annual evaporation exceeds rainfall by approximately 1,000 mm. The hottest month is October, with a mean maximum temperature of 37.6ºC, and the coolest month is July, with a mean minimum temperature of 18.3ºC.

The region is subject to potential extreme weather events such as tropical lows and cyclones. The water management system of the existing Ranger mine includes contingencies to manage such events.

Physical Environment

From a geological perspective the Alligator Rivers Region is located in the eastern section of the major geological structure of the region – the "Pine Creek Geosyncline". The northern part of Kakadu (which includes the Ranger Project Area) is located on the Cahill Formation and is the location of mineralisation of economic significance, in particular uranium.

The current operations and location of the Project lie on plains approximately 3.5 km north of the Mount Brockman Massif, which is an outlier of the Arnhem Land Plateau, and rises over 200 metres above the plain. These plains are rarely more than 45 metres above sea level. South and east of the Ranger Project Area, the Arnhem Land Plateau escarpment rises to between 200 and 300 metres above sea level. The Magela floodplain downstream of the Ranger Project Area is between 2 and 5 metres above sea level.

The Ranger mine is bounded by three ephemeral creek systems: Magela Creek to the north, Gulungul Creek to the west and Corridor Creek to the south. These three creeks form part of the Magela Creek catchment, which covers an area of approximately 1,600 km². The more significant of these is Magela Creek which lies immediately east of the Project location. Magela Creek is a seasonally flowing tributary of the East Alligator River, with a catchment originating from headwaters on the Arnhem Land plateau. The creek then flows into lowland woodland and subsequently into a large floodplain.

The regional hydrology of the Magela catchment is influenced by the seasonality of the monsoon driven wet season. Following the onset of the wet season the sand aquifers in the channels of the Magela Creek middle catchment fill with shallow groundwater and flow in the creek usually occurs after antecedent rains of 200 – 300 mm in the catchment. There is a rapid decline of flow with time following a flood event, as flow from direct surface runoff ceases. Some water remains in groundwater-fed rock pools in the plateau and in swampy depressions and isolated billabongs in the lowlands until the next wet season.

Extensive field studies undertaken over the past 30 years have characterised the groundwater regime in the Ranger Project Area. In simple terms a shallow groundwater system exists in the upper relatively permeable alluvium and weathered rock. Flow is driven by recharge, evapotranspiration (combined effects of direct evaporation and transpiration by the vegetation), surface and groundwater interactions and topography. Flow in a deeper bedrock groundwater system is driven by interaction with the near surface system and topography. The exchange between the systems is small due to the relatively low permeability of the bedrock.

4.2 BIOLOGICAL SETTING

Most of the Ranger Project Area is located within the north-east section of the Pine Creek Bioregion (as identified in a national classification of ecosystems), and is surrounded by the Kakadu National Park. ERA, over more than 30 years, has commissioned and participated in many studies of the terrestrial and aquatic environments to understand baseline conditions and the influence of threatening processes, including uranium mining, on the biological environment. A brief outline of ecologically sensitive habitats, and endangered or vulnerable flora and fauna species of relevance is provided here as context to subsequent discussion of the potential impact of the Project on the biological environment. More detail of the existing environment is provided in **Chapter 2**, **Section 2.5**.

National Parks and Protected Areas

Kakadu National Park is located within the Alligator Rivers Region of the Northern Territory and covers an area of approximately 19,800 km². Kakadu is a Commonwealth National Park jointly managed by Traditional Owners and Parks Australia through the Kakadu National Park board of management. The Park is world heritage listed for its outstanding natural and cultural values.

The wetlands are listed as Wetlands of International Importance under the Ramsar convention, supporting approximately three million waterbirds as well as large populations of many other vertebrate and invertebrate species.

Terrestrial Habitats

The landscape of the Ranger Project Area is predominantly eucalypt woodland/open forest. Magela Creek, which originates from the Arnhem Land Plateau, flows diagonally from the south-east to the north-west through the Ranger Project Area over a distance of approximately 5 km. Following the creek channels is denser vegetation, with a higher canopy, which quickly grades into woodland.

No flora species of conservation significance listed under the *Territory Parks and Wildlife Conservation Act 2000* (Territory Parks and Wildlife Conservation Act) and/or the EPBC Act has been recorded during surveys across the Ranger Project Area over the past 15 years. In a recent survey (2013) of lowland riparian and woodland areas, over 90 flora species were recorded. These species are also common in the surrounding Kakadu National Park and did not include any threatened or rare species.

Kakadu contains over one third of Australia's bird species (271), one quarter of Australia's land mammals (77), 132 reptile species, 27 frog species, and over 246 fish species recorded in tidal and freshwater areas. Eight fauna species of conservation significance (Northern Territory and Commonwealth) have been recorded in the Ranger Project Area during previous surveys. These species include the northern quoll, last observed in 2004, the partridge pigeon, and the fawn antechinus observed in the most recent 2013 survey. A description of these and other EPBC Act listed species and potential threats to them is provided in **Chapters 9, 14** and **Appendix 12**.

Aquatic Habitats

Surveys of the aquatic habitats of the Ranger Project Area and surrounds have been conducted over more than 40 years, including the initial assessments conducted for the Fox Report[5] in the 1970s. More recent surveys have assessed the billabongs and associated riparian zones within the Ranger Project Area and surrounds.

Aquatic vegetation, aquatic micro-crustaceans, aquatic macro-invertebrates, fish, frogs, aquatic and riparian reptiles, riparian birds, water birds, native riparian terrestrial mammals, and microbats have been sampled in 1994/1995 and 2000/2001, in three billabongs on the Ranger Project Area and compared to reference billabongs (Sandy and Buba) within Kakadu National Park. These studies concluded that, for most biota, whilst there were relative differences between billabongs within and between surveys there were no statistically significant differences in the number of functional groups[6], species richness[7] or relative abundance[8] between Ranger and reference billabongs and between the two sampling periods for most biota.

A comprehensive aquatic survey was undertaken in the 2009 wet season of creeks and billabongs within a 30 km radius of Ranger mine, which included sites both outside and within the possible influence of mining operations. No listed or endangered macro-invertebrate or fish species were recorded, and there were no species considered rare or restricted in distribution.

The Commonwealth Supervising Scientist Division, has been monitoring aquatic fauna downstream of the Ranger mine to assess the 'health' of aquatic communities, and potential impacts from mining for at least 30 years. Data have been collected on a range of water quality attributes, and habitat variables have routinely been collected in conjunction with the aquatic fauna sampling.

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[5] The Fox Report was the result of an enquiry by the Australian Government into the feasibility of uranium mining in the Alligator Rivers Region.

[6] Sets of species which require similar space and resources

[7] The number of species recorded in an ecological community, landscape or region

[8] How common or rare a species is relative to other species in a given location or community.

Threatening Processes

Kakadu has approximately 120 species of plants that are considered invasive, and approximately two thirds of these have been recorded in annual weed surveys at Ranger since 2003. ERA has an active weed management program on the Ranger Project Area.

Since the 1990s, a significant decline has been recorded in the abundance of 10 species of small mammals in the Park, including the Territory Parks and Wildlife Conservation Act listed fawn antechinus *(Antechinus bellus)* and pale fieldrat *(Rattus tunneyi)*, and the EPBC Act listed northern quoll *(Dasyurus hallucatus)*, northern brown bandicoot *(Isoodon macrourus)*, and common brushtail possum *(Trichosurus vulpecula)*. The decline has been attributed to a high fire frequency, feral cats, and cane toads.

Further background detail of the habitats in the vicinity of the Project, relevant native, introduced and conservation significant flora and fauna species, and the bushfire regime in the region is provided in **Chapter 2**.

4.3 SOCIO-ECONOMIC AND CULTURAL SETTING

Economic Environment

The Jabiru economy is underpinned by a narrow base, with mining being the town's principal provider of jobs and the main driver of its economic development. While other sectors such as tourism, services and education are important, they are also highly dependent on economic activity generated by Ranger mine.

Ranger mine is estimated to directly contribute 1.3% of the Northern Territory's gross value added (2012 data). Ranger's contribution is equivalent to the direct contribution of a number of industries in the Northern Territory including the arts and recreation services industry (1.1%), electricity, gas, water and waste services industry (1.2%) and the information, media and telecommunications industry (1.3%). Further detail on the socio-economic environment is provided in **Chapter 11**.

Aboriginal and Cultural Heritage

The entire Ranger Project Area is located within the Mirarr estate. Therefore, the proposed Project lies within the traditional estate of the Mirarr people. All of the Mirarr estate is of value to the Mirarr people; while the areas used for mining are not regularly used for traditional purposes, the physical and spiritual values remain.

Mirarr have obligations and responsibilities linked to the traditional estate. The management of the estate includes responsibility and obligations by Mirarr people to other people from surrounding or neighbouring estates. Obligations include caring for their country, maintaining the health of country, and particularly ensuring significant and sacred sites are not damaged. For instance, maintaining the health of Magela Creek is a responsibility of the Mirarr. Approximately 5 km downstream beyond the Ranger Project Area, the creek flows into the Madjinbardi (or Mudginberri) Billabong, beside which sits the small Mirarr community of Madjinbardi. The creek flows for a further 8 km downstream through numerous large billabongs before flooding into the expansive Magela wetland system. The wetland system is abundant in a variety of fish and bird life, which is a rich supply of traditional food sources for the Mirarr people. The wetlands also contain a number of cultural sites. The products of this wetland system are shared by a number of neighbouring and downstream estates, and consequently Mirarr people bear great responsibilities and obligations for ensuring the health of this wetland system. It is these values, and the natural cultural values of the Mirarr estate, that have significantly contributed to the world heritage listing of the surrounding Kakadu National Park.

Archaeological surveys of the Ranger Project Area have identified a total of 171 recorded places of indigenous cultural heritage significance, of which 99 are archaeological sites and 69 are archaeological background scatters. There is also an unregistered dreaming site, a cemetery and,

located within the surface projection of the Project, there is one surface site of cultural significance. This site, R34, is an archaeological site that provides evidence of occupation through a quartz quarry, area of stone implements and grinding holes. The site is located within a fenced exclusion zone, which protects it from potential surficial impacts such as clearing.

Detail of the various registers, locations and descriptions of places of natural, indigenous and historic heritage relevant to the project are provided in **Chapter 10**.

4.4 EXISTING RANGER MINE

Mining and Processing

Operations at Ranger uranium mine consist of both mining of uranium ore and processing of the ore to produce uranium oxide. Mining began in 1980, with production of uranium oxide from two deposits exceeding 110,000 tonnes in the period since. The mining method at Ranger has been by conventional open cut. Pit 1 was mined out in 1994 and mining in Pit 3 ceased in November 2012. Since that time, ERA has continued to process stockpiled ore through the plant at Ranger mine. Major components of the existing mining and processing operations include:

- the mill area comprising power station (which also provides power to the township of Jabiru), processing plant, administration and maintenance facilities;
- a tailings dam;
- two mined out pits – Pit 1 and Pit 3;
- ore and waste rock stockpiles;
- a number of water retention ponds and a constructed wetland filter;
- water treatment plants;
- irrigation areas, for the disposal of managed release water;
- access road and service tracks; and
- Jabiru Airport and associated infrastructure.

Pit 3 is currently being prepared for the transfer of tailings from the tailings dam. Pit 3 is scheduled to receive tailings direct from the plant from 2015 onwards.

Material that was extracted during open cut mining was transported by truck, passing beneath a "discriminator" which established the ore grade by measuring the average radioactivity of the load. Mined material was categorised as waste rock or various ore grades and stockpiled and/or processed accordingly. This general approach will continue for material mined from the Ranger 3 Deeps orebody.

Figure 13 is a schematic of the ore processing circuit, in which each of the grey blocks represents an existing stage of processing. The majority of ore mined from the proposed Project will be processed through these same steps, in combination with a continuation of processing of existing stockpiled ore. A small portion of the Ranger 3 Deeps ore is expected to have a higher proportion of carbonates minerals compared to existing ore. As these minerals are barren of uranium mineralisation and consume sulfuric acid, a beneficiation process (ore sorting) can be applied to reject the carbonate bearing component. The required additional steps are shown as brown blocks in **Figure 13**. The existing ore sorter has sufficient capacity to be used for the Project. Further detail of the existing operations is provided in **Chapter 2**.

