Northern Minerals Limited

Browns Range Rare Earths Project

Section 38 Referral - Supporting Information Document

May 2013

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Section 38 Referral - Supporting Information Document

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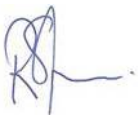
Final Report	Outback Ecology & Northern Minerals	R Jones		2 May 2013

Table of Contents

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

Northern Minerals Ltd (Northern Minerals) is seeking approval under Part IV of the *Environmental Protection Act 1986* (EP Act) for the development of a heavy rare earth elements (HREE) mine and ore processing facility at Browns Range, approximately 160 km southeast of Halls Creek, WA, (the Proposal).

The purpose of this document is to support the referral of a proposal under Section 38 of the EP Act. It provides additional information on the Proposal, the existing environment in the project area and potential impacts that could arise as a consequence of implementing the Proposal. This document should be read together with the referral form, table of legislation relevant to the Proposal (**Appendix A** of this document) and the draft Environmental Scoping Document (**Appendix B** of this document).

2. BACKGROUND INFORMATION

2.1. Proponent Details

Northern Minerals Limited (Northern Minerals) is listed on the ASX and owns a portfolio of heavy rare earth element (HREE) projects within the east Kimberley region of Western Australia and also in the adjoining northern Tanami region of the Northern Territory. Since discovering HREE's in xenotime mineralisation at Browns Range in 2010, Northern Minerals has been implementing a successful strategy of proving up the HREE resources as well undertaking metallurgical testwork and environmental surveys and studies to support the development of the Browns Range Project (the Project).

All requests for information and other correspondence related to regulatory aspects of the Proposal should be forwarded by post, facsimile or e-mail to the following address:

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2.2. Overview of Proposal

Northern Minerals proposes to mine and process ore containing HREE dominant xenotime mineralisation from multiple open pits at the Browns Range site. Xenotime is a rare earth phosphate mineral, principally comprising yttrium orthophosphate. The Browns Range dome, within which the rare earth deposits occur, extends into the Northern Territory, although to date Northern Minerals has focussed its exploration activities within its Western Australian tenements. This Proposal relates only to mining within Northern Minerals' Western Australian tenements at Browns Range.

The Proposal area is located approximately 160 kilometres (km) southeast of Halls Creek, approximately 10 km to the west of the Western Australian/Northern Territory border (Figure 1) and is located on the Gordon Downs pastoral station in the Shire of Halls Creek (Figure 2).

An on-site beneficiation plant would treat up to 750,000 tonne per annum (tpa) of ore to produce approximately 15,000 tpa of mineral concentrate. The beneficiation process would involve crushing, grinding, magnetic separation and flotation of the xenotime ore. The concentrate produced by the beneficiation plant would then be further processed via a hydrometallurgical process to produce up to 4,000 tpa of high purity mixed rare earth oxide for export overseas. The hydrometallurgical plant will be co-located on site and would involve a sulphation bake and water leach step using sulphuric acid to liberate and leach the rare earths into solution. This leach liquor would then be purified to remove any thorium and uranium present prior to precipitation of the rare earths using oxalic acid. The rare earth rich oxalate precipitate would then be calcined to produce a mixed rare earth oxide.

Waste products from the mining and mineral processing operation would include waste rock and tailings. The waste rock would be stored in above ground waste landforms and the combined tailings would be deposited in a purpose-built, engineered tailings storage facility (TSF).

In addition, the Project would involve the construction and use of:

- a borefield for water supply;
- access and haul roads; and
- support infrastructure, including an accommodation village, workshops and laydown areas, offices, stormwater management infrastructure (bunds, drains), water storage and evaporation ponds, telecommunications infrastructure, diesel power supply for the mine, plant and support facilities, and an extension of an existing exploration airstrip.

It is proposed that the mixed rare earths oxide will be transported from the site in shipping containers using public roads to either Darwin or Wyndham port for export. The proposed operational mine life is up to 10 years (not including construction and rehabilitation phases).

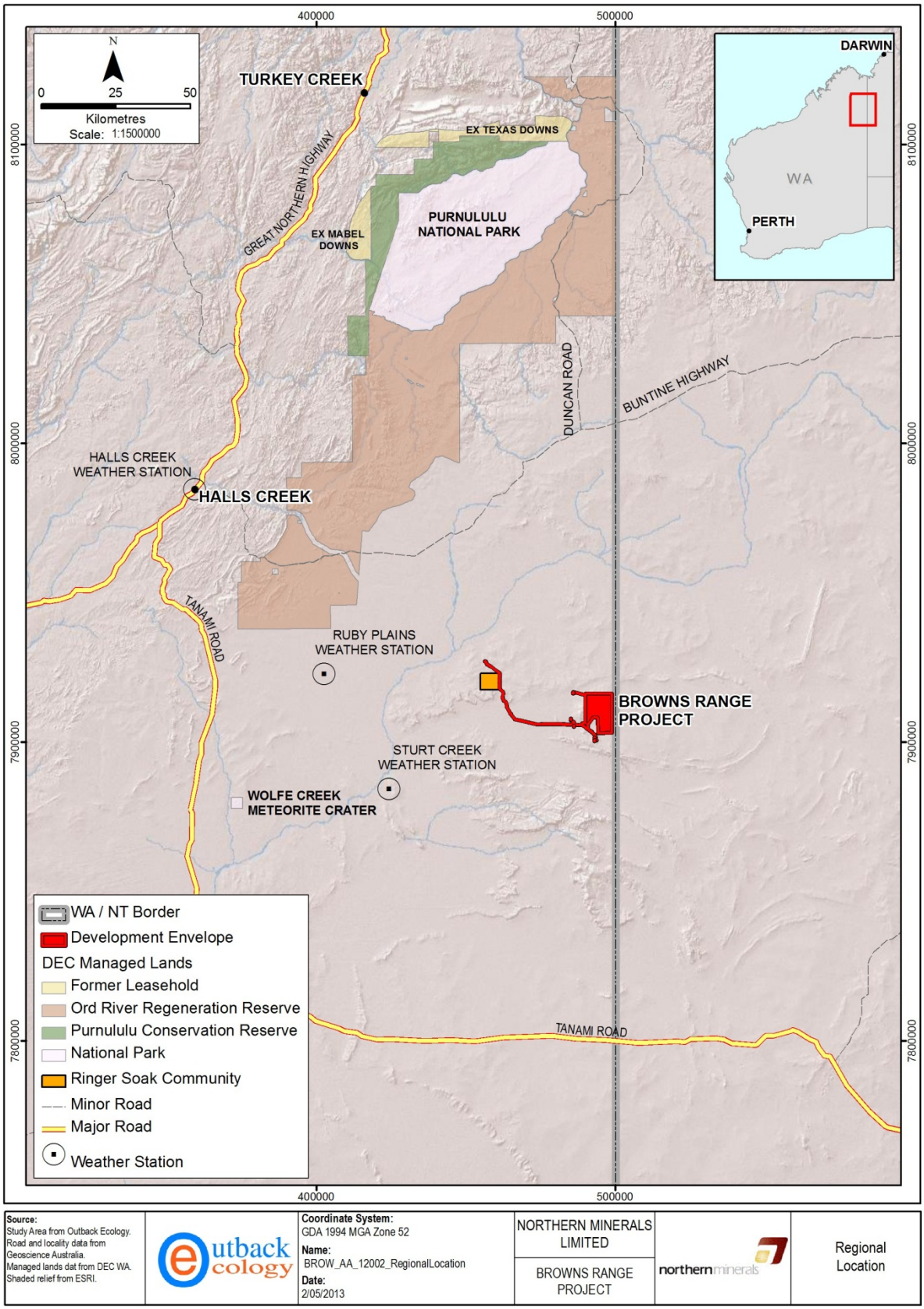

Figure 1: Regional location of the Browns Range Project

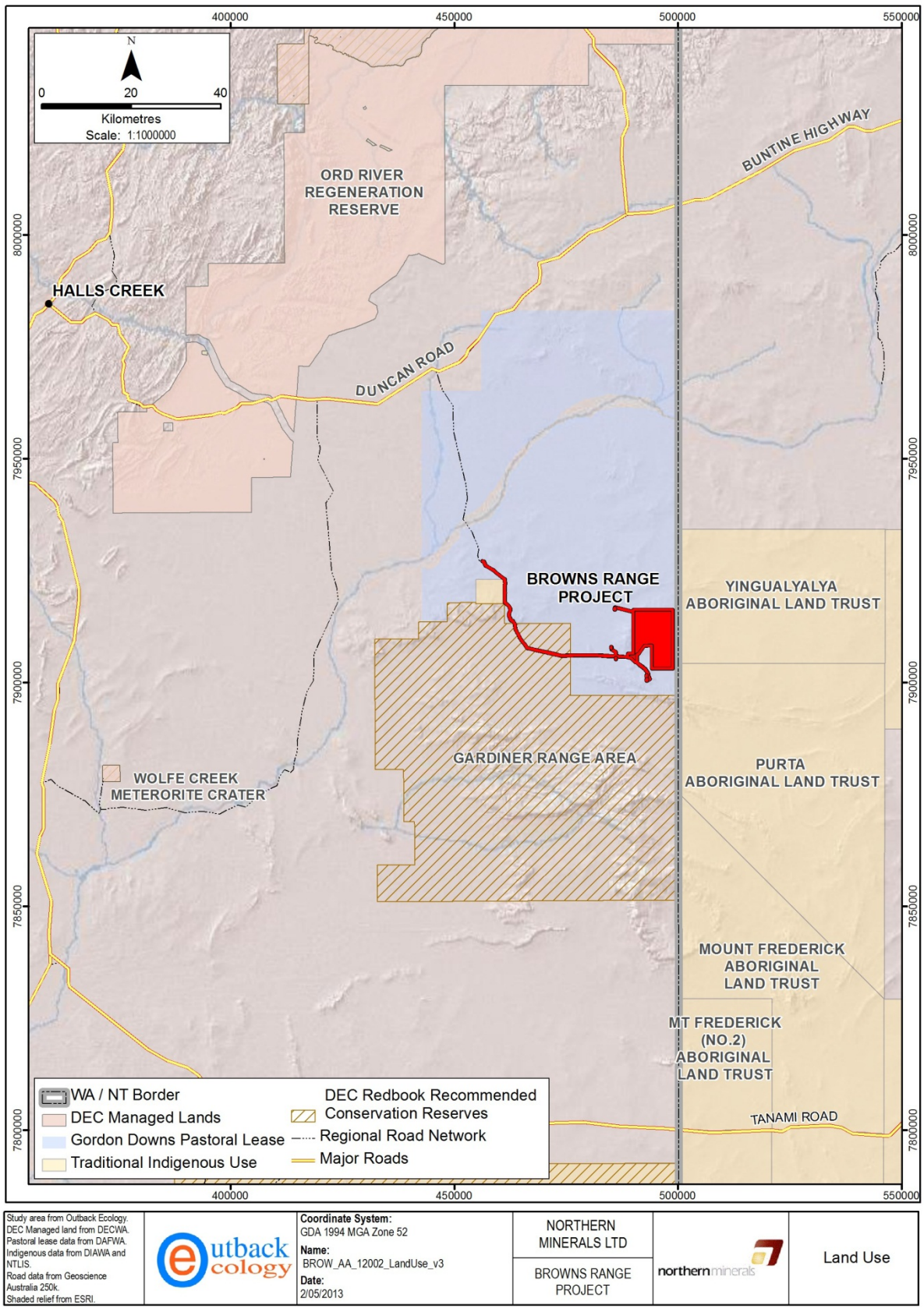

Figure 2: Land use within and surrounding the Browns Range Project Tenure

The Proposal will be located entirely within a nominal 5,800 ha development envelope (**Figure 3**) of which 925 ha is estimated to be the disturbance footprint. Project infrastructure, excluding the access roads and some water supply borefield infrastructure, will be located within exploration tenements currently held by Northern Minerals (Figure 11). The total extent of the exploration tenements held by Northern Minerals which form part of the Browns Range Proposal is approximately 43,400 ha. Additional miscellaneous licence applications will be sought from the Department of Mines and Petroleum (DMP) for all linear infrastructure such as access roads and water supply borefield infrastructure.