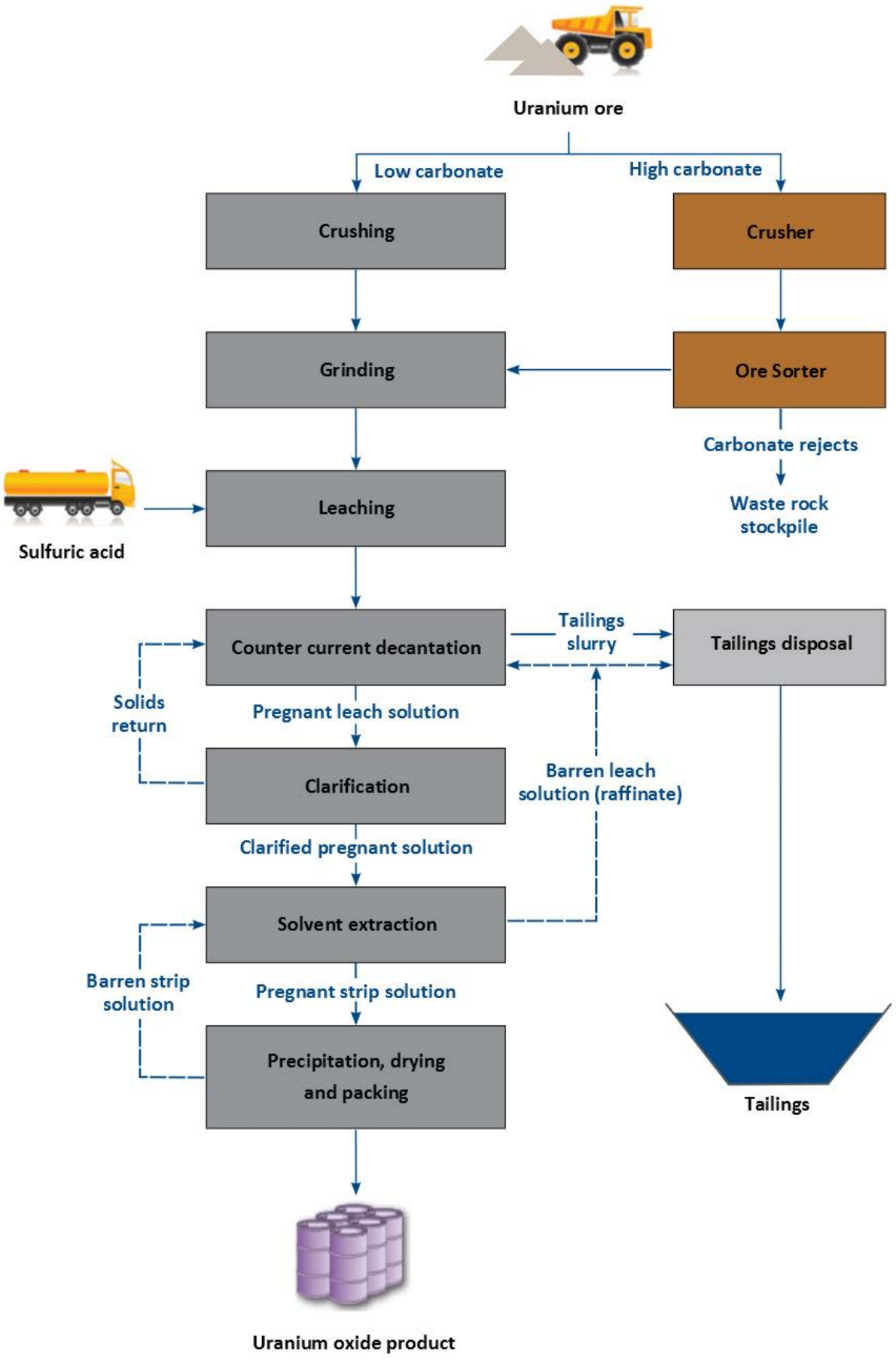


Figure 13: Existing processing circuit with high carbonate ore pathway

5 RISK ASSESSMENT METHOD

Risk management is a fundamental component of the way ERA conducts its business. Risk management is an integral part of good management practice. It is an iterative process consisting of steps, which, when taken in sequence, enable continual improvement in decision-making (**Figure 14**).

Risk management is not a matter of becoming risk averse and unnecessarily avoiding risks. Risk management enables an organisation to understand its risks, decide how to manage those risks and ensures that appropriate resources are allocated.

Risk assessment is a key step in the overall process and involves the systematic identification, assessment and mitigation of risk to the environment and the community. This section summarises the risk assessment method used to identify and categorise environmental and community risks that may result from the planned activities associated with the Project.

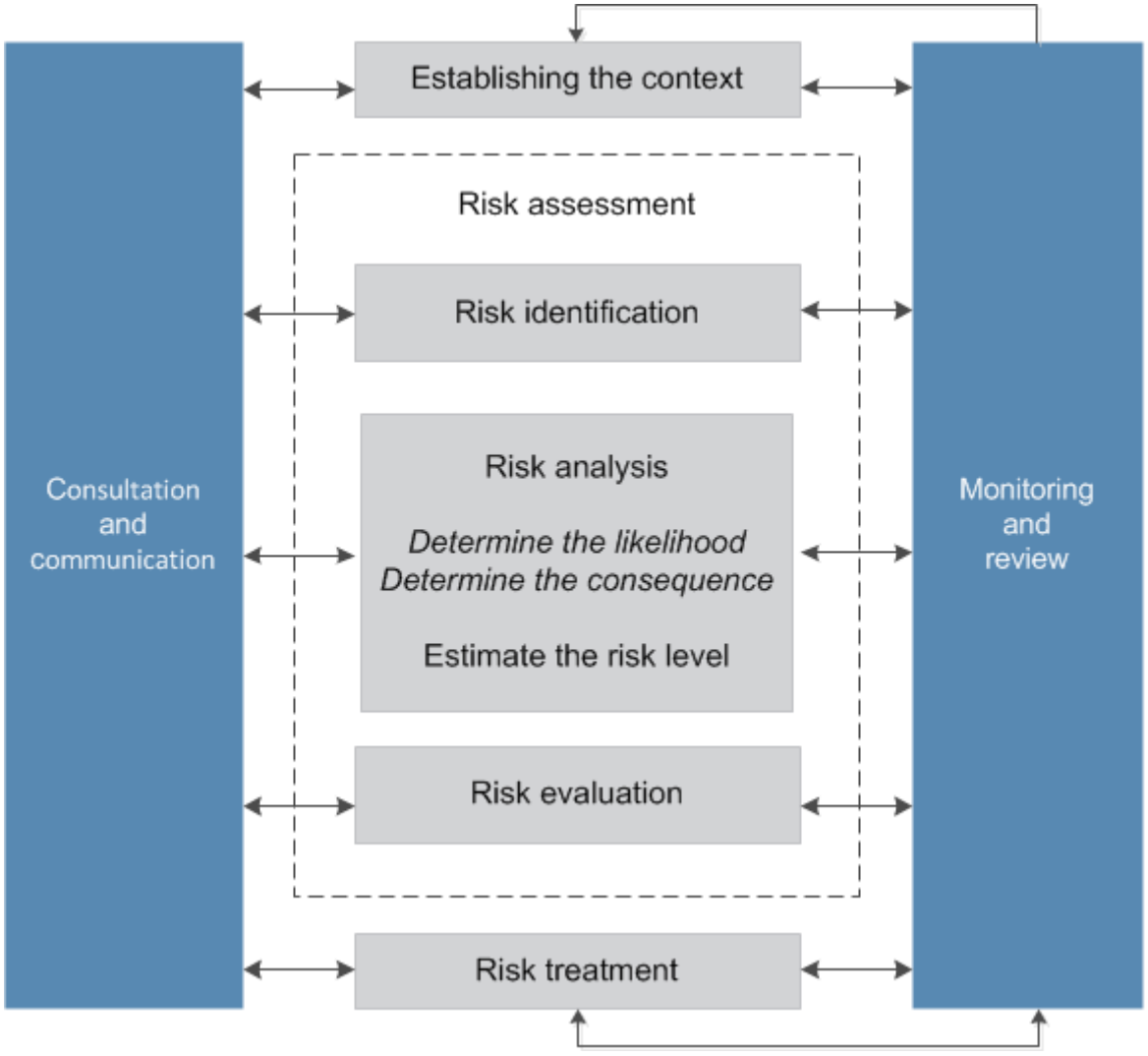


Figure 14: Risk management process – overview

5.1 ENVIRONMENTAL RISK ASSESSMENT

Environmental risk assessment is the process of identifying the likelihood and consequence of potential environmental impacts from an event, an action, or from lack of action. A risk assessment approach based on the requirements specified in ISO AS/NZS 31000-2009 Risk Management has assisted in identifying the potential environmental impacts of the Project.

Assessment was carried out through desk-based assessment and workshops using predetermined definitions of likelihood and consequence categories to rank each risk. Where appropriate, quantitative modelling was used to assist in evaluating risks; for example, risks arising from the movement of solutes from the tailings used in the backfill of underground mine stopes were modelled to predict the quantity and rate of solute migration to Magela Creek over time (10,000 years). Similarly, air emissions were modelled to predict ground-level concentrations of air pollutants at existing sensitive receptors, cultural and ecological receptors. These were then compared to national air-quality guidelines.

This approach has supported the Project to focus mitigation and management strategies on issues that pose higher environmental risk. Included in the assessment process, was a Bow Tie Analysis of a selected number of risks. This approach analyses the links between potential causes, preventative controls and consequences to gain a better understanding of the extent and quality of barriers and mitigation measures that exist for the management of those risks.

Through the application of new treatments (controls) and management strategies, all high risks were reduced, with most risks rated as "low". Those rated higher were the subject of particular attention, including the identification of additional new treatments or controls, which will be embedded into ERA's existing environmental management system and environmental management plans. Further discussion on the implementation of new treatments is provided in **Chapter 15** and **Appendix 17**.

5.2 SOCIAL IMPACT ASSESSMENT

ERA engaged specialist consultants, Banarra, to undertake an independent social impact assessment to predict and evaluate potential effects of change to the community associated with the Project.

The breadth of the study included social values and cultural area; a social baseline study (including demographic and social statistics); workforce profile; potential impacts (direct, indirect and secondary impacts including an assessment of the size, significance, and likelihood of these impacts at the local and regional level); mitigation measures and strategies. Based on the assessment outcomes, ERA has developed a social impact management plan.

The study included a review of the extensive existing literature available on Ranger, followed by a comprehensive consultation program. Key stakeholders such as the Gundjeihmi Aboriginal Corporation, Parks Australia, the Northern Land Council, and the West Arnhem Regional Council were consulted and/or took an active role in the process. A broad range of indigenous and non-indigenous stakeholders, non-government organisations, government departments, and local and regional business were also engaged.

5.3 TRAFFIC IMPACT ASSESSMENT

ERA recognises the importance of road safety through its current risk management activities and collaboration with transport providers and the Northern Territory Department of Transport. In 2012, this proactive approach to traffic risk management was nationally recognised, with ERA receiving the Australian Road Safety Foundation's Award for Outstanding Achievement at the Australia Road Safety Awards.

Recognising transportation as an activity with the potential for higher consequence incident outcomes, ERA engaged specialist consultants, GHD Pty Ltd, to undertake a specific traffic impact and risk assessment study.

The transport study area was set as a 10 km corridor along the Stuart, Kakadu and Arnhem Highways, being the primary transportation routes to Ranger mine. A desktop assessment was undertaken to identify species of conservation significance within the corridor and ecologically sensitive areas. A key aspect of the study was the quantitative analysis of the likelihood of an incident occurring at any location (or road length) along the haulage routes, for each consumable. This was, calculated as the product of two components: probability of a crash at a specific location; and the exposure, through the frequency of trips.

The risk assessment considered potential risks to both public health and safety and the environment inclusive of listed threatened and migratory species. The scope of the risk assessment included transport requirements associated with construction and operational phases of the Project and comprised both incremental (Project) and cumulative (Project and continuation of existing operations) impacts.

Discussion on the outcomes of the traffic impact assessment is provided in **Chapter 12** and **Appendix 8**.

6 EMISSIONS IMPACTS AND MANAGEMENT

The Ranger Project Area is surrounded by the eucalypt savanna dominated landscape of Kakadu National Park. During the period 2000 to 2013, Kakadu recorded a total fire frequency (both early and late dry season fires) such that approximately 55% of the total area was burnt each year. The frequency of fires is not only shown to have a deleterious impact on the environment, but also generates a significant contribution to particulate matter (PM_{10}), thereby having a major influence on ambient air quality.

To determine potential Project generated air quality impacts, an independent air quality assessment was completed using a number of public, cultural and ecological sensitive receptors, both on and off the Ranger Project Area. These receptors were derived from previous emissions assessments (including noise and vibration), and represent the nearest public and environmental aspects to the Project site. Their locations are shown in **Figure 15**, along with their designation as residential, commercial, cultural and ecological receptors.

In addition to air quality, energy consumption and greenhouse gas generation, noise and vibration were also assessed and compared with existing operations at Ranger.

1 Mudginberri (residential)
2 Transient Aboriginal Camp 009 (residential)
3 Jabiru (residential)
4 Jabiru Airport (commercial)
5 Ranger mine village (residential)
6 Mt Brockman (cultural)
7 Tree Snake Dreaming (location not disclosed)
8 R34 cultural heritage site (cultural)
9 Retention Pond 1 (ecological)
10 Magela Creek (ecological)
11 Georgetown Billabong (ecological)

Figure 15: Location of sensitive receptors

6.1 AIR QUALITY

A number of substances, generated through material movement, fuel combustion and ore processing were considered in an ambient air quality assessment. These included:

- Particulate matter with an aerodynamic equivalent diameter less than 10 µm (PM_{10});
- Particulate matter with an aerodynamic equivalent diameter less than 2.5 µm ($PM_{2.5}$);
- Total suspended particulate;
- Sulfur dioxide (SO_2);
- Nitrogen dioxide (NO_2); and
- Radon (a radioactive gaseous element).