Table 1 provides a summary of the tenements for the Project.

Table 1: Tenements held by Northern Minerals

Tenement	Blocks	Area (Ha)	Granted	Expires	Lessee
E80/3547	35	~10,850	03 Oct 2006	02 Oct 2013	Northern Minerals Ltd
E80/3548	70	~21,700	19 March 2008	18 March 2015	Northern Minerals Ltd
E80/4393	18	~5,580	30 Sept 2010	29 Sept 2015	Northern Minerals Ltd
E80/4479	17	~5,270	07 July 2011	06 July 2016	Northern Minerals Ltd

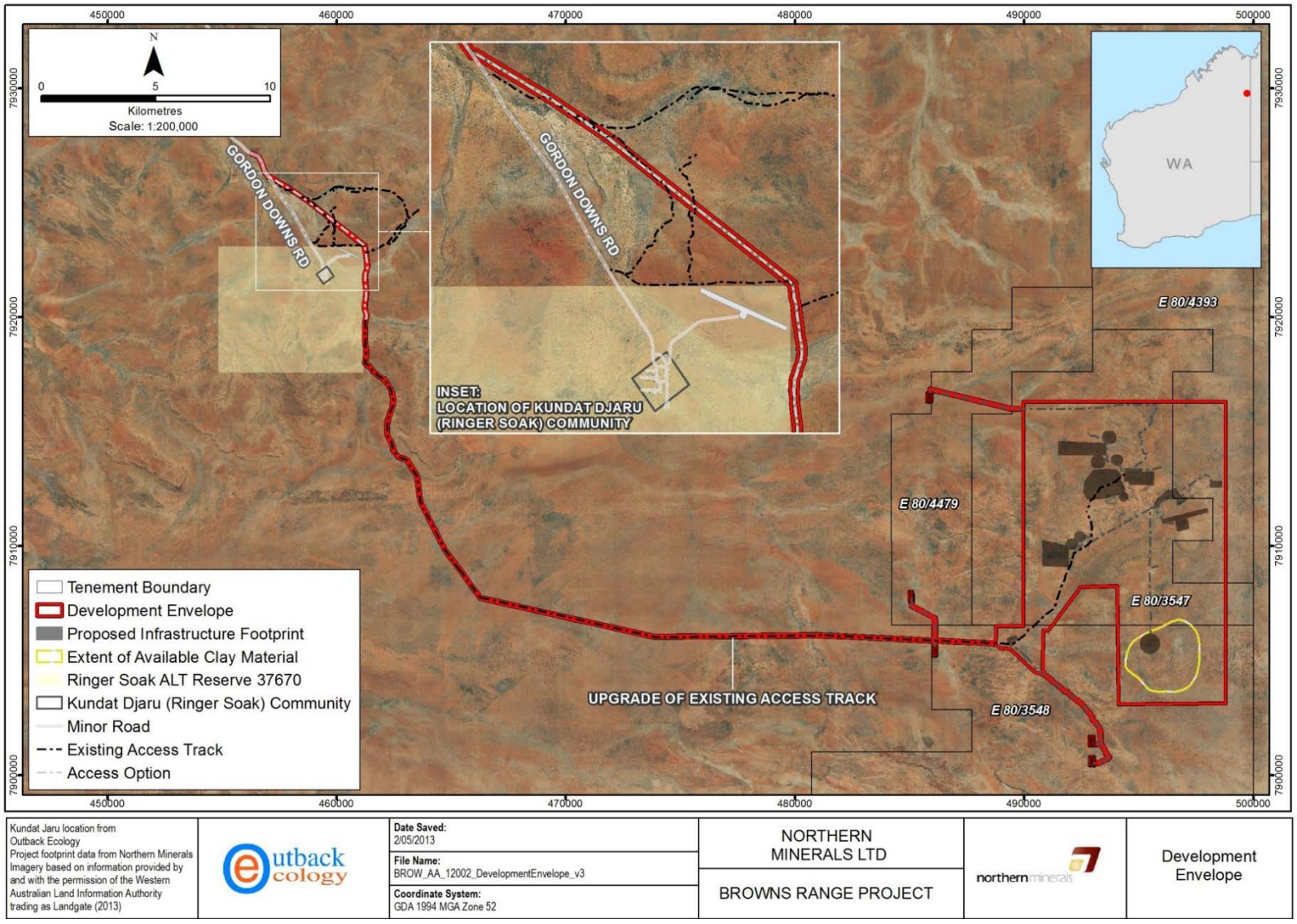

Figure 3: Development envelope for the Browns Range Project

3. EXISTING ENVIRONMENT

3.1. Climate

The Tanami 1 Sub-Bioregion, within which the Proposal area is located, experiences an arid-tropical climate with mainly summer rainfall due to a monsoonal influence (Graham 2001). The Bureau of Meteorology (BOM) weather station at Halls Creek airport, which is located approximately 160 km north-west of the Proposal, is the closest locality with comprehensive climate data available and provides climate information most relevant to the Proposal (**Figure 4**).

Mean maximum temperatures at Halls Creek airport range from 27.2°C in July to 38.4°C in November (**Figure 4**). Mean minimum temperatures in winter months range from 12.6°C to 14.8°C. The region experiences distinct dry and wet periods and there is a strong seasonality in rainfall patterns, with approximately 90% of annual rainfall generally occurring in the wet season between November and April (**Figure 4**). The mean annual rainfall at Halls Creek is 635.8 mm. The Halls Creek station records, on average, 49 rain days per year (BOM 2012). Mean annual pan evaporation is around 3495 mm with monthly averages ranging from 183 mm to 408 mm.

Rainfall in the region can be highly localised and unpredictable, with substantial variability both spatially and temporally (BOM 2012). For example, an unusually wet Dry Season was experienced by Northern Australia (including the Project area) in 2010, with many locations in the region measuring their highest dry season rainfall on record (National Climate Centre 2010). Monthly rainfall at Halls Creek airport was highly variable over the period from 2008 to 2012. For example, for the month of March, 379.8 mm of rain was recorded In 2011, but only 69 mm was recorded in March 2010 and only 11 mm was recorded in March 2008 (**Figure 5**).