These substances are associated with potential impacts to human health, the environment or the amenity of cultural heritage sites. Particulates such as PM_{10} and $PM_{2.5}$ are small enough to affect the human respiratory system. Both SO_2 and NO_2 are gases that are known to impact human health. Radon dispersion is relevant to the assessment of both public and environmental risks associated with radiation.

Air quality modelling predicted the dispersion of these substances from Project and existing sources. The model predicts that Project derived concentrations of all substances are well below relevant health and environmental criteria levels, except for possible infrequent elevated levels of

NO_2 at the Ranger mine village on the Ranger Project Area. A new monitoring station has been installed near the village to calibrate the air quality model and validate the conservative, predicted cumulative ground level concentrations. Overall, the annual Project derived NO_2 concentrations at this receptor are well under the National Environmental Protection Measure for ambient air quality. Combined with existing operations the modelling predicts that for all other pollutants considered levels will not exceed relevant criteria within any sensitive receptor areas.

The design of the Project has incorporated a number of measures to minimise emissions and improve dispersion characteristics, including the integration of catalytic converters on power generators, routing of exhaust gases to a stack, and routine dust suppression on haulage routes and during material handling activities.

6.2 GREENHOUSE GAS AND ENERGY

Historically, greenhouse gas emissions from the current Ranger mine fluctuate from year-to-year in response to mining and milling rates, as well as processing and power station efficiency. Over the period 2007 – 2013, Ranger mine greenhouse gas emissions and annual energy demand averaged 114 kilotonnes carbon dioxide equivalent (kt $CO_{2\text{-}e}$) and 1.5 peta Joules (PJ) of energy respectively. In the absence of the Project over the proposed Project years (2016 – 2020), greenhouse gas emissions are forecast to increase to 126 kt $CO_{2\text{-}e}$ and 1.7 PJ of energy demand, driven by an increase in process water treatment through the recently commissioned brine concentrator.

The Project will result in an annual average increase to greenhouse gas emissions of approximately 50 kt $CO_{2\text{-}e}$ and an average annual increase in energy demand of around 0.5 PJ. The increase in greenhouse gas emissions and energy demand is attributed to power generation, mobile equipment and ancillary mining equipment.

There will be negligible greenhouse emissions from the Project construction phase. During mine operation (development and ore extraction), the main source of energy demand and greenhouse gas emissions will be from diesel power generation. The forecast annual cumulative greenhouse gas emissions from the Project are shown in **Figure 16**. The cumulative average annual greenhouse gas emission is 176 kt $CO_{2\text{-}e}$. To put these figures into perspective, the annual (cumulative) Project CO_2 emissions represent approximately 0.033% of Australia's annual estimated CO_2 emissions for 2013 (538.4 Mt).

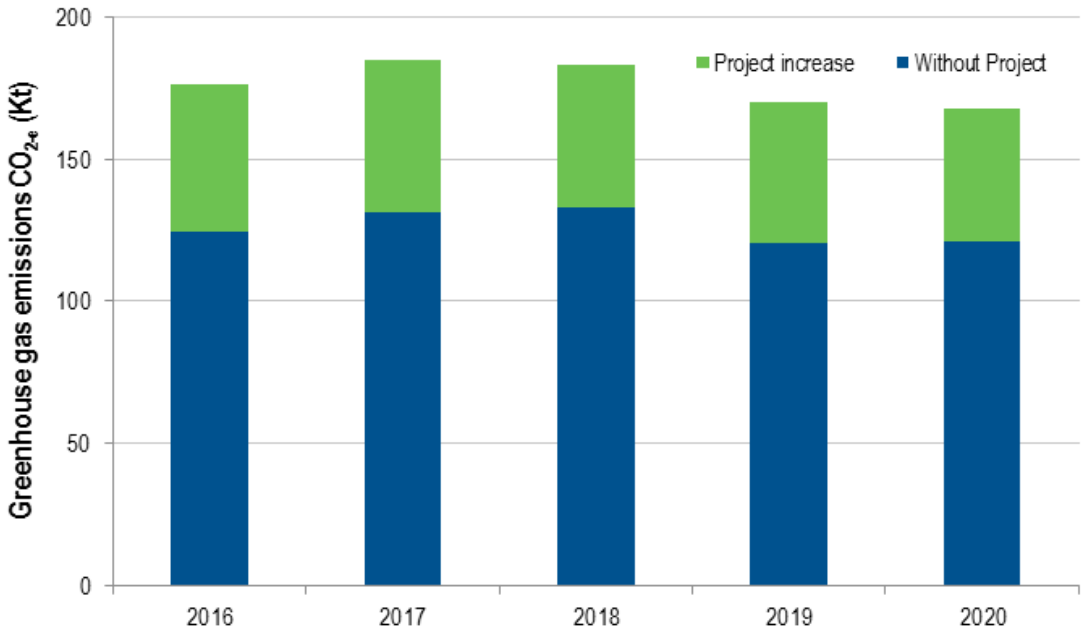


Figure 16: Annual cumulative greenhouse gas emissions

The design of the Project has incorporated a number of measures to minimise greenhouse gas emissions. An environmental design measure is the integration of the Project power infrastructure with existing power generation for enhanced energy efficiency.

6.3 NOISE AND VIBRATION

Noise

Noise at the Ranger mine has historically been associated with open cut mining and ore processing. Noise sources associated with these activities include; blasting, heavy vehicle movements and the operation of the processing plant and power generation infrastructure.

During Project construction, the noise and vibration profile will differ to that of the previous Ranger mine operation. While surface and underground material movement by heavy vehicles will continue, the backfill of Pit 3 is scheduled to switch from material (waste rock) movement to tailings transfer, thereby reducing heavy vehicle movements. During this time, no surface blasting will occur. Sources of Project construction noise will include the installation of ventilation shafts and associated surface infrastructure. The installation of other surface infrastructure such as the backfill plant, refrigeration units and power plant are not significant sources of noise.

During the operational phase, the primary noise sources will include the operation of ventilation fans, refrigeration units, backfill plant, crushing and screening plant, power generation and material movement. Cumulative noise sources will not exceed relevant noise criteria (35 dBA) at sensitive residential and commercial receptors (refer **Figure 17**).

Noise can also affect fauna and while thresholds for individual species or species tolerance are not well defined, an incremental increase in noise levels is predicted at both Georgetown Billabong and Magela Creek ecological receptors. In combination with existing noise levels, the occasional fauna disturbance noise criteria of 50 dBA will be exceeded, but noise levels will remain below the frequent fauna noise disturbance criteria of 65 dBA.[9] Therefore, within the immediate vicinity of the Project, there will be a minor to moderate impact on habitat use for most species.

Based on the outcomes of the noise impact assessment, the Project has included noise attenuation in the design of specific infrastructure and equipment. These include ventilation fans, refrigeration plant and compressors.

Vibration

Project vibration levels will be well below the threshold of human detection. This is mainly due to the small scale surface construction and the depth at which underground activity occurs, being greater than 100 metres vertically beneath the surface of the closest receptor cultural site R34.[10]

Sources of vibration during construction are operation of mobile equipment and establishing the ventilation raises. There are no blast related activities for establishing this infrastructure. Relevant sources of vibration during the operational phase are associated with light and heavy vehicle movement.

[9] 50 dBA is equivalent to quiet conversation; whilst 65 dBA is of equivalent "loudness" to a normal conversation 1 metre away.

[10] The decline, providing the main access to the underground mine passes 130 metres below R34, and has already been constructed. Underground mining will occur at depths of greater than 300 metres below R34.

The vibration assessment has considered potential impacts to sites of cultural significance. Using defined criteria, vibration is predicted to be well below levels that have potential to impact these sites. To confirm these predictions, surface vibration has been monitored during the development of the exploration decline and will continue to be monitored in the early phase of Project development.

A detailed discussion of air emissions, greenhouse gas production and energy usage, and noise and vibration risks and mitigations is provided in **Chapter 6** and associated **Appendices 6** and **7**.

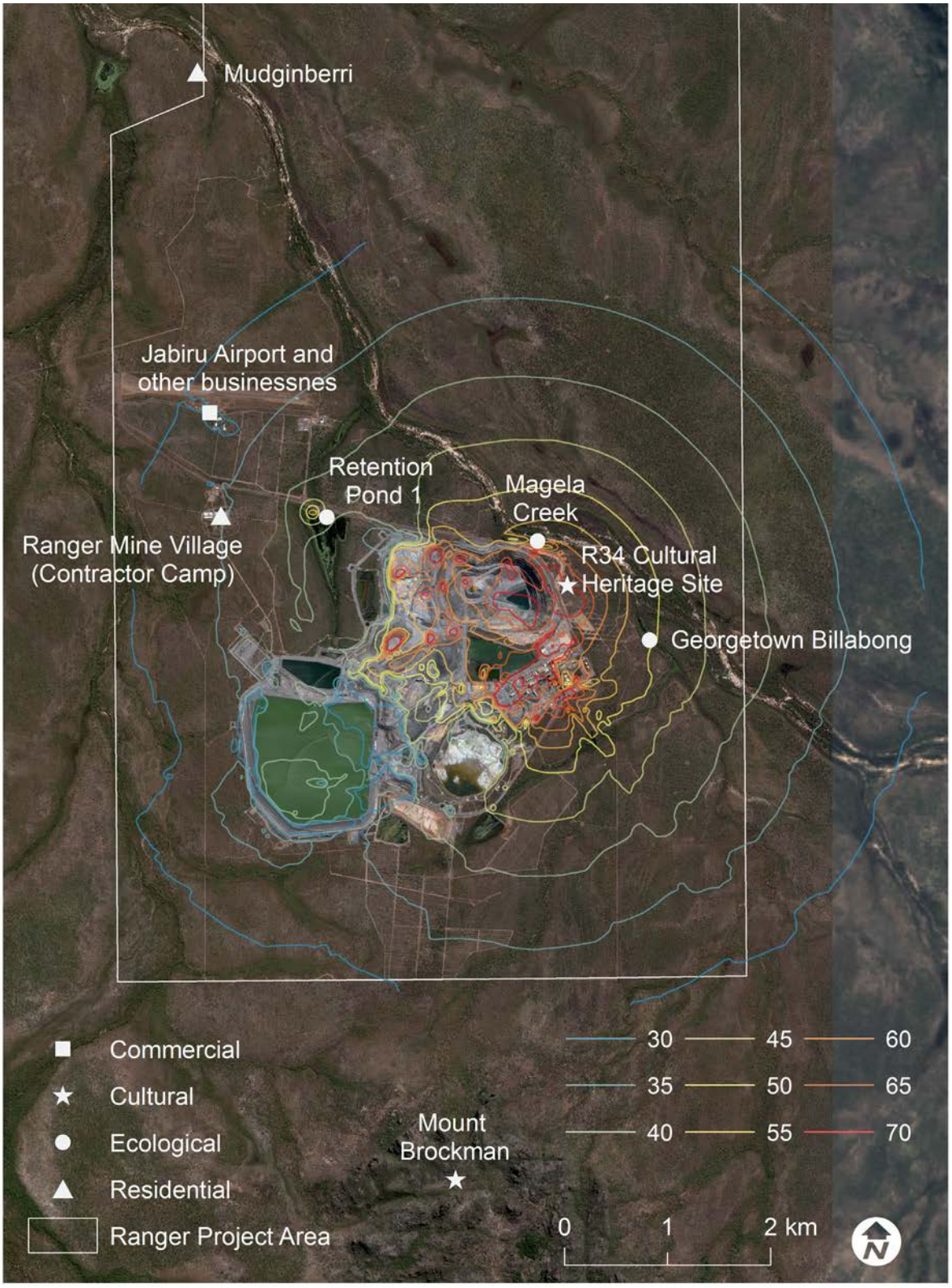


Figure 17: Cumulative operational noise contours

7 HUMAN HEALTH AND SAFETY IMPACTS AND MANAGEMENT

ERA has been operating the Ranger mine for more than 30 years and has an established and mature system for the management of health and safety of workers. This system is based on formal company safety standards that provide assurance that relevant hazards and risks are identified and controlled.

Health and safety are core values within the organisation, guiding all aspects of work from long-term decision making through to day-to-day operations. These values are applicable to all people associated with Ranger operations, including contractors, employees and visitors.

Health and safety of workers on the Project will be managed through the existing health and safety systems and standards. With the move from open pit to underground mining ERA will implement an underground safety standard to ensure the highest level of protection for the health and safety of workers. This standard will cover all key underground mining risks including; ground control, emergency response, fire, explosives, hazardous atmospheres, air blasts and inrush of liquids or solids.