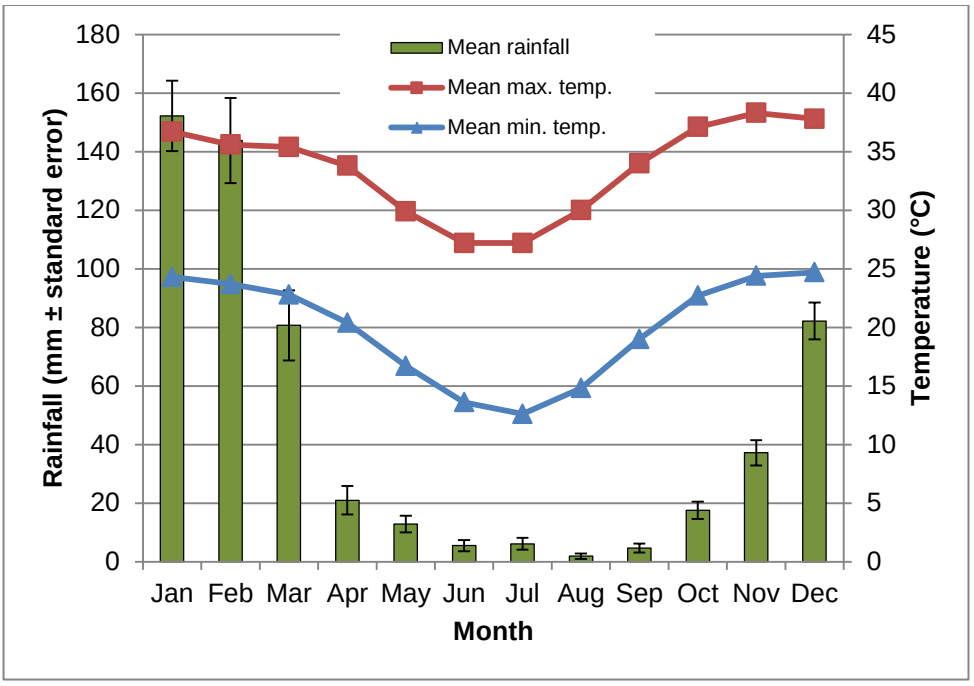

Figure 4: Climate Data for Halls Creek airport

Source Data: BOM (2012), Weather Station 002012, 1944 To 2012

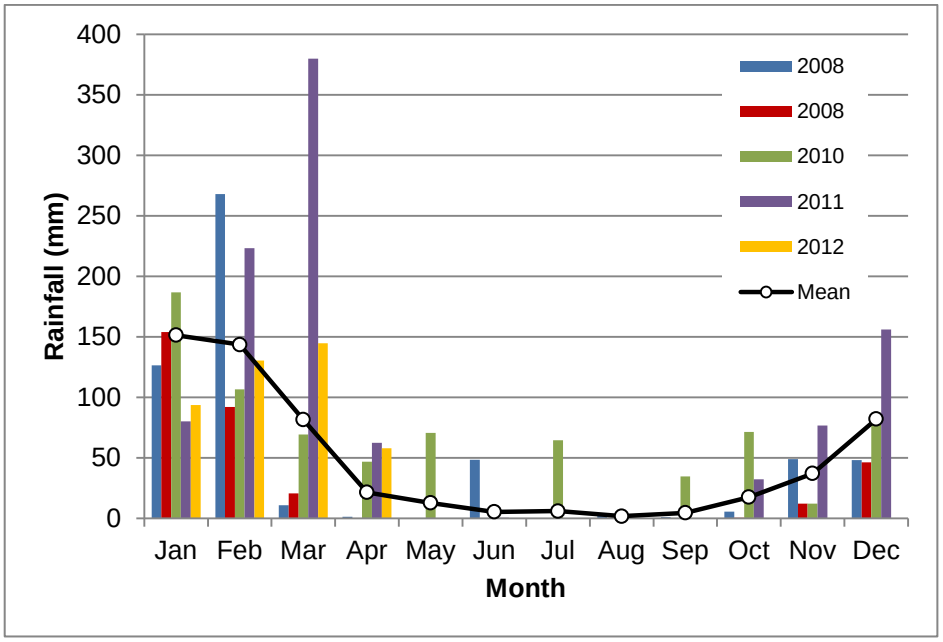

Figure 5: Monthly rainfall for Halls Creek airport

Source Data: BOM (2012), Weather Station 002012, 1944 To 2012

3.2. Geology

The Proposal is located on the western side of the Browns Range Dome, a Paleoproterozoic dome formed by a granitic core intruding the Paleoproterozoic "Browns Range Metamorphics" (meta-arkoses, feldspathic metasandstones and schists) and an Archaean orthogneiss and schist unit to the south. The dome and its aureole of metamorphics are surrounded by the Paleoproterozoic (1735-1640 Ma) Gardiner Sandstone (Birrindudu Group). Middle-Devonian to (likely) Ordovician sandstones from the eastern Canning Basin margin (Billiluna Shelf) have also been interpreted to occur over the Gardiner Sandstone to the south-west of the dome (Das 2012).

The Proposal area is primarily covered with a shallow thickness of transported soil. The main rock type consists of arkose and meta-arkose outcrops which are the dominant geological unit throughout the Proposal area. Other rock types include quartz mica schists, banded ironstone formation/quartz pebble conglomerate, dolerite and calc-silicate rocks. Minor occurrences of quartzite, silcrete, ferricrete and ironstone have also been identified. The Gardiner Sandstone flanks the western margins of the Proposal area and unconformably overlies the older Browns Range metamorphic rocks.

Mapping by Northern Minerals has identified both mineralised and non-mineralised occurrences of quartz veins and quartz breccia veins occurring as elongated discontinuous bodies, up to several metres wide and tens of metres long and intruding along possible shears or faults trending 320˚ (north-west) and 270˚ (east-west).

3.3. Regional Landscape and Soils

The Proposal is located within an area of rocky outcrop at the northern edge of the Tanami Desert. It lies within the Tanami bioregion, as defined by the Interim Bioregion of Australia (IBRA) classification

system (Graham 2001). The Tanami bioregion is composed of three sub-bioregions: Tanami 1, Tanami 2 and Tanami 3. The Proposal occurs in Tanami 1, which is the largest of the three sub-bioregions.

The Proposal lies within the eastern Kimberley region of Western Australia. Numerous rangelands surveys conducted in the 1940s have contributed to a comprehensive description of biophysical resources present within the Kimberley region, including the condition of soil and vegetation (Payne and Schoknecht 2011). This information has been used to classify and map the land systems of the Kimberley region based on landforms, soils, vegetation, geology and geomorphology. The Proposal area contains two land systems: Coolindi and Winnecke (**Table 2**, Figure 6). Details of baseline soil investigations completed to date are presented in **Appendix C**.

Table 2: Land systems within the Proposal area

Land System	Description	Area within Study Area (hectares)	Proportion of Study Area (%)
Coolindie	Consists of gently undulating red desert sandplains and dunes supporting *Acacia* shrublands, *Eucalyptus* woodlands and soft spinifex (*Triodia pungens*) grasslands. These grasslands are subject to frequent fires that cause short-term changes in floristic composition and abundance. Drainage lines are shallow, widely spaced and infrequent, and erosion is minimal.	6,473	84.3
Winnecke	Consists of stony hills and lowlands associated with red desert sands that support *Acacia* and *Eucalyptus* woodlands and soft spinifex (*Triodia pungens*) grasslands. These grasslands are subject to frequent fires that cause short-term changes in floristic composition and abundance. Intensive parallel drainage lines occur on upper slopes, while widely spaced angular drainage lines occur on lower slopes and terminate at the base of hills. Erosion is generally minimal, though some drainage floors are moderately susceptible.	1,203	15.7

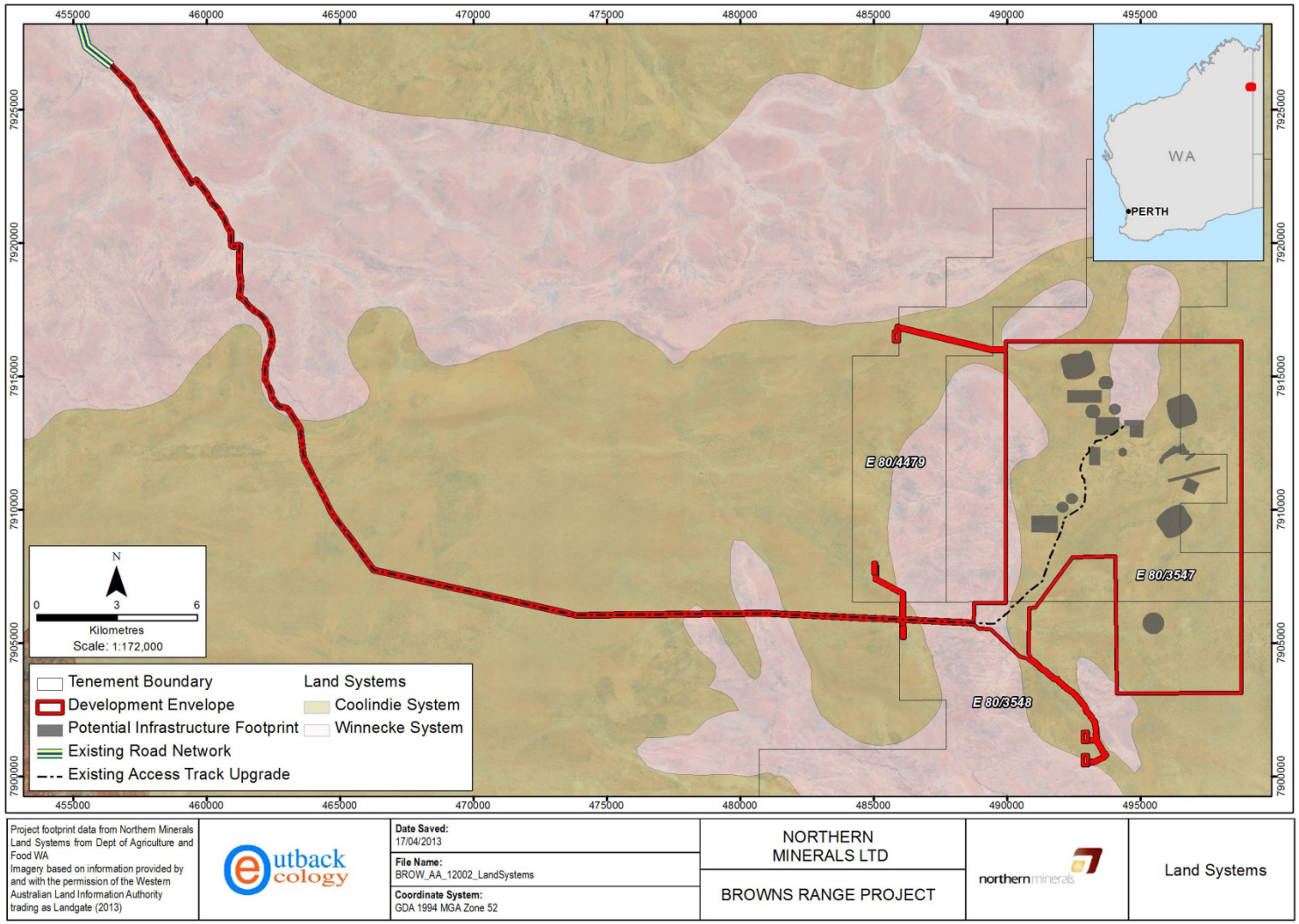

Figure 6: Land systems within and surrounding the Browns Range Project Area

3.4. Geochemical Assessment

Northern Minerals commissioned SRK to conduct an assessment of the existing geochemical data for the Proposal, focusing on those geochemical characteristics which have the potential to exert a detrimental environmental influence; and could influence the success of mine rehabilitation (SRK Consulting 2013). A review of geochemical testing completed to data is provided in **Appendix C**.

3.4.1. Waste Rock

Static acid-base testing of thirty-three representative waste rock (Figure 7) has indicated that the rock samples generally have low acid generating potential (SRK Consulting 2013).

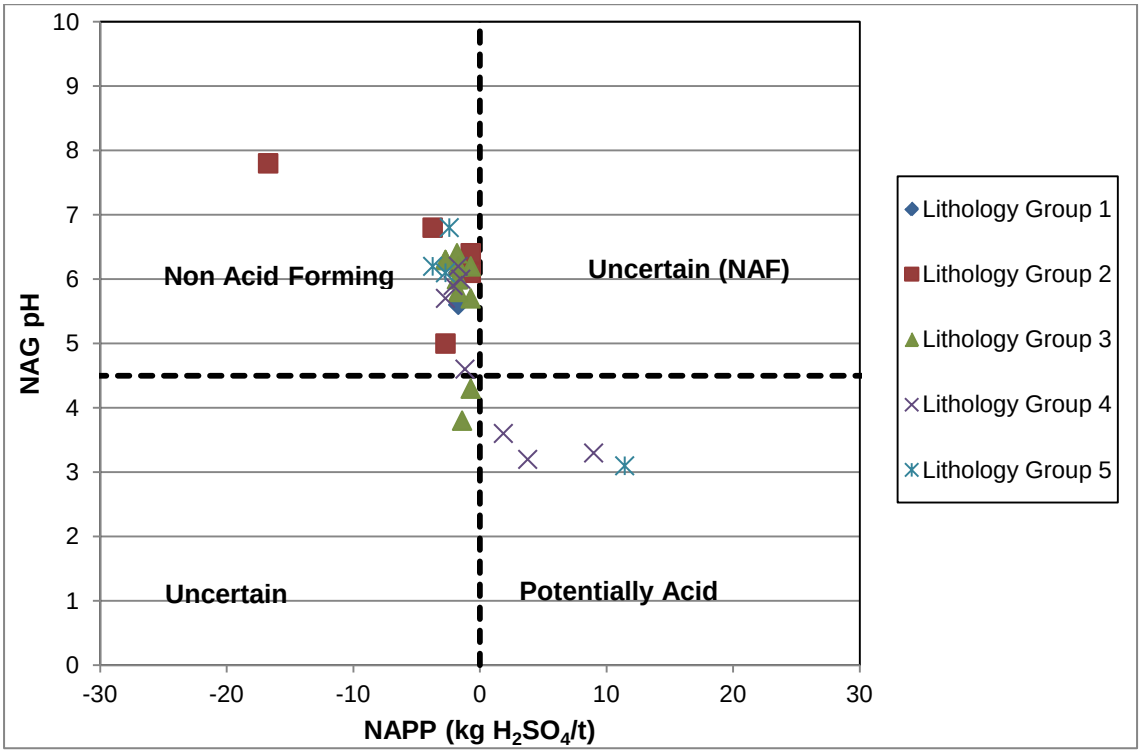

Figure 7: Geochemical classification plot (NAPP vs NAG pH)

Note: lithological groups are as follows: Group 1 - transported overburden, Group 2 - mottled saprolite, Group 3 - weathered arkose, arenite and siltstone, Group 4 - orebody (mainly brecciated arkose), Group 5 - footwall (mainly non-brecchiated arkose or arenite)

The waste rock samples occasionally showed 'enriched' elements, relative to average global crustal abundance levels (Bowen, 1979). The most frequent occurrence of elemental enrichment was found within samples taken from the ore zone (Table 3). Boron and selenium were identified as the elements most widely enriched in the sample dataset and additionally were enriched outside the ore zone (SRK Consulting 2013). Review of the trace element data available within the Northern Minerals geochemical database (which includes comprehensive trace element analysis of several hundred samples) also indicated that trace element enrichment tends to be coincident with the ore zone.

Table 3: Average trace element crustal abundance summary

Element	LOD	Units	Lithological Grouping					Beneficiation Tailings	GAI=3
			1	2	3	4	5		
			Ave.	Ave.	Ave.	Ave.	Ave.	-	
As	0.5	mg/kg	3.1	5.2	3.8	23.6	12.8	7.7	18
B	50	mg/kg	84	155	165	126	225	119	120
Ce	0.01	mg/kg	32.46	50.29	71.65	406.42	79.34	256.04	816
Cu	1	mg/kg	10	4	2	73	3	74	600
Dy	0.01	mg/kg	1.60	1.64	4.18	110.64	2.27	40.71	72
Er	0.01	mg/kg	0.92	1.01	2.68	72.11	1.53	26.00	45.6
Eu	0.01	mg/kg	0.41	0.38	0.53	7.56	0.50	3.15	25.2
Gd	0.01	mg/kg	1.85	1.78	3.27	70.02	2.00	27.19	92.4
Ho	0.01	mg/kg	0.33	0.34	0.87	24.00	0.47	9.23	16.8
La	0.01	mg/kg	17.24	28.41	37.56	167.38	52.47	105.85	384
Lu	0.005	mg/kg	0.14	0.17	0.37	8.85	0.24	2.98	6.12
Nd	0.01	mg/kg	12.57	18.09	28.01	246.20	27.89	153.47	456
Pr	0.005	mg/kg	3.59	5.40	8.16	57.06	8.67	34.17	114
Sb	0.05	mg/kg	0.39	0.38	0.33	0.66	0.63	0.88	2.4
Se	0.5	mg/kg	0.63	0.6	0.7	0.6	0.63	0.02	0.6
Sm	0.01	mg/kg	2.24	2.63	4.19	49.12	3.45	28.48	94.8
Tb	0.005	mg/kg	0.27	0.27	0.60	15.33	0.34	5.95	13.2
Tm	0.01	mg/kg	0.14	0.16	0.40	10.60	0.23	3.54	5.76
U	0.01	mg/kg	1.11	1.26	2.01	7.95	1.72	3.26	28.8
Y	0.05	mg/kg	8.13	9.68	23.45	656.75	13.95	235.66	360
Yb	0.01	mg/kg	0.98	1.06	2.62	65.88	1.64	24.05	39.6

Note: Lithological groupings are as in Figure 7. "GAI" means average global abundance index (Bowen, 1979)

Leach testing (1:5 water to solid solution) was used to assess readily leachable constituents of composited samples of waste rock (Table 4). The pH of the leachates ranged from pH 5.0-7.6. The leachable trace metal concentrations of the composite rock samples were generally low, and often below detection limits.

Although selenium was identified as one of the two most “enriched” elements on the basis of the GAI assessment of the solid samples, no leachable selenium concentrations above detection level were obtained. Boron, the most commonly “enriched” element within the solid samples, was present in the leach extractions. Leachable REE (Er, Eu, Gd, Lu, Pr, Rb, Tb and Y) were found to be leached in the highest concentrations from the ore zone composite sample (lithological group 4), with the exception of Pr and Rb.

Table 4: Leachate composition (elements present above detection limits)

Element	Units	Lithological Groupings					Beneficiation Tailings	ANZECC Livestock Drinking Water Guideline Value
		1	2	3	4	5		
pH	-	6.7	7.6	6.8	5.7	5.0	6.8	-
Al	mg/l	0.7	4.55	0.63	0.65	0.21	0.45	5
As	µg/l	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	0.4	500
B	mg/l	2.19	0.64	0.05	0.44	0.45	0.08	5
Ba	mg/l	1.54	0.07	0.2	0.52	0.42	0.28	-
Be	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	0.1	-
Bi	µg/l	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	0.008	-
Ce	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	4.915	-
Co	µg/l	*0.05*	*0.05*	*0.05*	*0.05*	0.09	0.5	1000
Cs	µg/l	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	0.045	-
Cu	mg/l	*0.05*	*0.05*	*0.05*	0.84	*0.05*	0.08	0.4/1 (sheep/cattle)
Dy	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	4.831	-
Er	µg/l	0.047	0.177	0.122	2.616	0.656	3.001	-
Eu	µg/l	0.01	0.068	0.025	0.199	0.121	0.306	-
Fe	µg/l	*0.05*	1.34	*0.05*	0.14	2.54	0.44	-
Ga	µg/l	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	0.06	-
Gd	µg/l	0.081	0.356	0.17	2.199	0.972	3.146	-
Hf	µg/l	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	0.008	-
Ho	µg/l	-	-	-	-	-	1.056	-
In	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	0.002	-
La	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	2.242	-
Li	µg/l	0.034	0.019	0.01	0.008	0.008	1.22	-
Lu	µg/l	0.016	0.042	0.008	0.237	0.084	0.321	-
Mn	mg/l	0.32	*0.05*	*0.05*	0.1	0.33	0.07	-
Mo	mg/l	*0.02*	0.11	*0.02*	*0.02*	*0.02*	1.69	0.15
Nd	mg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	4.164	-
Ni	mg/l	*0.05*	*0.05*	*0.05*	*0.05*	0.07		1
Pb	µg/l	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	2.1	100
Pr	µg/l	0.123	0.387	1.251	0.657	0.153	0.862	-
Rb	µg/l	0.02	0.02	0.04	0.07	0.09	1.14	-
S	mg/l	-	-	-	-	-	2	-
Sb	µg/l	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	0.08	-
Si	mg/l	-	-	-	-	-	4.05	-
Sm	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	1.501	-
Sn	µg/l	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	0.3	-
Sr	µg/l	0.175	0.073	0.024	0.106	0.369	12.31	-
Tb	µg/l	0.018	0.075	0.029	0.358	0.176	0.673	-

Element	Units	Lithological Groupings					Beneficiation Tailings	ANZECC Livestock Drinking Water Guideline Value
		1	2	3	4	5		
Th	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	0.191	-
Ti	mg/l	-	-	-	-	-	0.01	-
Tl	µg/l	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	0.02	-
Tm	µg/l	-	-	-	-	-	0.409	-
U	µg/l	*0.005*	*0.005*	*0.005*	0.007	*0.005*	0.623	-
Y	µg/l	*0.005*	*0.005*	*0.005*	0.015	0.007	32.146	-
Yb	µg/l	*0.005*	*0.005*	*0.005*	*0.005*	*0.005*	2.339	-
Zn	mg/l	1.75	*0.05*	0.08	0.08	0.15	0.22	-
Zr	µg/l	-	-	-	-	-	0.29	-

Nine rock samples from the uppermost three lithological groupings were selected for Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP) analyses. CEC is a measure of a soils ability to adsorb and exchange cations which are held by the negatively charged clay and organic matter via electrostatic force. The CEC may be used as an indicator of the potential available nutrient reserve in the soil and inherent fertility. The CEC of the alluvial/colluvial overburden ranges between 32-64 meq/100 g, typical of clay or clay loam soils. The CEC of the arkose and arenite/agrillite samples are towards the lower end of the range (32 meq/100 g) due to the reduced surface area exchange sites (i.e. lesser weathered soil minerals and organic matter content).

The exchangeable sodium percentage (ESP) can be used as an indication of the susceptibility of soil to dispersion. Soils with an ESP greater than 6% are generally classified as “sodic” and greater than 15% as strongly sodic (Northcote and Skene, 1972). Seven of the nine waste rock samples tested gave ESP determinations equal or less than 1%, indicating that they would not be classified as sodic. These results suggest that the soils are unlikely to be prone to dispersion when exposed to water. A colluvial clay sample (BR020028) and a clay (with arkose) sample gave higher ESP determinations of 7.1% and 8.1% respectively, and are therefore classed as sodic samples. Although none of the samples were considered as highly sodic, suitable precautions would need to be taken to prevent water flow over or ponding on the waste dumps to minimise physical erosion of materials, and also to minimise waste rock deterioration.

Radionuclide assessment of the leachate extracts from waste rock samples indicated that the radioactivity is below the mandatory DMP investigation levels for naturally occurring radioactive material (NORM). Daughter/parent activity ratios that differ from unity indicate secular disequilibrium. The radionuclide concentrations for the solid waste rock composite samples showed no significant evidence of disequilibrium, suggesting long-term stability, with no ‘recent” fractionation of parent and daughter radionuclides.

3.4.2. Tailings Characteristics

A single sample of beneficiated tailings has been tested to date. The paste pH of the sample was near-neutral (pH 6.8) and the paste EC was low (40 µS/cm). The sample had a low sulphur content (0.03 wt%), and a low correspondingly Maximum Probably Acidity (MPA) value (0.92 kg H2SO4/t). The beneficiation tailings samples studied had a low potential for acid generation. No elements were enriched in the beneficiation tailings solid sample, relative to average global crustal abundance values (Table 3). The leached concentrations from the tailings sample were generally higher than those observed for the waste rock samples, possibly reflecting a finer grain-size. When compared to the leachate data for waste rock samples, a wider range of elements were detectable in the leachate from the tailings sample.

3.5. Surface Hydrology

There are no permanent watercourses or surface water bodies in the Project area. Moderate relief in the form of low hills and rocky outcrops occurs sporadically throughout the Project area. Incised drainage systems are common in these areas and numerous drainage lines and ephemeral creek systems can be seen on satellite imagery (Golder Associates 2013). The mine tenements lie mostly within the Sturt Creek catchment and the dominant direction of surface flow would be in a westerly direction. Surface water runoff drains away from the Browns Range Project site at gradients in the order of 1%.