ERA also has core values relating to radiation safety and protection, with a goal to ensure that radiation exposure to workers, the public and the environment is as low as reasonably achievable (ALARA). This is reflected through its radiation protection policy and radiation protection program.

ERA currently maintains an approved radiation management plan for existing operations that provides the framework for meeting its policy commitments; this would provide the basis for radiation protection of workers on the Project and will be updated with the additional controls for underground mining operations.

The radiation protection program for Ranger mine is based on the international commission of radiation protection fundamental principles of radiation protection and the code of practice for

radiation protection and radioactive waste management in mining and mineral processing. All radiation doses are managed so that they are below the recommended dose limits and optimised to ALARA. The recommended limits are:

- 20 milli-Sievert (mSv) per year for occupational exposure of workers; and
- 1 mSv per year above background for exposures to members of the public.

The results of the dose assessment for the Project has demonstrated that radiation exposure to workers will be below this safe working limit with the maximum predicted radiation dose for the project of 12 mSv per year; consisting of up to 7 mSv per year from gamma radiation, 1 mSv from inhalation of radioactive dust, and 4 mSv from inhalation of radon decay products. Average radiation doses for the Project were predicted to be much less than the maximum, with a significant number of employees expected to have annual doses below 5 mSv per year.

These radiation exposures are higher than those typically recorded for the current processing plant and recent open pit workers at Ranger, but they are expected with the move to underground mining and similar to that for other underground uranium mines worldwide.

Members of the public living in Jabiru and eating a traditional diet of bush foods are predicted to receive up to a maximum of 0.09 mSv per year from the cumulative operations of the Project and the Ranger mine. This is well below the annual dose limit (1 mSv), demonstrating that the risks to members of the public from the Project and Ranger mine in general are low.

The assessment of risks to human health and safety identified a number of mitigation measures, these include:

- Complying with applicable Australian and Rio Tinto group standards, employing competent personnel to manage and operate the underground works, rigorously applying the underground safety procedures and rules, and instilling the current ERA safety culture within the new workforce to protect the health and safety of workers.
- Shotcreting of underground walls and placing of clean fill on underground drives to, for example, provide shielding and thus reduce gamma exposure to workers.
- Providing fresh air to all active work areas underground to reduce radon decay product exposure of workers.

A detailed discussion of human health and safety risks of the Project, including analysis of worker radiation doses as a function of radiation type, work groups and in comparison to similar operations worldwide is provided in **Chapter 7** and **Appendix 8**. An extensive range of health and safety controls and mitigations for both underground mining and radiation hazards is also provided within the chapter.

8 WATER IMPACTS AND MANAGEMENT

ERA's operations are surrounded by the world heritage listed Kakadu National Park and located upstream of the Ramsar wetlands of the Magela flood plain. As such risks to environmental water values are of concern to stakeholders including the traditional owners and managing and monitoring water is an area of particular environmental focus for ERA.

Specific environmental concerns from a surface water and groundwater perspective include the potential ecological effects of mine-derived stressors such as uranium (U), magnesium (Mg), radionuclides and transported sediment on aquatic biota and human health. To ensure a high level of protection of the aquatic ecosystem, and in recognition that surface water releases are the main pathway by which Ranger mine may impact the downstream environment, a hierarchy of management or compliance trigger values for key variables has been established. These are incorporated into Ranger mine's regulatory requirements. Further detail of the established water quality criteria, extensive surface and groundwater monitoring systems and operational approach to existing water management is provided in **Chapter 8**.

The Project has the potential to impact the environment through groundwater drawdown, creating potential for contamination of surface or ground water systems, altering hydrology and/or stressing the existing water management system through changes in quality (composition) or quantity of water to be managed. To assess these potential impacts data was gathered from extensive field studies, including that obtained through the progression of the exploration project. The data provided inputs to computational flow and inventory models to conservatively predict incremental Project and whole of site cumulative impacts.

These studies, summarised in **Chapter 8** and provided in **Appendices 9, 10** and **11** show that the low level of residual risks presented by the Project reflect mitigation measures that are based on ERA's experience and existing environmental controls and systems, and have been demonstrated to be feasible and successfully implemented. The features of the Project and the existing Ranger mine that minimise water-related risks include:

- Demonstrated capability for the existing water management system to manage water from various sources and of varying quality, thereby meeting both the water quality objectives for Magela Creek and the additional annual load limits under which the Ranger mine operates. This ensures a high level of protection for the downstream ecosystem and the environmental values associated with Kakadu National Park.
- The capacity for the water management system to accommodate mine water from the underground mine in both normal and high rainfall conditions (including several levels of redundancy).
- The proven effectiveness of current process controls, management plans, standards, and standard operating procedures.

No new discharges of water to the downstream environment are associated with the Project. Inherent and residual risks, and associated potential impacts, to groundwater and surface water relate primarily to:

- Additional drawdown of both the Magela or Brockman borefields, and the shallow groundwater surrounding the underground mine.
- Contamination of aquifers from underground mining and related activities.
- Management of mine water from the underground mine.
- Solute loads from the underground mine that will report to Magela Creek after mine closure via movement through the surrounding rock or more direct pathways such as through the backfilled decline or vent raises.

However, with the suite of existing controls and those proposed for the Project, the consequent residual risks are all low level. The highest ranked risk, due to the high potential consequence, is the risk of underground workers contracting Legionnaire's disease. Water purification has been incorporated in the design, along with routine monitoring to mitigate this particular risk.

ERA has been effectively managing water at Ranger mine through a range of meteorological conditions, including extreme rainfall events since 1980. During this period the Supervising Scientist has confirmed there has been no detrimental environmental impact to Magela Creek and the downstream receiving environment. Water balance modelling has shown that water generated by the Project can be fully integrated into the current water management system, thus ensuring that the environment will remain protected.

9 FLORA AND FAUNA IMPACTS AND MANAGEMENT

Historically many studies of the terrestrial and aquatic environments on the Ranger Project Area and surrounding Kakadu have informed baseline conditions and the influence of threatening processes, including uranium mining, on the biological environment. A Project specific flora and fauna survey was conducted in September 2013 encompassing an area of potential interaction with the Project, of approximately 220 hectares (or 2.2 km^2).

The vegetation in the survey area is comprised of five main groups (**Figure 18**). The terrestrial vegetation communities adjacent to the Project have been heavily impacted by past land use practices (e.g. clearing, fire management, and land application), and naturally occurring events such as late dry season fires, flooding and storms/cyclones, and impacts due to feral pigs and weeds. Moreover, these vegetation communities are not uncommon, and are indicative of those that occur in surrounding Kakadu National Park. There were no Commonwealth or Northern Territory listed plant species or threatened ecological communities assessed as likely to occur in the vicinity of the Project. It is highly unlikely that there are threatened flora communities on the Ranger Project Area, given that none have been found in numerous surveys over the past 20 years.

Significant potential downstream impacts from clearing, including those on drainage lines, watercourses, wetlands, and sensitive or significant vegetation communities (including nearby sections of Magela Creek, Georgetown Billabong and all associated riparian habitats) are considered to be unlikely due to the distance of the proposed development from these water bodies and the very small scale of clearing associated with the Project.

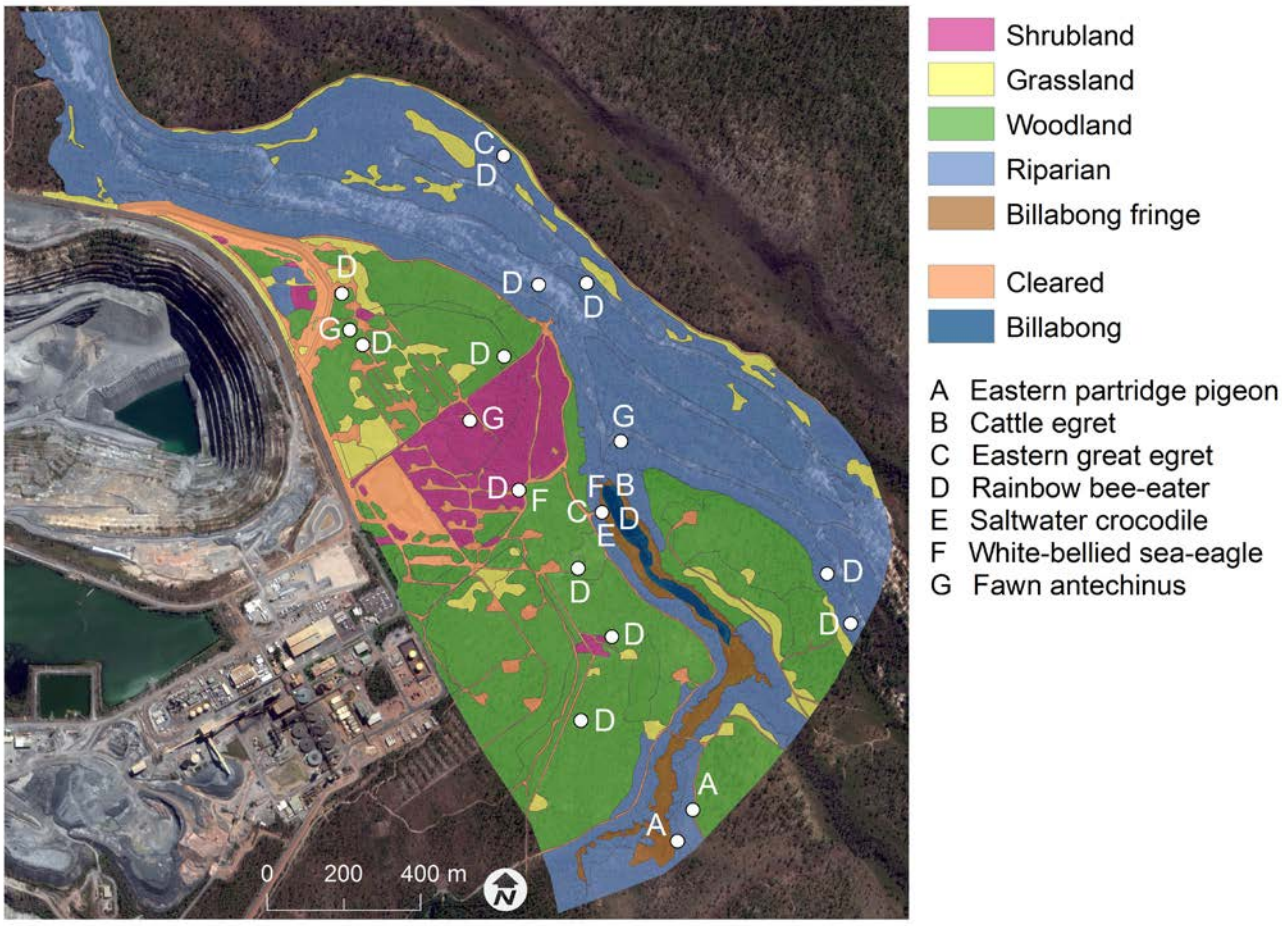


Figure 18: Vegetation units (habitat types) in the survey area and recorded listed species

A combination of techniques was used for the fauna survey over a 40 day period. At least[11] 127 species were recorded during the survey, comprising 8 native amphibian species, 79 bird species, 17 native mammal species, 20 reptile species and 3 introduced species. Of the total fauna species recorded within the survey area, 7 were EPBC Act and/or Territory Parks and Wildlife Conservation Act listed species (**Figure 18**).

A significant impact assessment was conducted for 12 EPBC-listed threatened species and 14 EPBC-listed migratory species.[12] For each of these species the following impacts from the Project were considered:

- long-term decrease in the area of occupancy, or population size or of an important population;
- fragmentation of an important population;
- adverse effects on critical habitat;
- disruption of the breeding cycle of an important population;
- modification, destruction, removal or reduction of availability or quality of habitat; and
- establishment of harmful invasive species, or disease

The analysis concludes that such impacts are considered unlikely, due to, for example, the very low level of new clearing, and the predicted air, noise and vibration model outcomes.

[11] There were several bat species whose calls could not be positively identified.
[12] These 22 species are those identified by application of the EBPC search tool and/or otherwise listed in the guidelines.

The radiation risk to both aquatic and terrestrial flora and fauna was assessed using the ERICA tool[13] and all available site specific data. The pathways for exposure were via controlled release of treated water to Magela Creek and dust deposition onto local soils. The results of the assessment showed that the radiation risk to aquatic and terrestrial plants and animals as a result of the cumulative operations at Ranger mine is not considered significant.

The majority of new infrastructure for the Project will be located on the inside of the mine access road, thereby reducing impacts associated with land disturbance. There is a low risk associated with airborne dust, weeds, and radiation contamination causing habitat degradation in the immediately adjacent or surrounding areas. The removal of less than 1 hectare of disturbed habitat directly adjacent to the mine site is unlikely to reduce the area or quality of habitat for threatened and migratory species.

Despite the low potential for impacts to habitat, flora or fauna, the Project design incorporates several additional controls to reduce impacts resulting in habitat degradation and/or loss that may occur through emissions (e.g. dust deposition and noise), creek flow issues, radiation contamination, and light amenity:

- monitoring at sensitive receptors, dust mitigation measures, active rehabilitation of disturbed areas
- noise monitoring at sensitive receptors, equipment selection and noise control technology
- small stope size and backfilling of stopes (eliminating subsidence or influence on creek flow)
- the majority of vent shafts located on the existing operational footprint
- lighting directed away from sensitive receptors

No risks from the Project were identified relating to invasive fauna (feral animals). Feral animals are well established in Kakadu National Park, which surrounds the RPA; there are no natural or artificial barriers on the Ranger Project Area that restrict feral animal access from Kakadu National Park; and there are no areas on the Ranger Project Area that can be considered free of feral animals or where feral animals could be eradicated.

In addition to the ERICA assessment, a traffic impact assessment considered risks to threatened and migratory species as identified under the EPBC Act and the Territory Parks and Wildlife Conservation Act along the main arterial corridors to and from the Ranger mine. The study identified locations along the transport corridor that are of greater environmental sensitivity to a spillage of consumables/product or associated with greater than average crash rates. The relative consequence of these events was informed by expertise in transport logistics, and ecological impact assessment.

The Project will not materially alter the existing transport risk profile, and these risks remain effectively the same whether the Project proceeds or not. The Project will utilise the current road transport network and requires the same consumables as those currently used for existing Ranger operations, although the quantities will vary. Extensive preventative and mitigation strategies are currently in place around the transport of hazardous and dangerous goods and light vehicle travel to and from the Ranger mine.

[13] ERICA – Environmental Risk from Ionising Contaminants: Assessment and Management and recommended as an appropriate assessment tool by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).

10 CULTURAL HERITAGE IMPACTS AND MANAGEMENT

As described in **Section 4.3**, archaeological surveys of the Ranger Project Area have identified and recorded a large number of sites of indigenous cultural heritage significance. ERA has a cultural heritage management system that protects cultural heritage values. All aspects of existing system will apply to the Project construction, operation and closure. The ERA cultural heritage management system is informed by the requirements of the ERA Gundjeihmi Aboriginal Corporation Interim Cultural Heritage Protocol (agreed with Traditional Owners in 2006), Northern Territory and Commonwealth heritage legislation, and Rio Tinto cultural heritage management standards.

The protocol provides for an agreed process, which ensures that cultural heritage surveys are conducted prior to any land disturbance on undisturbed land or land that has already been disturbed with authorisation. This process must include Mirarr Traditional Owners. Cultural heritage surveys have been conducted across approximately 73% of the Ranger Project Area under this agreement; including the whole of the area in which infrastructure for the Project will be located and also adjacent areas up to Magela Creek to the east.

There is one surface site of cultural significance located within the surface projection of the Project. This site, R34, is an archaeological site that provides evidence of occupation via a quartz quarry, area of stone implements and grinding holes. The site is located within a fenced exclusion zone, which protects the site from potential surficial impacts such as clearing. The nearest proposed location for surface infrastructure is of the order of 100 metres from the protective fence.

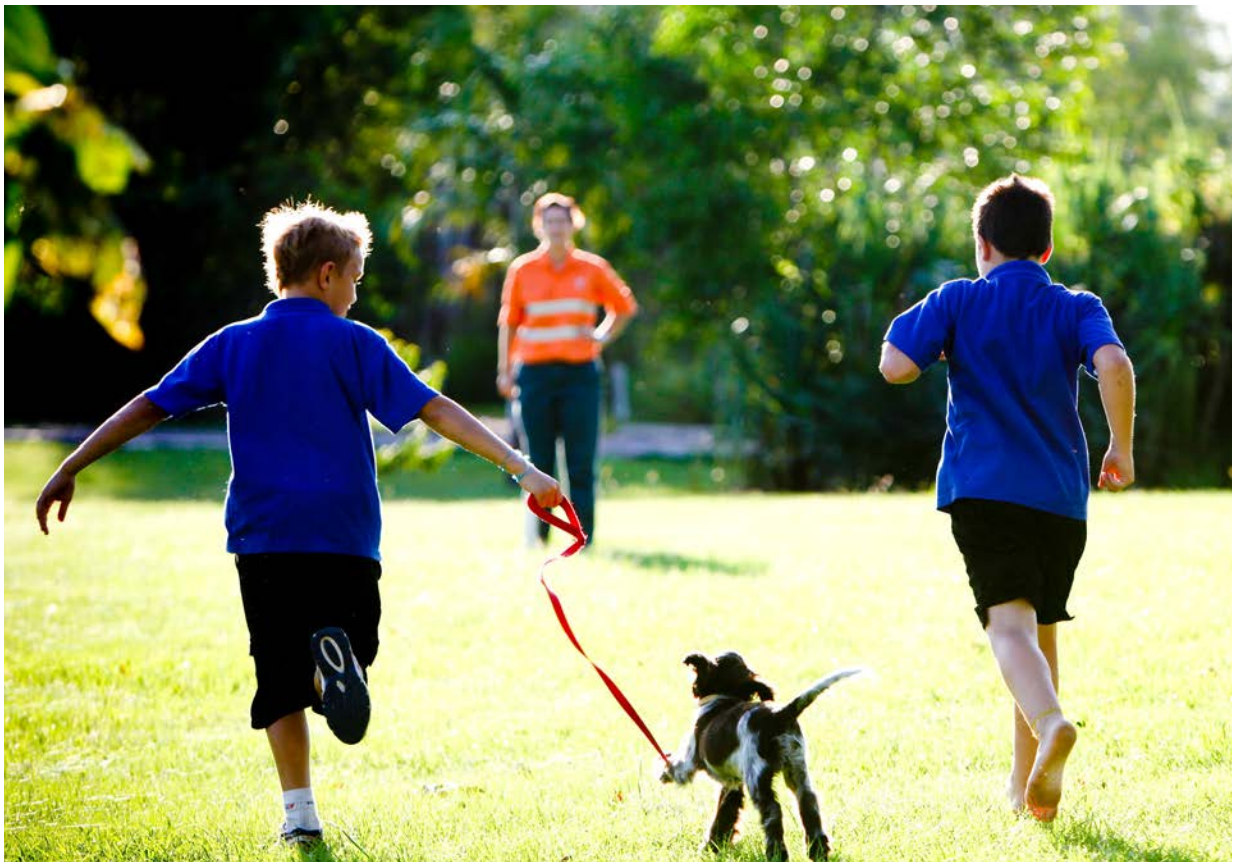
The scale and location of the surface infrastructure related to the Project is a much smaller footprint than several recent projects undertaken on the Ranger Project Area, such as construction of the Magela levee, and close spaced exploration drilling pads at over 100 sites. These projects have been conducted in the immediate vicinity of cultural sites without adverse impacts.

In addition to land disturbance, a number of risks to cultural heritage were identified, such as from noise generation, dust and other air emissions, and vibration. These are discussed in detail in **Chapters 6** and **10**, and as discussed in **Section 6** above, studies have shown these risks present negligible potential for impact to cultural heritage values:

- Air quality studies show dust and emissions as a result of the Project will have no measurable physical effect on cultural sites. Ranger operations since 1980 have involved two open cut mining pits. Air quality as a result of the mining and stockpiling of mineralised material has had no physical impact on cultural sites.
- Vibration monitoring of Ranger 3 Deeps exploration decline blasting indicates that the below ground aspect of the Project will not have a physical impact on surface cultural sites. There are no known subsurface sites upon which the Project could have an impact.

A concern raised in the early consultation process was of possible visual amenity impacts, for example of ventilation infrastructure. A visual amenity assessment, using topographic information, information of vegetation and design information of infrastructure indicates that the Project infrastructure will not be visible from areas used for cultural purposes within the Ranger Project Area.

Based on the information presented above, development of the Project is not expected to impact on cultural heritage in the near vicinity of the Project and the cultural heritage values of the surrounding Kakadu National Park will also remain protected.



11 COMMUNITY INVOLVEMENT AND SOCIAL IMPACTS

ERA's operations have historically been subject to much public interest, and have been a focal point for debate on the merits of uranium mining, the broader nuclear industry, and issues relating to mining on Aboriginal land. As previously discussed in **Section 5.2**, ERA engaged specialist consultants, Banarra, to undertake a social impact assessment, based on a review of extensive existing literature and a comprehensive community consultation program.

This section of the Executive Summary provides an overview of the findings of the social impact assessment, the risks, benefits and contribution of the project across key social and economic aspects. Further detail of the assessment method and potential social and economic impacts of the Project, including cumulative impacts is presented in **Chapter 11**, whilst the consultant report and ERA's social impact management plan are provided as **Appendices 14** and **15**, respectively.

11.1 STAKEHOLDER CONSULTATION

Historically, ERA has engaged with many stakeholder groups through various fora. Consultation with the Mirarr and community stakeholders is a key component of ERA's social performance standard. Company personnel are in regular contact with the Gundjeihmi Aboriginal Corporation who represents the Traditional Owners, the Northern Land Council, the Northern Territory Department of Mines and Energy, the Commonwealth Supervising Scientist Division and Commonwealth Department of Industry, both informally and through the Minesite Technical Committee. ERA informs, and hears from, road users and tourism businesses through its membership of a transport working group, which is working with the Northern Territory Government to consider improvements to the Arnhem and Kakadu highways. ERA also provides quarterly business updates to a range of Jabiru stakeholders including local, Northern Territory and Australian Government agencies, local businesses/organisations and West Arnhem Regional Council.

A specific community consultation program was undertaken in relation to the proposed Project, over a nine month period from June 2013. Targeted participants included:

- Mirarr Traditional Owners;
- other Aboriginal communities within the Alligator Rivers Region;
- residents of Jabiru township;
- local environmental organisations;
- Australian and Northern Territory Governments and their agencies;
- tourism organisations; and
- users of the Arnhem and Kakadu highways.

Through an iterative process of consultation and analysis, a number of risks and opportunities were identified across 10 social aspects. The independent consultants, Banarra, concluded that the Project "*… has the potential for both positive and negative impacts, but overall, has greater potential to realise positive social outcomes*."

11.2 ECONOMIC AND SOCIAL IMPACT

The local economies of Jabiru and the wider West Arnhem Region are both highly dependent on the Ranger mine. Whilst ERA has an authorisation to operate until January 2021, regardless of the Project proceeding, the mine will only continue to operate while it is financially viable to do so. The Project will enable ERA to maintain ongoing community investment at current levels.

The key potential socio-economic benefits of the Project include:

- an additional 180 – 280 jobs to be sourced either locally or nationally;
- opportunity for continued skills development and capacity in the region;
- maintaining ERA's economic contributions to the region estimated at 87% of gross value added for Jabiru, 58% for West Arnhem and 3.8% for the Northern Territory (2012 data);
- maintaining financial payments to all levels of Government and Aboriginal interests, in particular the Mirarr, at existing levels (estimated to be $10 – 30 million per year);
- supplementing production above current levels, through the processing of high grade Project derived ore, thus generating additional revenue;
- local and regional businesses will benefit as the Project provides business certainty and promotes business diversity and resilience; and
- maintaining Jabiru's population which directly benefits local service providers and business; and sustaining community investment to current levels for services, infrastructure and community programs.

Should the Project not proceed, revenue will decline over time as a result of processing lower grade material contained within existing stockpiles and will result in a reduction in ERA's ability to maintain all forms of contribution to the region, both economic and social.

The key potential risks of the Project include:

- additional employees creating further demand on Jabiru health services;
- perceptions of health, well-being and personal safety of individual and communities leading to stress, such as arising from concern of the potential for contamination of natural resources; and
- continuation, or exacerbation, of existing negative impacts, such as issues relating to future use of mine revenue (royalties) and social cohesion, and the well-being of Mirarr Traditional Owners.

Table 2 provides each of the "very high" and "high" opportunities and risks identified, by Banarra, during the social impact assessment. There were no "very high" risks identified during the assessment.