Surface water runoff and stream flow responses in the region are wet season dominated (November to April), with dry season flows contributing only a small fraction of the total annual runoff volume (Golder Associates, 2013). The region has a high inter-annual variability in runoff, reflecting the temporal variability in rainfall. Estimates of annual rainfall for a range of Average Recurrence Intervals (ARIs) are presented in Figure 8. The average annual rainfall for the 100 year ARI is estimated to be 1,052 mm.

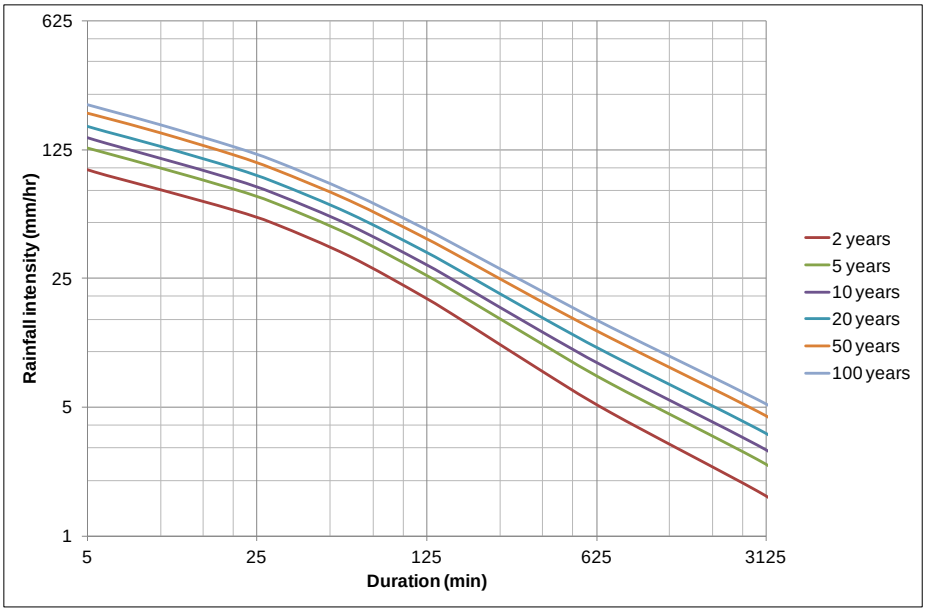

Figure 8: Estimated IFD curves for the Browns Range Project Area

3.6. Groundwater

Three potential aquifers have been identified at the Project site:

1. A primary porosity aquifer within the alluvial sediments adjacent to, and generally in connection with the unnamed ephemeral water courses. This aquifer is likely to consist of alluvial sands and silts, pinching out laterally away from the channel. This aquifer may be connected to underlying fractured aquifers. This aquifer is likely to have a limited regional extent.

2. A deeper fractured-rock aquifer hosted within the secondary porosity of the metamorphic/igneous units at the Project site. Generally, deep regional and localised fault zones are anticipated to be more water-bearing than the country rock, although permeability is likely to decrease with depth.

3. The Gardner Sandstone aquifer, a medium grained sandstone, is expected to yield good supplies of water due to its high primary porosity, with potential secondary porosity in localised fault and fracture zones. This unit underlies the Browns Range metamorphic/igneous units, and outcrops to the west of the Project site.

Although there is potential for a shallow unconfined weathered aquifer to exist above the deeper fractured aquifer (weathered country rock), limited information is currently available from this potential aquifer.

There is limited groundwater level information available across the Project site. Groundwater levels recorded to date range from about 6 metres below ground level (mbgl) to about 30 mbgl. It is not clear to which aquifer unit(s) these levels relate.

The available water quality data indicates that the groundwater is fresh, with a neutral to alkaline pH (Table 5). The high total alkalinity (>180 mg/L) indicates that the water is hard.

Table 5: Water Quality Analyses from Camp Water Supply Bore

Parameter	Units	2011 Sample	2012 Sample
pH	pH units	9.3	7.85
Electrical Conductivity	µS/cm	897	1260
Total Dissolved Solids	mg/L	-	819
Turbidity	NTU	-	0.9
Total alkalinity ($CaCO_3$)	mg/L	178	394
Sulphate (SO_4)	mg/L	47	75
Chloride	mg/L	93	186

There are no known groundwater users within at least 10 km of Northern Mineral's leases. Banana Springs, a culturally significant area, is located approximately 15 km to the west of the Area 5 deposit. The extent of any hydraulic connection between the Spring and the groundwater system associated with the Proposal area is currently unknown (Klohn Crippen Berger 2013).

3.7. Vegetation and Flora

An initial Level 1 survey was conducted during excellent seasonal conditions in May 2012 (Outback Ecology 2013b). A report on flora and vegetation surveys completed to date is provided in **Appendix C**. A second survey will be completed in May 2013, which will convert completed survey effort to a Level 2 vegetation and flora survey in line with EPA Guidance Statement 54a.

A total of 264 vascular flora species were recorded during the May 2012 survey. This represents 34% of the total number of species previously recognised in the Tanami bioregion (based on Florabase records). In addition, 126 species were recorded which have not previously been listed for the bioregion. This reflects the lack of previous survey effort in the region (Outback Ecology 2013b).

Eighteen vegetation communities were recorded. None of the vegetation communities were analogous to any listed Threatened Ecological Communities or Priority Ecological Communities (Outback Ecology 2013b).

No Threatened (Declared Rare Flora) listed under the WA *Wildlife Conservation Act 1950* (WC Act), or Threatened Flora species listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded (Outback Ecology 2013b). Two species listed on the Department of Environment and Conservation (DEC) Priority Flora list, *Goodenia crenata* (Priority 3) and *Trachymene villosa* (Priority 1) were recorded during field surveys to date. Flora of 'Other Conservation Significance' recorded included one unnamed *Goodenia* sp. Two taxa, *Goodenia goodeniacea* and *Sesbania muelleri* have not previously been recorded in Western Australia, five taxa represent significant range extensions and one species has been poorly collected within Western Australia (Table 6) (Outback Ecology 2013b).

Table 6: Conservation significant flora recorded at Browns Range (May 2012)

Species	Conservation Significance
Trachymene villosa	Priority 1
Goodenia crenata	Priority 3
Acacia gonocarpa	Possible range extension
Goodenia azurea subsp. *azurea*	Poorly collected in WA
Goodenia goodeniacea	First confirmed record for WA
Goodenia sp. (unnamed)	Possible new species
Marsdenia australis	Range extension for WA
Rhyncharrhena linearis	Range extension for WA
Sesbania muelleri	Range extension for WA

Eucalyptus camaldulensis subsp. *obtusa* was observed within vegetation association 3 in the south of the study area. This species is generally considered to be a facultative phreatophyte (groundwater dependent species), which makes use of seasonal floodwater and develops deep sinker root systems that infiltrate groundwater systems (Figure 9) (Outback Ecology 2013b). In addition, small areas in close proximity to the base of rocky hills may represent either seasonally inundated, or possibly permanent damplands. These areas provide habitat for several plant species that may provide moisture and food for fauna during the dry season and, accordingly, should be avoided where possible.

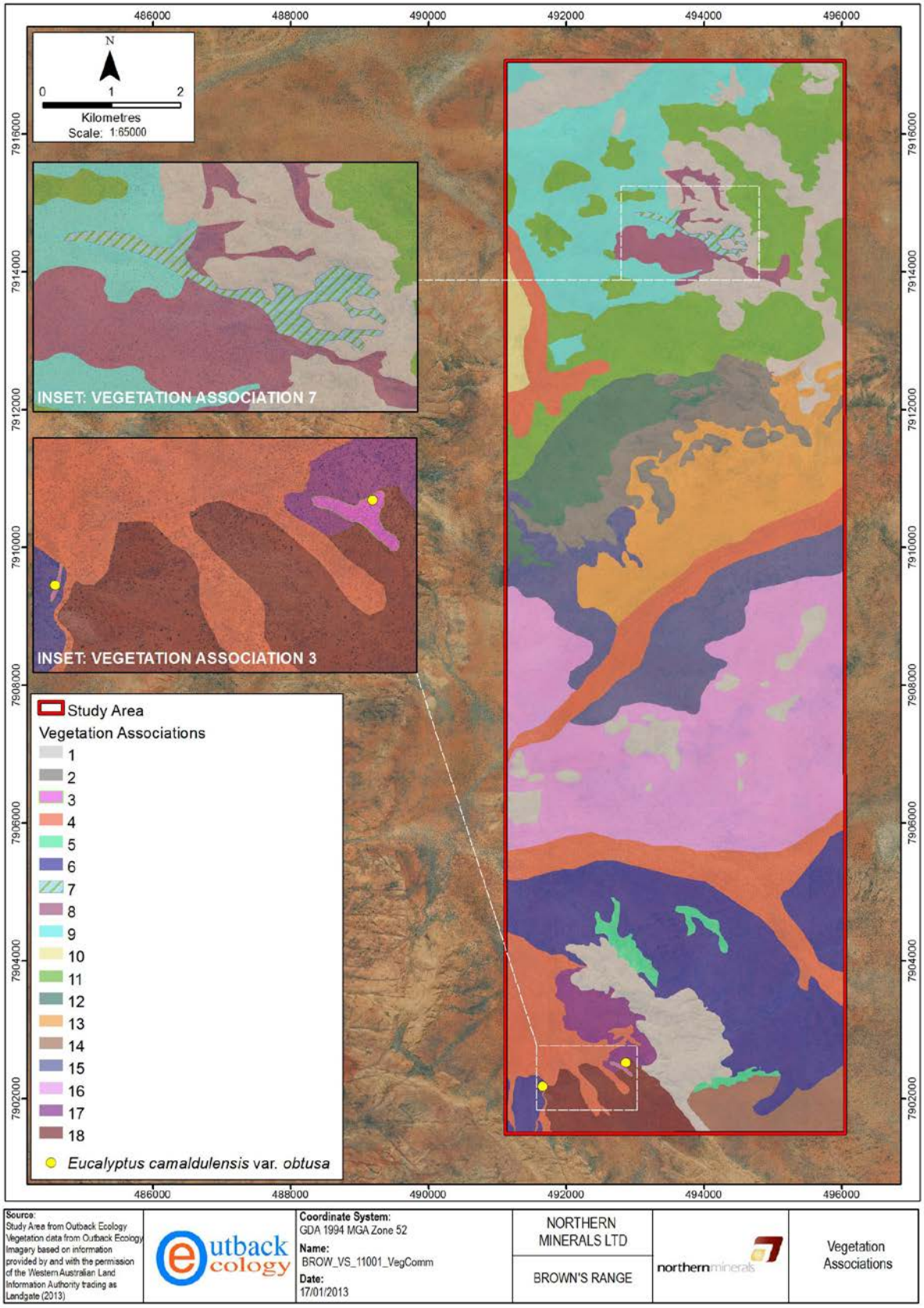

Figure 9: Vegetation Association and location of *Eucalyptus camaldulensis* subsp. *obtusa*

3.8. Terrestrial Vertebrate Fauna

Habitat assessments and systematic, targeted and opportunistic sampling for terrestrial vertebrate fauna were undertaken across the Project area in May 2012. Systematic sampling methods comprised pitfall, Elliott, funnel and cage trapping, hand searching, spotlighting and avifauna censusing. Targeted search methods comprised manual searching and the use of motion-sensor cameras and bat echolocation recording devices (Outback Ecology 2012). A report of terrestrial fauna studies completed to date is provided in **Appendix C**.