Table 2: Very high and high risks and opportunities

Risk ranking	Social factor	Description
		Opportunities
Very High	Future of Jabiru	Ranger 3 Deeps enhances the opportunity for key organisations (including those with governance roles) to plan for the future of Jabiru
	Service demand and viability	Ranger 3 Deeps enables the ongoing funding of the Kakadu West Arnhem Social Trust and associated initiatives either directly by ERA or indirectly through royalties
	Employment and industry in Jabiru and the region	Ranger 3 Deeps enables ERA to maintain high levels of direct employment at Ranger, sustaining or increasing the level of employment in the region
High	Rehabilitation of the Ranger Project Area and incorporation into Kakadu National Park	Ranger 3 Deeps enables improved capacity within ERA to plan and manage rehabilitation over the life of the mine, resulting in an improved ability for the Ranger Project Area to be successfully incorporated into Kakadu National Park*
	Attraction and retention of residents and visitors	Increased certainty over the future of Jabiru leads to retention of Jabiru residents and increased use of the town by orbiting Aboriginal people and casual visitors, e.g. tourists
	Attraction and retention of residents and visitors	Ranger 3 Deeps enables investment in cultural heritage maintenance, directly by ERA, and indirectly through royalties, encouraging the retention of the regional Aboriginal population
	Attraction and retention of residents and visitors	Ranger 3 Deeps enables the continued funding of Jabiru services and infrastructure maintenance, directly by ERA, and indirectly through royalties, encouraging the retention of the regional population
	Service demand and viability	The extension of revenue and royalties from Ranger 3 Deeps provides for continuation of, or development of new partnerships or initiatives to deliver social services
	Employment and industry in Jabiru and the region	Ranger 3 Deeps enables ERA to support indirect employment linked to Ranger sustaining the level of employment in the region
	Employment and industry in Jabiru and the region	Ranger 3 Deeps reduces uncertainty over Ranger's future by providing more stability in the local economy and enhancing the potential for increased investment by government and commercial operators
	Aboriginal employment and enterprise development	Ranger 3 Deeps enables continuation of ERA education partnership, training and apprenticeship programs, thus supporting regional skills development
	Aboriginal employment and enterprise development	Ranger 3 Deeps enables ERA to indirectly support Aboriginal employment in other industries, businesses and service providers (including the Gundjeihmi Aboriginal Corporation)
	Aboriginal employment and enterprise development	Ranger 3 Deeps enables ERA to continue its high levels of Aboriginal employment at Ranger
	Access to socio-economic benefits of Ranger	Through continued revenue, royalties and presence in Jabiru, Ranger 3 Deeps enables ERA to leverage relationships and networks to reduce socio-economic inequity across the region
	Access to socio-economic benefits of Ranger	Ranger 3 Deeps enables the continuation of social initiatives funded/ administered by the Gundjeihmi Aboriginal Corporation from royalties
	The quality of the natural environment	Closure and rehabilitation activities enabled by Ranger 3 Deeps enhance the quality of the natural environment*

Risk ranking	Social factor	Description
		Risks
High	Protection and enjoyment of Aboriginal land rights	Traditional Owners and other affected Aboriginal peoples are aggrieved as free prior informed consent is not required for Ranger 3 Deeps approval under conditions of the Ranger Authority
	Future of Jabiru	Ranger 3 Deeps enables a business as usual approach in the governance of Jabiru and inadequate future planning is undertaken
	Quality of water resources	Ranger 3 Deeps contributes to continued or increased concern amongst local and regional communities about possible, or perceived, contamination of water and food resources, and the health implications of consuming them
	Aboriginal employment and enterprise development	Ranger 3 Deeps contributes to continued dependence by Aboriginal organisations on royalties contributing to a socio-economic reliance on mining and a delay to a post-mining economy
	Access to socio-economic benefits of Ranger	The distribution of royalties from Ranger 3 Deeps exacerbates tensions and conflicts between Traditional Owners and other affected people regarding equity in the distribution of benefits from Ranger
	Access to socio-economic benefits of Ranger	Continuation of royalties as a result of Ranger 3 Deeps contributes to continued social cohesion challenges, including alcohol use, violence and other forms of antisocial behaviour

* Note these opportunities were identified through consultation and are reported by Banarra. ERA has a regulatory responsibility to close and rehabilitate the whole site to established Environmental Requirements and views these as core commitments rather than "opportunities". The closure provision is annually reviewed by regulators and set aside for this purpose.

In several social aspects it is difficult to separate the Project opportunities and risks from those of existing operations or from broader community issues. For example, the social impact assessment identified three areas in which the Project has the potential to generate cumulative social impacts and which invite coordinated and collaborative responses from key stakeholder organisations. These areas are:

- Sustainable community benefits from revenue and royalties: A number of initiatives, including the Kakadu West Arnhem Social Trust-funded Children's Ground and the GAC funded Djidbidjidbi College, show early signs of providing sustainable benefits to the regional Aboriginal community. Both are, indirectly, funded by Ranger mine revenue.
- A planned vision for the future for Jabiru: Sustained or enhanced investment and greater certainty over the future of Jabiru will enable more clarity about the town's future, including its planning.
- Continuation or exacerbation of existing negative social impacts (for example, substance abuse, antisocial behaviour, inequity of royalties distribution, concern for water contamination).

11.3 SOCIAL IMPACT MANAGEMENT PLAN

To mitigate the potential risks and maximise the opportunities for positive social impacts, ERA has developed a social impact management plan, **Appendix 15**. The plan has been developed using the outcomes of the social impact assessment and builds on a strong platform of community programs and existing stakeholder fora. The social impact management plan details the management actions in response to, particularly the higher ranked risks and opportunities. This includes both current responses, additional actions and the proposed timeframe for implementation and review. ERA has committed to implementing the following actions:

- ERA will continue to advocate for and collaborate with the Gundjeihmi Aboriginal Corporation regarding implementation of the 2013 suite of mining agreements, Jabiru Town Development Authority, Kakadu West Arnhem Social Trust, Relationship Committee and Gunbang action group.
- Implementation of joint cultural heritage projects on the Ranger Project Area in collaboration with the Gundjeihmi Aboriginal Corporation and the Northern Land Council.
- ERA will collaborate with relevant agencies and organisations to improve communications aimed at addressing concerns about environmental performance and possible or perceived contamination of water and food resources over the life of the Project.
- ERA has an extensive cultural heritage management system. In parallel with and incorporating the Project, this system will be formalised into a cultural heritage management plan for the Ranger Project Area.
- Inclusive of the Project, ERA will continue to incorporate local and traditional indigenous knowledge into the closure planning process.
- Where a sensitive anthropological site is encountered during the mining process, ERA will discuss and negotiate appropriate action with the Traditional Owners and relevant agencies.
- ERA will continue to engage with all key stakeholders to develop a plan and a process which considers the social and community implications associated with the closure of Ranger including impacts and opportunities of the Project.
- ERA will collaborate with the Gundjeihmi Aboriginal Corporation and health authorities to develop a health partnership.
- ERA will maintain its existing focus on regional employment including its pre-employment, indigenous traineeships and apprenticeship programs, diversity, employment and recruitment selection policies. ERA will expand its focus to build capacity and employment pathways for the regional population through support for local businesses and improved involvement with the Regional Jobs and Communities provider.
- ERA will continue to invest in the local community such as through support for the West Arnhem Social Trust, Education Partnership, Community Partnership Fund, and local services and infrastructure.
- ERA will include underground mining related aspects in its traineeships programs.
- ERA commits to maintaining a local presence in Jabiru, a local employment focus and use of local businesses for services and goods whilst the Project is in operation.
- Taking guidance from the outcomes of the noise impact assessment to comply with noise criteria, noise attenuation will be integrated into the design of the exhaust ventilation fans, refrigeration plants and compressors and where practicable, for other infrastructure, low noise emitting equipment will be selected.
- Surface vibration monitoring will continue at culturally significant locations, including during the first 12 months of mine development to validate predicted vibration identified in the vibration impact assessment.
- A buffer (pillar), consistent with geotechnical and hydrogeological assessments, will be retained between stope development for the Project and Pit 3. (This action addresses the concern for underground worker health and potential impacts to water resources.)
- In addition to engineering requirements, where practicable, potential impacts associated with visual amenity will be considered in the detailed design phase.
- Dust deposition monitoring will be undertaken at the R34 cultural heritage site to validate the predictions of air quality modelling which indicate very low levels of incremental impact. Dust suppression will be undertaken on all earthen areas.

12 TRAFFIC IMPACTS AND MANAGEMENT

The Project will utilise the current road transport network identified in **Figure 19**. The Project requires the same types of consumables as those currently used for existing Ranger operations, although the quantities will vary. For example due to the additional power generation and the mine backfill process, there will be additional diesel and cement requirements. In contrast the quantity of explosives required is significantly less compared with the open pit operations. The characteristics of these consumables are well understood, and their management is, and will continue to be, commensurate with ERA's understanding and experience.

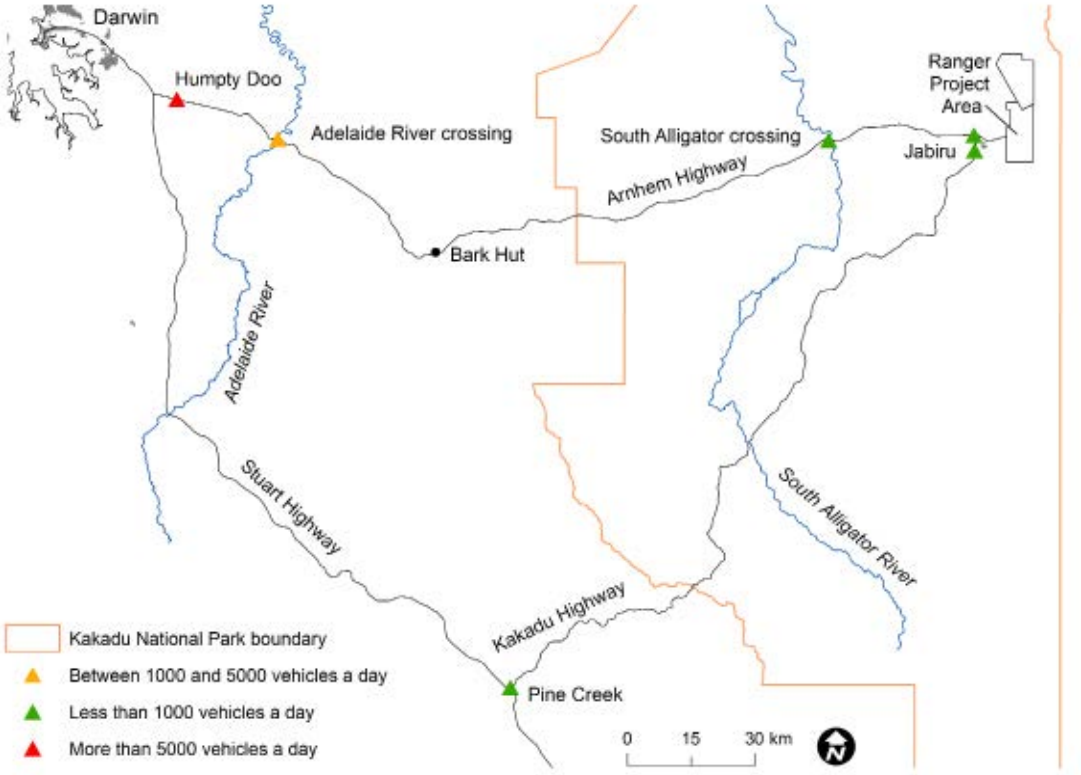


Figure 19: Predominant transport routes to the Ranger mine

At its peak, the total traffic volume for the Ranger mine, along the Arnhem and Kakadu Highways, is anticipated to consist of 20 round trips per day, of which, the Project will contribute 6 round trips (refer **Figure 20**). The current round trip movements between Jabiru and Ranger mine are not anticipated to change significantly. The route capacity assessment has determined that these volumes, in addition to predicated traffic movements by other users, are well within the capacity of the road transport network.

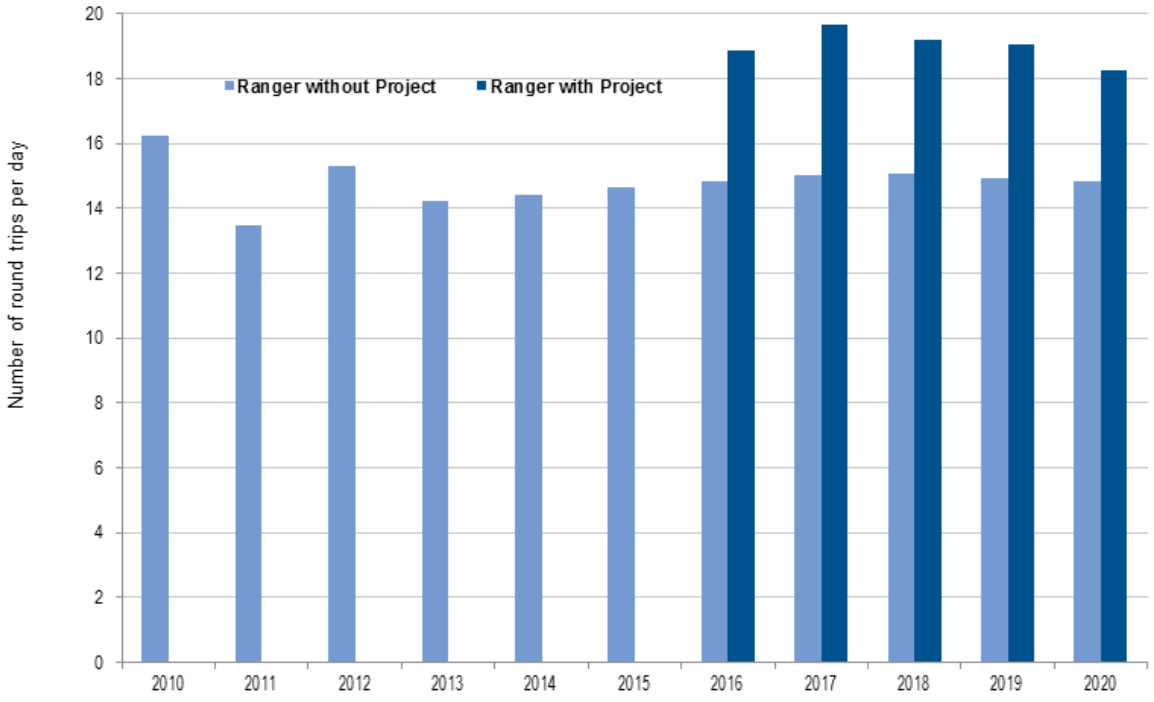


Figure 20: Historical and projected traffic volumes

As previously outlined in **Section 9.1**, the traffic impact assessment considered risks to both threatened and migratory species, as identified under the EPBC Act and the Territory Parks and Wildlife Conservation Act, and to public health and safety. The assessment identified locations along the transport study corridor that are of greater environmental sensitivity to a spillage of consumables/product or associated with greater than average crash rates. The relative consequence of these events has been informed by expertise in transport logistics, and ecological impact assessment.

The risk assessment identified a number of risks across listed threatened and migratory species, environmental values, and public health and safety. Those identified were an outcome of assessing specific risk scenarios associated with a range of consumables at up to 14 separate locations, identified for their environmental sensitivity.

There were no expected combinations of consequence and likelihood resulting in critical (Class IV)[14] risks to listed threatened and migratory species or environmental values. In fact the likelihood of an event associated with threatened and migratory species or environmental values was assessed as rare in the majority of scenarios examined.[15] However critical risks were identified for public health and safety as a vehicle collision leading to a fatality is defined as a catastrophic outcome.

Extensive preventative and mitigation strategies are currently in place around the transport of hazardous and dangerous goods and light vehicle travel to and from the Ranger mine. These controls comply with, and in some cases exceed legislative requirements, codes of practice, voluntary accreditation schemes and the risk management practices of the transport industry.

These same controls will continue to be employed by the Project. In addition to these established controls, ERA collaboratively engages with its suppliers, transport providers and the Department of Transport to discuss transport risks, and identify opportunities to further improve road safety.

The traffic impact assessment concluded that the risks remain effectively the same whether the Project proceeds or not. The assessment did not identify any additional controls that would significantly influence these risks. The current ERA controls will continue to be maintained for the Project. These controls have been demonstrated to provide a high level of ongoing protection to the public and the environment and include:

- The ERA contractor management system.
- Dangerous goods regulations and code of compliance.
- National heavy vehicle accreditation scheme compliance.
- Hazard identification and risk management.
- Emergency preparedness and response.

[14] Classes I to IV are designations from Rio Tinto risk assessment standard practice. Specific descriptors for consequence and likelihood levels are provided in the relevant chapters and appendices for the traffic and environmental risks.

[15] The analysis was conducted, for the combined Project and continuing operation, for each consumable across each relevant route segment identified to have higher ecological significance. For example, the likelihood of a diesel loss 2 km either side of the Kakadu National Park gate is in the order of one event in every 4,000 years.

13 REHABILITATION AND CLOSURE

Rehabilitation of the Project will occur within the existing Ranger mine closure framework. This framework has been developed in order to meet the overall goal for rehabilitation of the Ranger Project Area; that is, to establish an environment similar to the adjacent areas of Kakadu National Park and to a standard that it could be incorporated into the Park.

ERA has well-developed closure planning strategies to ensure decommissioning and eventual closure of the Ranger Project Area will be achieved with due consideration of Traditional Owner, stakeholder and community expectations. This plan has been developed through the application of best practicable technology within a risk based framework.

A closure strategy for the Project has been developed that fully aligns with closure planning for the current Ranger operations. Following approval of the Project, this strategy will be integrated into the overall Ranger operations closure planning. The key tasks associated with closure of the Project are: backfill of underground mined voids, ventilation shafts, the decline and drill holes; tailings and waste rock management; infrastructure removal and revegetation of disturbed areas, including the management of fire and weeds; and rehabilitation monitoring.

The key Project risks associated with rehabilitation and closure are outlined in **Chapter 13**, these are; the potential for transport of solutes to the Magela Creek generated through the disposal of waste rock and tailings, and the potential for the Project to impact on the current Ranger mine closure schedule.

Modelling of solutes generated from the final disposal of tailings and waste rock has demonstrated that the Project will not impact Magela Creek over a time frame of 10,000 years. Further details of this modelling work and the assessment of potential impact to Magela Creek are provided in **Appendix 9** and **11**. **Table 3** shows the predicted concentrations in Magela Creek from Project sources and compares them to the current operational limits; this clearly shows that even in the worst case scenarios, Project sourced concentrations in the creek post closure will be very low.

Table 3: Predicted concentrations of solutes in Magela Creek post closure compared to current operational limits

Variable	Predicted concentrations in Magela Creek from Project sources		Current operational limit
	Worst case	Wet season average	
Magnesium (mg/L)	0.036	0.0000081	3 [1]
Uranium (µg/L)	0.0053	0.0000012	6
^{226}Radon (mBq/L)	0.051	0.000012	10 [2]
Manganese (µg/L)	0.027	0.0000061	75

[1] – Limit for exposure times greater than or equal to 72 hours

[2] – Limit based on whole of wet season median difference between up and down stream concentrations

The Project closure strategy has demonstrated that rehabilitation of proposed activities can be completed within the current closure schedule using the same closure methods. Any additional waste rock material remaining on the surface can be disposed of in Pit 3 with no impact on the final backfill of this pit or rehabilitation landform. **Figure 21** shows how the small difference in tailings and waste rock volumes in Pit 3 for the Project integrated case compares to the current closure design. The additional rock layer above the tailings in the Project integrated case is that portion of existing, stockpiled, low grade ore that is displaced as plant feed by higher grade Ranger 3 Deeps ore.

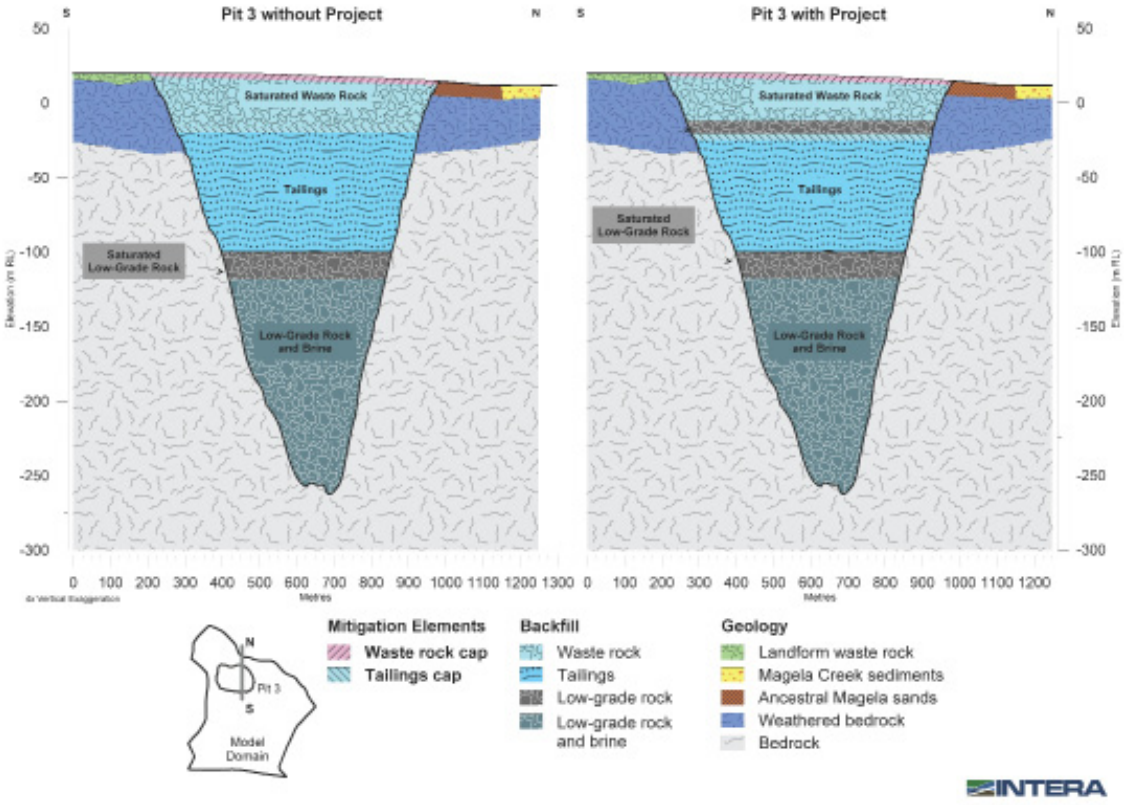


Figure 21: Comparative tailings and waste rock placement in Pit 3

In addition to using the same closure methods, there will be no impact on the current progressive rehabilitation and revegetation programs; this is due to the very small disturbance footprint associated with the Project.

14 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE IMPACTS AND MANAGEMENT

The Project is being assessed to the level of an EIS, based on the potential to impact one or all of the following controlling provisions, protected under Part 3 of the EPBC Act: world heritage properties; national heritage places; wetlands of international Importance; listed threatened species and communities; listed migratory species; nuclear action; and Commonwealth land.

With the exception of potential impacts arising from a nuclear action, all other potential Project impacts to Matters of National Environmental Significance (MNES) have been assessed in accordance with Commonwealth guidelines. For example, potential impacts to listed threatened and migratory species, wetlands of international importance (Ramsar), world heritage properties and national heritage places have been assessed against criteria described within *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance*. Similarly, potential impacts to the environment on Commonwealth land have been assessed against Commonwealth guidelines: *Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies. Significant impact guidelines 1.2 Environment Protection and Biodiversity Conservation Act 1999.*

The EPBC Act defines mining and milling uranium ore as a nuclear action. The Draft EIS and in particular, **Chapters 6** to **13**, address the potential impacts associated with extracting, processing and transporting uranium material. By assessing the impacts of the Project on other matters of national environmental significance, the Draft EIS also assesses the potential impacts of this nuclear action on the environment.

14.1 CURRENT ENVIRONMENTAL PROTECTION REGIME

ERA manages the existing Ranger mine under Commonwealth and Northern Territory regulations and conditions to minimise impacts and mitigate the potential for additional risks to the surrounding environment beyond the Ranger Project Area, e.g. Kakadu National Park. These environmental management practices have culminated in the Commonwealth's Supervising Scientist consistently stating in annual reports that their extensive monitoring and research programs confirm that the surrounding environment remains protected.

In support of these findings and as outlined previously, ERA has commissioned and participated in many studies of the terrestrial and aquatic environments on the Ranger Project Area and surrounding Kakadu to understand baseline conditions and the influence of threatening processes, including uranium mining, on the biological environment.

Potential Project-derived impacts to the surrounding environment are not mutually exclusive of historical environmental data and existing operational practices. This is reflected in the overall environmental risk assessment profile, that indicates all Project risks with a direct impact on the surrounding environment and MNES were ranked very low (Class I) and low (Class II) (e.g. risks associated with soil, water, listed threatened and migratory species).

14.2 ASSESSMENT AGAINST PRESCRIBED SIGNIFICANT IMPACTS CRITERIA

As highlighted above, Ranger mine has an extensive suite of existing environmental controls, that form the basis of the mine's environmental, health and safety management system (refer **Section 15**). In addition to existing environmental controls, the risk assessment (**Appendix 5**) provides a comprehensive assessment of the proposed environmental controls and mitigation measures (new treatments) that will be implemented over the life of the Project, to further protect the downstream natural and world heritage values.

Assessment against Commonwealth prescribed significant impacts criteria is provided in detail in **Chapter 14**, and is considered across all Project phases and takes into account historical data and Project specific studies.

A particular focus of the assessment of potential impacts to MNES[16] is the consideration of mine derived stressors such as uranium, magnesium, radionuclides and transported sediment on quatic biota. The stressor can enter the ecosystem via: Surface water to surface water pathways; storm water runoff from onsite non-mine areas; seepage from groundwater to surface water; and, bioaccumulation and trophic transfer, thereby affecting habitats on a regional scale. Potential Project impacts to species populations, critical habitat, breeding cycles, etc, do not differ from those of the existing Ranger mine. Adverse incremental impacts on water quality within the vicinity of Ranger and further downstream relative to those associated with the existing mine are considered negligible. This is largely due to: the comprehensive surface water hierarchy of controls incorporated into Ranger mine's regulatory requirements; and, because the Project does not alter potential stressors currently associated with existing operations at Ranger mine. New treatments identified during the risk assessment can be readily incorporated into the existing health, safety and environment management system.