Six broad fauna habitat types were identified within the study area:

- Open Shrubland over Mixed Grassland on Sandy Plain;
- Drainage Line;
- Hummock Grassland on Rocky Hill;
- Hummock Grassland on Stony Plain;
- *Acacia* Heath over Mixed Grassland on Sandy Plain; and
- Mixed Grassland on Sandy Plain.

The habitat types identified within the Proposal area were consistent with habitat types known to occur within the Winnecke and Coolindie Land Systems. No habitat types identified within the Proposal area were considered regionally significant and none were found to contain an exceptional diversity of vertebrate fauna.

A total of 122 vertebrate species was recorded during the field survey of the Proposal area. Of the 122 species recorded during the field survey, 12 species were not identified by the literature review or database searches as potentially occurring within the Proposal area, including five mammals, one bird, five reptiles and one amphibian.

Of the 32 species of fauna of conservation significance that were identified by the desktop study as potentially occurring within the Proposal area (i.e. listed under the EPBC Act and/or the WC Act, and/or included on the DEC Priority Fauna list) four were recorded during the field survey (Table 7 and Figure 10). The field survey also confirmed the presence of a fifth species of conservation significance, the Bush Stone-Curlew, not identified by the desktop study as potentially occurring within the Proposal area.

Four unexpected species were recorded during the survey (none of which is of conservation significance) that may represent range extensions (Table 7).

Table 7: Conservation significant vertebrate fauna observed at Browns Range Proposal Area

Common name (Scientific name)	Conservation Significance
Major Mitchell's Cockatoo (Lophochroa leadbeateri)	Schedule 4 – WC Act
Lakeland Downs Mouse (Leggadina lakedownensis)	Priority 4 – WC Act
Australian Bustard (Ardeotis australis)	Priority 4 – WC Act
Bush Stone-curlew (Burhinus grallarius)	Priority 4 WC Act
Rainbow Bee-eater (Merops ornatus)	Migratory – EPBC Act; Schedule 3- WC Act
Ooldea Dunnart (Sminthopsis ooldea)	Possible range extension
Fat-tailed Antechinus (Pseudantechinus macdonnellensis)	Possible range extension
Inland Snake-eyed Skink (Cryptoblepharus australis)	Possible range extension
Rosen's Snake (Suta fasciata)	Possible range extension

The desktop study identified an additional 28 species of conservation significance that were not recorded during the field survey of the Proposal area, but which have the potential to occur within the Proposal area. Of these:

- eleven species are listed as Threatened under the EPBC Act and/or WC Act;
- six species are recognized as DEC Priority Fauna (including two species also listed under the EPBC Act); and
- fourteen species of bird (including one species also listed under the EPBC and WC Acts) are listed as Migratory under the EPBC Act and Schedule 3 under the WC Act.

Of the 28 species of conservation significance identified by the desktop study as having potential to occur in the Proposal area, 11 were determined by this study to possibly occur, or were determined to be likely or very likely to occur, including:

- Greater Bilby, Australian Painted Snipe and Great Desert Skink (VU – EPBC, S1 – WC Act);
- Brush-tailed Mulgara, Purple-crowned Fairy-wren (VU – EPBC, P4 – DEC);
- Peregrine Falcon and Woma (S4 – WC Act);
- Spectacled Hare-Wallaby (P3 – DEC);
- Grey Falcon, Flock Bronzewing and Pictorella Mannikin (P4 – DEC); and
- Oriental Plover (M – EPBC, S3 – WC Act).

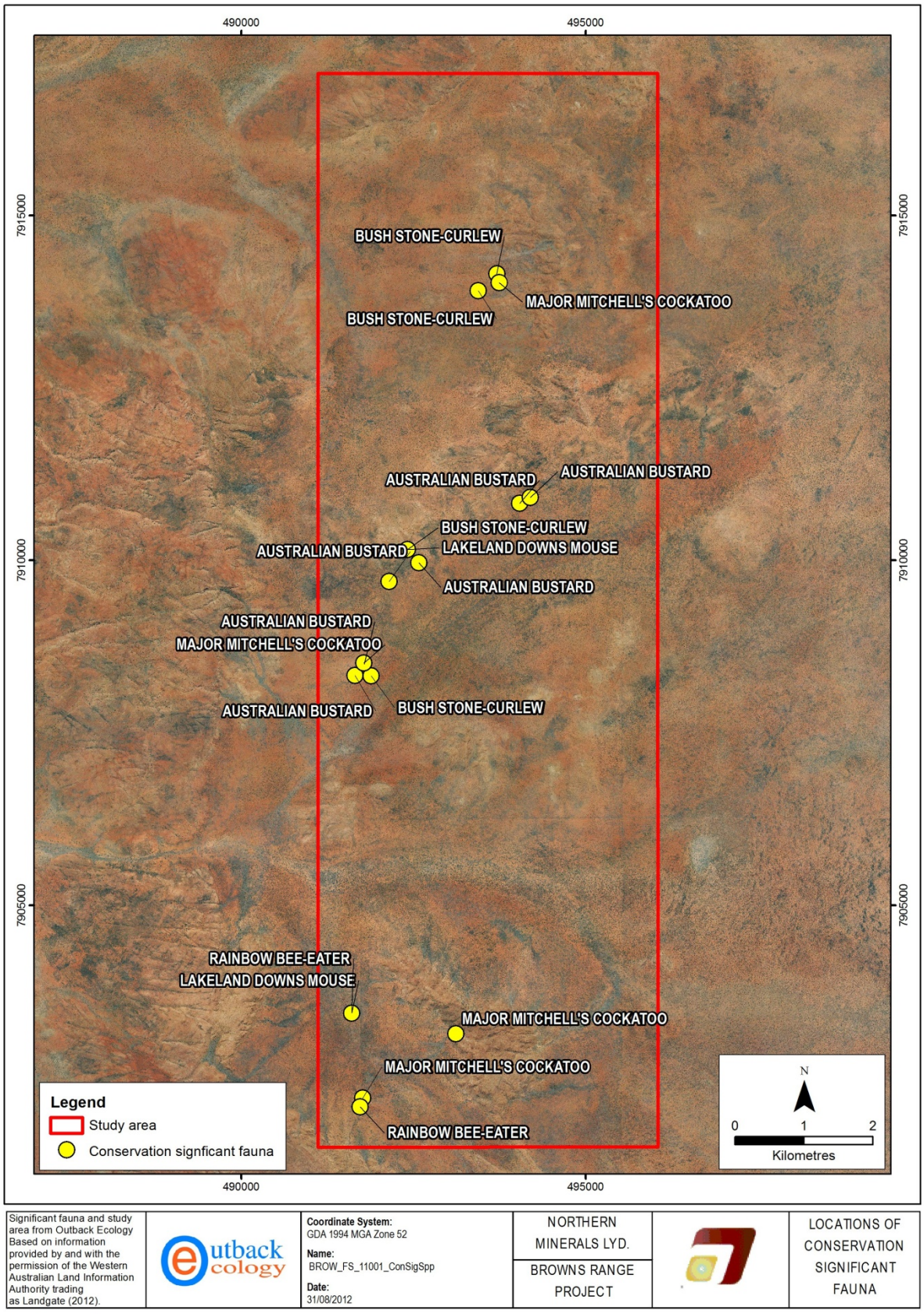

Figure 10: Location of fauna of conservation significance recorded near Browns Range

3.9. Terrestrial Short Range Endemic Invertebrate Fauna Assessment

A terrestrial short-range endemic (SRE) invertebrate fauna assessment was completed in 2012 (Outback Ecology 2013c) and follow up surveys were conducted between December 2012 and April 2013. A report on the results of investigations into the occurrence of short range endemic fauna completed as at April 2013 is provided in **Appendix C**.

Twenty-five identifiable species and morphospecies were recorded in and around the Proposal area during surveys in 2012. Based on current knowledge, 17 of these species were designated SRE species, as they are not known to have been recorded outside the study area. Two SRE Mygalomorph spider species, *Aganippe* 'MYG260' and *Aname* "MYG258', were collected from restricted habitats within the study area. The remaining 15 inferred SRE species were collected from habitats that occur widely in the region and are not considered to be restricted to the Project area. Accordingly, the provisional SRE status of these species may not represent a restricted distribution but rather an artefact of a lack of regional survey work (Outback Ecology 2013c).

An additional targeted survey for Mygalomorph spiders is currently being undertaken to search for the two restricted SRE species outside the potential impact areas; to further define the habitats where *Aganippe* 'MYG260' and *Aname* "MYG258' were collected; and to evaluate the occurrence of these habitats in the surrounding landscape, including internal drainage habitat occurring outside the Proposal area. Information from this targeted survey will be used to further assess the impact of the Proposal on these invertebrate species (Outback Ecology 2013c).

3.10. Subterranean Fauna Assessment

A preliminary baseline subterranean fauna (stygofauna and troglofauna) assessment of the Proposal area was completed in 2012/2013 (Outback Ecology 2013a). A total of six stygofauna species have been recorded for the Proposal area, including four Parabathynellidae species (all belonging to a new undescribed genus), one Bathynellidae species, and one Enchytraeidae species. Additional information on subterranean fauna studies completed to date is provided in **Appendix C**.

Genetic analysis of the stygofauna specimens collected in 2012 has demonstrated that two species (*Parabathynellidae* OES17 and *Enchytraeidae* OES17) possess a wide distribution across the Proposal area. Further investigation of the stygofauna assemblage is still required. Additional survey work is scheduled for completion in May, 2013.

A relatively extensive troglofauna survey program, involving the deployment of more than sixty litter traps over three survey rounds, collected no troglofauna from the Proposal area. These results indicate that the Proposal area does not support a troglofauna assemblage.

4. PROPOSAL DESCRIPTION

4.1. Project Summary

This Proposal is to mine and process HREE dominant xenotime mineralised ore from multiple open pits at the Browns Range site, approximately 160 km southeast of Halls Creek. The potential exists for underground mining beneath one or more of the open pits. The ore would be beneficiated and then treated in a hydrometallurgical plant to produce a high purity mixed rare earth oxide. Waste products from the mining operation and mineral processing operation would include waste rock and tailings. The waste rock would be stored in above ground waste landforms and the combined tailings would be deposited in a purpose-built, engineered TSF. Consideration would be given to placing waste rock and tailings into an integrated waste landform.

In addition to the mine, plant and waste storage facilities, the Project would involve the development and use of:

- a borefield for water supply;
- access and haul roads; and
- support infrastructure, including an accommodation village, workshops and laydown areas, offices, water management infrastructure (bunds, drains, storage ponds), telecommunications infrastructure and diesel power supply for the mine, plant and support facilities, and an extension of an existing exploration airstrip.

The project includes mine progressive rehabilitation and decommissioning, and closure works at cessation of mining.

4.2. Overview of Physical Elements

All disturbance areas for the Proposal will lie within a nominal 5,800 ha development envelope (Figure 3). Indicative disturbance areas for key project physical elements are summarised in Table 8 and Figure 11**.**

Table 8: Disturbance areas for key physical elements of the Browns Range Project*

Element	Proposed Maximum Extent (ha)
Mine pits (up to five)	100
Waste rock landforms	300
Tailings storage facility	110
Borrow pits	55
Process plants	25
Access / haul roads	200
Other linear infrastructure (power, water supply)	20
Accommodation village	20
ROM pad	10
Airstrip extension	15
Borefield	45
Evaporation ponds and/or water storage	25
Total	**925**

*Note: all disturbance lies within a nominal 5800 ha development envelope - refer **Figure 3.**

4.3. Operational Elements

The key operational elements of the Proposal are summarised in Table 9.

Table 9: Key operational elements for the Browns Range Project

Element	Location	Proposed production / use
Mining	Browns Range	Open cut potentially followed by underground.
Ore Processing	Browns Range	Up to 750,000 tpa
Mixed rare earth oxide product	Browns Range	Up to 4,000 tpa
Tailings generation		
From beneficiation	Browns Range	Up to 735,000 tpa
From hydrometallurgy	Browns Range	Up to 40,000 tpa
Mine dewatering	Browns Range	Currently under assessment
Water abstraction from borefield	Browns Range	~1.5 GLpa
Power generation	Browns Range	~6 MW
Product transport	Export from Wyndham or Darwin	~ 4 x 20 tonne shipping containers on 2 x B-double trucks per week.

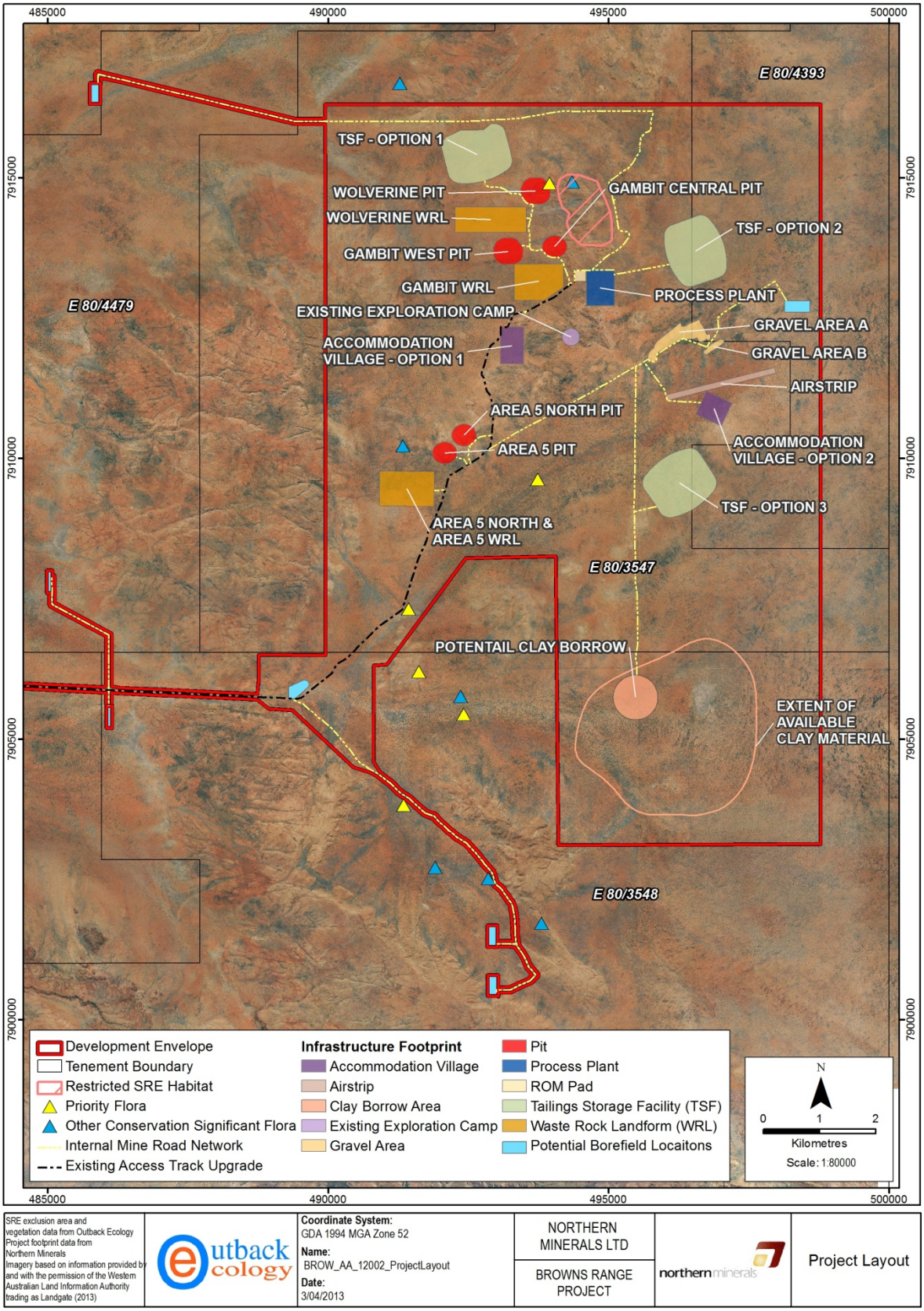

Figure 11: Indicative layout of the Browns Range Project

4.4. Mining and Mine Waste Storage

The targeted mineralised areas lie within the development envelope as indicated in (Figure 3). Exploration to date has discovered five prospective deposits and Northern Minerals proposes to mine these initially as a series of open pits, using conventional open cut methods to extract up to 750,000tpa of ore for a period of 10 years. Depending on the size, shape and grade of each deposit it is envisaged that underground mining techniques may be employed at some of the deposits once open pit mining becomes uneconomic. Depending on the open pit to underground crossover point, the strip ratio could be up to 25:1 over the life of mine. Non-mineralised waste rock would be stored as near as practicable to the mine pits (subject to safety considerations) to encourage efficient use of resources.

The ore contains low levels of uranium and thorium, averaging 26 ppm and 28 ppm for U_3O_8 and ThO_2, respectively, at the anticipated average feed grade to the process plant. The combined head of chain activity for the ore, the waste rock and the tailings will be less than 1 Bq/g and is consequently not defined as a "radioactive material".

4.5. Processing

The overall process for ore processing consists of three distinct steps: beneficiation, hydrometallurgical treatment and waste disposal. The preliminary beneficiation process will consist of:

- crushing and grinding to approximately 100 µm; and
- physical separation using a combination of magnetic separation and flotation.:

The beneficiation process is expected to produce approximately 15,000 tpa of mineral concentrate containing 20-30% total rare earth oxides (TREO). Tailings generated from the beneficiation plant would be deposited in a purpose-built, engineered TSF.

The proposed hydrometallurgical plant will further process the mineral concentrate and separate the rare earths from the thorium, uranium and other contaminants such as iron and aluminium to produce approximately 4,000 tpa of high purity mixed rare earth oxide. This final product would be exported overseas for subsequent separation into individual rare earth elements. The hydrometallurgical process will involve the following steps:

- Drying the concentrate;
- Mixing the concentrate with sulphuric acid;
- Baking at about 350°C to “crack” the mineral structure;
- Water leaching to bring the metals into solution;
- Neutralisation with limestone or magnesium hydroxide followed by ion exchange to purify the solutions from thorium and uranium, which are removed via the leach residue and purification residue;
- Precipitation of the rare earths using oxalic acid; and
- Conversion of the rare earth oxalates to oxides.

4.6. Process Wastes

4.6.1. Solid Wastes

Tailings generated from the beneficiation plant would be deposited in a purpose-built, engineered TSF. The hydrometallurgical plant is expected to produce the following solid waste:

- Leach residue from the water leach containing traces of sulphuric acid and the elements contained in the ore and leachate including uranium and thorium;
- Purification residue from the purification thickener filter containing iron, aluminium and most of the thorium hydroxides together with some uranium; and
- Waste water treatment plant residue containing gypsum and the remaining metals as hydroxides. This residue will have a pH of 9.

It is proposed to combine these three waste streams with the beneficiation plant tailings prior to deposition in the purpose-built TSF. The low activity of the combined tailings means that the combined tailings will not be classified as a "radioactive material".

4.6.2. Liquid Effluents

Liquid waste will be produced mainly from the oxalate precipitation circuit. The untreated liquid effluent from the oxalate precipitation circuit contains metals and oxalate in solution. The liquid waste will be treated in a waste water treatment facility by increasing the pH through the addition of lime to precipitate the metals as hydroxides. The effluent is expected to contain mainly dissolved oxalates.

Liquid effluents would be treated to remove metals and organic content, and then stored in lined evaporation ponds until evaporated. The remaining salts would be stored in lined ponds. Fully treated water is likely to be recycled, at least partially, in the process.

4.7. Emissions to Air

Emissions to air from the hydrometallurgical process are expected to include combustion gases and off-gases from the dryer, sulphation bake and calciner. Emissions released from the dryer will pass through a particulate scrubber before release. Potential emissions from the sulphation bake include sulphuric acid, sulphur trioxide, dust and traces of hydrochloric acid and fluorosilicic acid. These vapours will be scrubbed before release to atmosphere using a multi stage lime scrubber. The purification step will release carbon dioxide, which will be vented above the purification reactor as a wet gas. Emissions from the oxalate calciner include carbon dioxide, water vapour and dust which will be scrubbed before release to atmosphere (Tenova 2012a, b).

Emissions of radionuclides (in the form of radon and radionuclides in dust) during processing of the ore are expected to be negligible. Radionuclide concentrations in ore and tailings are below the definition for radioactive materials and therefore radioactive emissions in beneficiation would be controlled by standard dust controls, such as watering of stockpiles and good housekeeping procedures. Once the material is in slurry form, dusting is non-existent. Radionuclides concentrations are enhanced in the intermediate TREO concentrate at the end of beneficiation. At the commencement of hydrometallurgical treatment, the concentrate is to be dried, creating the potential

for dusting. Appropriate dust controls will be implemented ensure that particulate emissions are minimised.