Other key threatening processes and activities which may lead to potential significant impacts to listed threatened and migratory species such as land clearing, altered or inappropriate fire regimes and introduction of exotic species, will not be exacerbated by the Project. For example, overall,

[16] In particular listed threatened and migratory species, wetlands of international importance, world heritage properties, national heritage places and Commonwealth lands.

native vegetation clearing is expected to be less than 1 hectare and confined to the Ranger Project Area and areas which have been heavily impacted by past land use practices (e.g. clearing, fire management, and water disposal), and naturally occurring events such as late dry season fires, flooding and storms/cyclones, and impacts due to feral pigs and weeds. The small clearing footprint for Project infrastructure is therefore unlikely to contribute to land degradation of the surrounding Kakadu National Park or lead to a significant impact on listed threatened and/or migratory species.

Moreover, the vegetation communities of the Ranger Project Area are not uncommon or listed critical habitat, and are indicative of those that occur in surrounding Kakadu National Park.

Ranger's fire management practices, which are not dissimilar to those implemented by Parks Australia, are guided by five year and one year fire management plans. Burning is used as an asset protection mechanism (by reducing fuel loads) and for controlling the spread of weeds. Burns along the Ranger Project Area boundary and in non-operational areas of the RPA, north of Magela Creek are typically co-ordinated with Parks Australia as part of their annual aerial burning program. Overall, the potential impacts of fire from the Project are very low and not considered to result in significant impacts on the surrounding Kakadu.

Potential impacts from transport activities on the controlling provisions for the Project were also assessed across all Project phases, through an independent traffic impact assessment (refer **Section 12**). The assessment involved the identification of sensitive ecological locations along the road network (Kakadu and Arnhem Highways), and included rivers and associated wetlands and floodplains that provide habitat for large numbers of threatened and migratory species. The highest ranked transport risk that could impact listed threatened and migratory species, and ecologically sensitive locations along the route was a vehicle incident involving loss of containment of, for example, diesel or ammonia. However the overall transport risk profile remains virtually unchanged from that of existing operations.

During assessment of impacts to MNES, consideration was given to addressing the potential longer term impacts, associated with the Project, to the surrounding environment post closure. Extensive groundwater-related conceptual models have been developed for the Ranger mine and Ranger Project Area by specialist geosciences and engineering consulting firm, Intera. These models are continually updated to incorporate new data and improved understanding of the processes involved. Specific modelling has been undertaken to address Project generated solute transport from backfilled underground stopes to Magela Creek over a 10,000 year period. As well as the work that was undertaken to address solute transport, Intera undertook additional modelling to examine groundwater drawdown that might be associated with development of the underground mine.

Both studies indicate that Project impacts on the surrounding environment from groundwater discharges to Magela Creek, groundwater drawdown on creek hydrology, and/or losses from the creek into the underground workings are negligible. When compared to Magela Creek's mean annual flow (382 Mm^3), there are three key factors that contribute to the very low risk of impact to the surrounding environment:

- the very low permeability of the host rock;
- the low permeability, low moisture content of the backfill paste combined with the low groundwater discharge; and
- a small relative volume of the underground void (totalling 3 Mm^3).

15 ENVIRONMENTAL MANAGEMENT PROGRAM

15.1 EXISTING ENVIRONMENTAL MANAGEMENT PLANS

Environmental aspects are managed at Ranger mine in accordance with the operation's AS/NZS ISO 14001:2004 and AS4801 certified health, safety and environmental management system. The system has been rigorously reviewed and amended over time to become the comprehensive and streamlined system it is today. The system aligns with the Rio Tinto Management System Standard, and specifically addresses each of the 17 elements and is designed along the principles of the "Plan, Do, Check and Review" continual improvement cycle as shown in **Figure 22**.

The ERA health, safety and environmental management system will continue to be used should the Project be approved and progressed.

Figure 22: Health, safety and environment management system elements

15.2 NEW ENVIRONMENTAL MANAGEMENT STRATEGIES

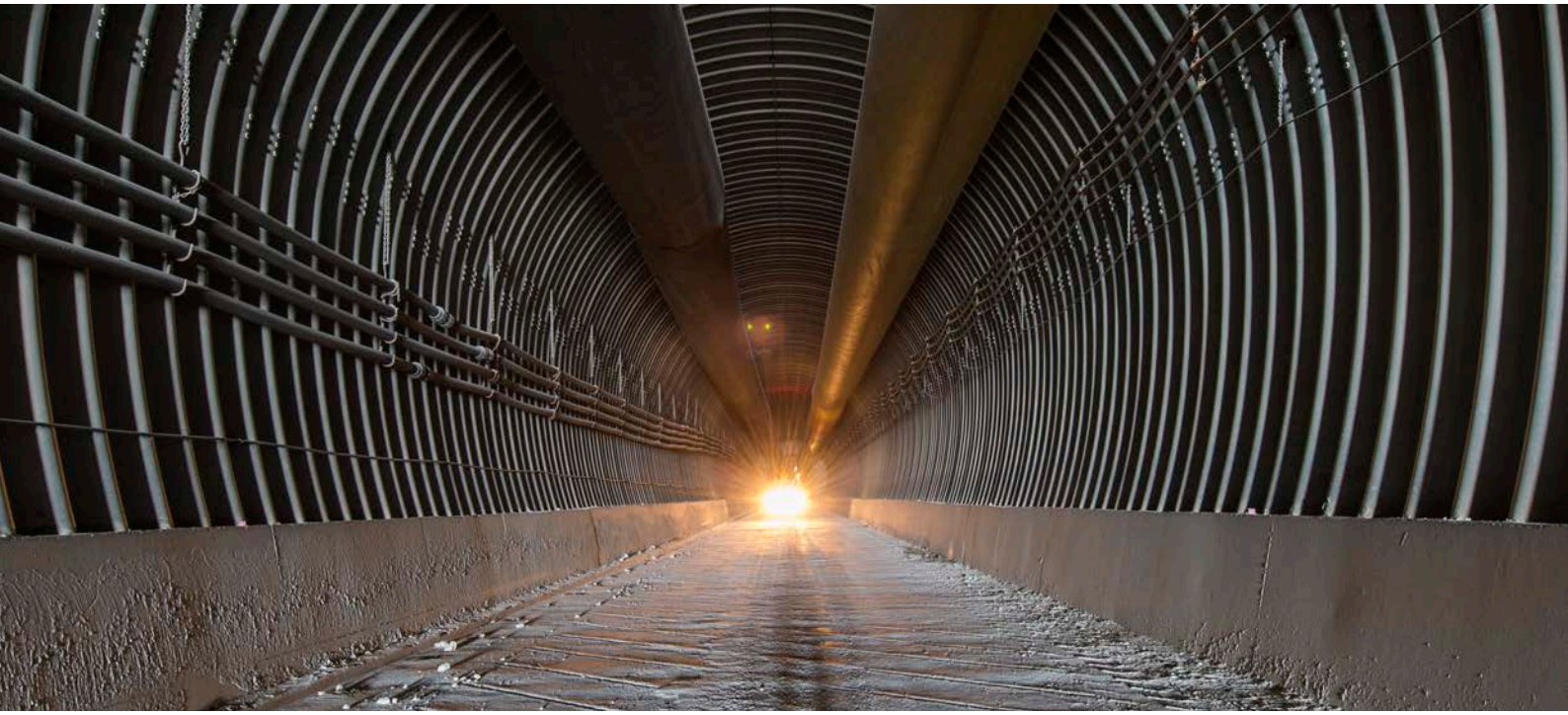
A rigorous risk assessment process was undertaken to evaluate the risks of the Project with ERA's current controls and to determine which risks may require additional controls (new treatments). Where new treatments were identified they were factored into either the Project design or }environmental management.

To ensure the new management treatments are implemented at Ranger mine, an action plan has been developed for each health, safety and environmental aspect. Each plan includes objectives and targets, new treatments for each project phase, new measuring and monitoring programs, and relevant performance indicators. Should the Project be approved and progressed these Action Plans will be integrated into the existing ERA health, safety and environmental management system.

Action plans have been developed for the following key risk areas:

- air, noise and vibration emissions;
- occupational health and safety;
- radiation protection;
- water management;
- flora, fauna and land use stewardship;
- cultural heritage; and
- rehabilitation and closure.

A detailed description of the environmental management framework for the Project is provided in **Chapter 15**. The process for integration of new treatments into the existing Ranger environmental management plans and the action plans for each major health, safety, environmental and cultural aspect are provided in **Appendix 17**.



16 SUMMARY

The Project presents a new mining approach, delivering high grade ore to the existing Ranger processing plant. The underground mine will have a very small surface footprint, predominantly within the existing Ranger mine operational area.

Whilst there are risks to the environment, these risks can be readily managed through application of ERA's well established and robust health, safety and environment management system, a range of design aspects and identified additional controls. The Project is anticipated to generate small incremental impacts on the environment, generally in the immediately adjacent areas, through for example minor land clearing and ongoing operational noise. Studies have shown these impacts are expected to be negligible in respect to any significant or lasting impacts on the biophysical environment.

The Project does present some social risks, however it will add substantially to the regional economy, and presents opportunities to realise positive social benefits in areas such as employment, training, and local services and infrastructure. These benefits can also lead to improvements in establishing a long term, collaborative and sustainable future for the Jabiru township and wider regional community.

This Project will be constructed, operated and closed in accordance with ERA’s focus on safety, sound environmental management practice and extensive monitoring programs. The very small residual impacts and low level of residual risks, verified through the comprehensive studies presented in this Draft EIS, demonstrate a strong environmental and social case to proceed.

INVITATION TO COMMENT

All members of the public are invited to comment on the Ranger 3 Deeps underground mine Draft Environmental Impact Statement (Draft EIS).

The Draft EIS has been prepared to comply with the EIS guidelines set out by the regulatory bodies and to explain the potential impacts and benefits of developing the Ranger 3 Deeps underground mine (the Project). It is proposed to construct and operate an underground mine, and associated supporting surface infrastructure, to extract uranium ore from the Ranger 3 Deeps orebody. The ore will be transported to surface via the existing exploration decline and processed through the existing Ranger mine processing plant.

The proposal is being assessed at the level of an Environmental Impact Statement (EIS) by the Australian Government, under the *Environment Protection and Biodiversity Conservation Act 1999* and the Northern Territory (NT) Government under the *Environmental Assessment Act*.

The Draft EIS is available for public review for 10 weeks, as advertised in the national and Northern Territory press.

Accessing the document

An electronic version of the Draft EIS can be viewed and downloaded via the ERA website at: www.energyres.com.au/whatwedo/2324.asp and at the NT EPA website: www.ntepa.nt.gov.au/envirocomment. Hard copies of the Draft EIS are available for viewing at the following locations;

Darwin

- NT EPA, 2nd Floor, Darwin Plaza, 41 Smith Street Mall
- Mines and Energy Information Centre, Department of Mines and Energy, 3rd Floor, Paspalis Centrepoint, 48 Smith Street Mall
- Department of the Environment (Darwin Office), corner Pederson Road and Fenton Court, Darwin International Airport
- NT Library, Parliament House
- The Environment Centre NT, Unit 3, 98 Woods Street
- Northern Land Council Head Office, 45 Mitchell Street

Jabiru

- Jabiru Public Library, 13 Tasman Crescent
- Northern Land Council West Arnhem, 3 Government Building, Flinders Street
- Gundjeihmi Aboriginal Corporation, 5 Gregory Place

Lodging a submission
Electronic submission can be made via the ERA website at: www.energyres.com.au.

A submission may include comment, additional information, or an opinion relevant to the information provided in the Draft EIS, or in a general way related to the Project.

Submissions may be made in writing and respondents should note the following:

- Refer to the Project title (*Ranger 3 Deeps underground mine*).
- Each matter raised within the submission should clearly state which chapter and section of the Draft EIS is being referred to (e.g. Chapter 6, Section 6.1.2).
- Supporting factual information and/or references should be provided for each point raised.
- The name and address of the respondent(s) and the date of submission should be included.
- All written submissions should be signed.[1]

For your submission about the Draft EIS to be considered, it must be received by 5.00 pm (Central Standard Time) on the close of submissions date and appropriate contact details must be provided.

Submissions can also be posted to either:

Energy Resources of Australia Ltd
GPO Box 2394
Darwin NT 0801
ATTENTION: Draft EIS comment

or

Environmental Assessment
NT Environment Protection Authority
GPO Box 3675
Darwin NT 0801

P: (08) 8924 4139
E: eia.ntepa@nt.gov.au

ERA will acknowledge receipt of all submissions received prior to the close of the review period. Submissions will be recorded, collated, and copies provided to the relevant government assessment agencies.

What happens to my submission?

When you make a submission to the Draft EIS it will be reviewed and used in the production of the final EIS document. Written submissions will also be provided to the NT EPA, and included in summary documentation that may appear on the ERA website, unless anonymity or withholding of comments is requested from the public. Members of the public who wish their comments to remain confidential or anonymous should specify this in the comments.

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[1] Details of submissions, including the name of submitter, may be published in the supplementary EIS, unless it has been clearly stated that the submission is submitted in confidence.