The diesel-fired power supply for the mine and processing facilities, and mobile mining fleet will also be sources of emissions to air.

4.8. Dewatering and Water Supply

Studies for project water supply and dewatering design are at a relatively early stage. Planned hydrological and hydrogeological studies will inform both project design and the assessment of environmental impacts for the Proposal. The Project water demand is estimated to be approximately 1.5 GLpa. The Project water supply will comprise water from pit dewatering, water recycled from the TSF and make-up water from a water supply borefield.

4.9. Materials Transport

Transport of consumables, reagents and fuel will generate in the order of five B-double truck movements (or three triples) per day.

High purity mixed rare earth oxide product will be transported as packages in sea containers and backloaded on inbound supply trucks to either the Darwin or Wyndham port for export. The product is expected to contain less than 10ppm of both uranium and thorium, and is unlikely to be defined as a radioactive material. However, the fate of the thorium and uranium daughters in the hydrometallurgical process is not known in detail at his stage. These daughters could flow through into the final product, in which case the final product may be defined as a radioactive material. Further testwork and analysis are planned to determine the fate of the uranium and thorium daughters.

4.10. Exclusions from this Referral

Existing infrastructure, including access roads, drill pads and the current exploration camp do not form part of this assessment. In addition, an airstrip will be constructed to support exploration activities currently being conducted by Northern Minerals. The construction of this small airstrip will not form part of the referral, as the assessment of the proposed exploration airstrip will be carried out through permitting processes administered by the DMP pursuant to the *Mining Act* 1978. An extension of the airstrip to support operational scale mining will be required prior to the commencement of the Proposal as defined in the referral document. The extension of the airstrip will form part of the Proposal.

5. POTENTIAL IMPACTS

Three categories of environmental factors relevant to the Proposal have been identified: 'Preliminary key' factors have the potential to be significantly impacted by the Proposal; 'secondary' factors are not expected to be significantly impacted by the Proposal, but further studies are proposed to verify this expectation; 'other' factors are clearly unlikely to be significantly impacted by the Proposal, and therefore no additional studies are planned. Factors are detailed in Table 10.

Table 10: Environmental factors for the Browns Range Project

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Principles of Environmental Protection	To address each of the following principles (set out in section 4A of the *Environmental Protection Act 1986* (EP Act) and described in Position Statement No. 7): • the precautionary principle; • the principle of intergenerational equity; • the principle of the conservation of biological diversity and ecological integrity; • principles relating to improved valuation, pricing and incentive mechanisms; and • the principle of waste minimisation.	The Proposal has the potential to impact on the biodiversity values of the area and surrounding environment through the clearing of native vegetation, the removal of fauna habitat and modification to landforms.	Comprehensive baseline surveys of environmental aspects and ongoing monitoring will be implemented to adequately assess the impact of the Proposal on biodiversity values. The mine closure and rehabilitation plan for the Proposal will ensure that the condition of post-mining land is consistent with agreed future beneficial uses. Infrastructure footprints will be positioned and mining activities planned and managed to minimise impacts to biological diversity and ecological integrity. Waste minimisation principles will be reflected in the Proposal design and environmental management. Mine operations will be implemented in accordance with a comprehensive environmental management system.	The proposal is not at variance with the principles of environmental protection. **The Principles of Environmental Protection are variously considered other or secondary :** • The precautionary principle – considered an' other' factor due to biological surveys. • Intergenerational equity – secondary factor – addressed in closure requirements. • Biodiversity – preliminary key – addressed by other key or secondary factors. • Improving valuation, pricing and incentive mechanisms – other factor. • Waste minimisation – other factor.
BIOPHYSICAL				
Flora	To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	The proposal has the potential to impact on flora and vegetation communities through the following: • loss of biological diversity and reduced regional representation of flora and vegetation communities; • loss of conservation significant flora; • increased weed distribution; • loss or degradation of flora and vegetation due to dust deposition; • increase risk of fire; • increase movement of people and vehicles resulting in damage to native flora via off road travelling; • altered drainage patterns resulting in loss or alteration to vegetation communities and conservation significant flora; and • impacts from altered groundwater levels on groundwater dependent ecosystems.	Management actions to minimise impacts to flora and vegetation communities will include as a minimum: • clearing for infrastructure and operations will be kept to the minimum required for safe and efficient operations; • vehicle movements will be restricted to designated roads and speed limits will be regulated to minimise dust; • implementation of progressive rehabilitation and clearing protocols; • water supply strategy to be designed so as to limit adverse effects on water-dependent ecosystems; and • infrastructure to be designed and located so as to minimise changes to pre-development surface water flow regimes.	An initial flora and vegetation survey has indicated that while there are flora species of conservation significance in the Proposal area, these exist in large populations. These populations are well represented outside the Proposal area, as are the vegetation communities observed to date. There have been no protected ecological communities observed within the Proposal area. The proposed area of clearing is considered small in comparison to the extent of the vegetation communities. There are few or no other similar proposals in the vicinity. Further survey will increase the level of certainty in predicting impacts. It is considered likely that if appropriate management methods, including those listed here are implemented, then the impacts to flora and vegetation will not be significant. Further, existing statutory decision making processes (e.g. under the *Mining Act 1978* and the EP Act) exist to regulate impacts from clearing on this scale. **Impacts on flora and vegetation communities are considered a 'secondary' factor.**

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Fauna – Terrestrial Vertebrate Fauna	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	The Proposal has the potential for: • the direct clearance or disturbance of fauna habitat areas; • reductions in the connectivity of fauna populations; • increased risk of fauna mortality from vehicle strikes; • impacts to conservation significant species via clearing and secondary impacts to fauna habitat; • effect on fauna from noise emissions during construction and operations; and • potential to increase populations of introduced species and predation on indigenous fauna species.	Management actions to minimise impacts to fauna will include as a minimum: • limiting of clearing of native vegetation to minimum requirements; • training of relevant employees including fauna awareness and procedures to manage impacted fauna if required within site induction; • speed limits established along roads and tracks to minimise fauna deaths; • a schedule and register of fauna monitoring events; and • maintenance of a register of fauna mortalities.	It is possible that up to 11 conservation significant vertebrate fauna species may occur in the Proposal area. However, all vertebrate fauna habitat types observed thus far are well represented outside of the Proposal area. No observed habitat types are considered regionally significant and none were found to contain an exceptional diversity of vertebrate fauna. The life of the project (10 years) is considered short in relation to vertebrate population processes. Potential impacts from the Proposal will be able to be managed (including using methods described here) to prevent significant impacts to fauna. There are few or no other similar proposals in the vicinity. **Terrestrial vertebrate fauna is considered an 'other' factor.**
Fauna – Short-range Endemic Terrestrial Invertebrate	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	The Proposal has the potential for • the direct clearance or disturbance of fauna habitat areas; • reductions in the connectivity of fauna populations, and/or isolation of local habitats, especially in regards to terrestrial SRE invertebrate species; • impacts to conservation significant species via clearing of fauna habitat.	Management actions to minimise impacts to fauna will include as a minimum: • siting of infrastructure to avoid direct disturbance to, or fragmentation of, restricted habitats required by SREs; • limiting of clearing of native vegetation to minimum requirements; • habitat known to support SRE species will be avoided where practicable; and • restricted habitat supporting SRE species (i.e. the 'internal drainage' habitat type) will not be cleared.	Two habitat types with medium or high potential to support SRE species were observed close to the Proposal area. Given the close proximity of potential disturbance areas to restricted habitat area, **short range endemic terrestrial fauna is considered a 'preliminary key' factor.**
Fauna – Subterranean Fauna	To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	The Proposal has the potential to impact on stygofauna values by: • direct disturbance to stygofauna habitat (e.g. mining and dewatering activities); • contamination of groundwater due to spillages of hydrocarbons and hazardous materials; and • alterations to groundwater tables (ie.g. via drawdown from groundwater abstraction. Extensive survey effort found no evidence of troglofauna assemblages in the Proposal area.	Management actions to minimise impacts to fauna will include as a minimum: • monitoring of groundwater levels around mining activities and water supply areas; and • regular inspections of hazardous goods storage areas, workshops and pipelines and implementation of appropriate clean up measures if required.	Preliminary evidence indicates that stygofauna habitat extends at least five kilometres beyond the proposed area of impact. The potential for significant impact to subterranean fauna is considered low and further surveys will increase the level of confidence in predicting impacts. There are few or no other similar proposals in the vicinity. There is unlikely to be a significant level of public concern. **Stygofauna is considered a 'secondary' factor. Troglofauna is considered an 'other' factor.**

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Land (terrestrial)	To maintain the integrity, ecological function and environmental values of the soil and landforms.	The Proposal has the potential to permanently modify the landscape and increase erosion and sedimentation, resulting in habitat loss.	Suitable material will be identified and strategically placed for construction and rehabilitation purposes. Topsoil stockpiles will be re-seeded as soon as practicable, to help minimise loss of topsoil through dispersion and erosion. Rehabilitation of disturbed land will be carried out progressively. Waste rock landforms (WRL) and tailings storage facilities will be designed and constructed to ensure they are compatible with surrounding landforms, as far as practicable.	It is considered likely that if appropriate management methods, including those listed here, are implemented then the impacts to the integrity, ecological function and environmental values of soil and landforms will not be significant. Assessments of soil and vegetation along with closure planning will provide adequate confidence to predict impacts. Statutory decision making processes (under the *Mining Act* 1978) exist to regulate rehabilitation. There are few or no other similar proposals in the vicinity. Impacts to land and management of those impacts will be considered under 'Mine Closure and Rehabilitation' (see below), which is considered a preliminary key environmental factor.
Conservation Areas	To protect the environmental values of areas identified as having significant environmental attributes.	DEC-managed lands closest to the proposal include the Ord River Regeneration Reserve, located approximately 100 km northwest of the proposal and the Wolfe Creek Meteorite Crater National Park, located approximately 120 km to the west-southwest. The closest Aboriginal reserves are Kundjat Djaru (Ringer Soak), located 40 km northwest of the proposal area, and the Northern Tanami Indigenous Protected Area, approximately 50 km east in the Northern Territory. The closest proposed protected area is Gardiner Range proposed conservation area located south and west of the Proposal. The proposed upgrade of the existing access track to Browns Range will occur within the northern part of the proposed Gardiner Range conservation area (Figure 2).	Management actions to minimise impacts to conservation areas will include as minimum: • management strategies to be implemented to reduce occurrence of exotic plants and feral animals; • implement a fire prevention strategy; • restriction on vehicles to designated roads and regulation of speed limits, and • clearing for the upgrade of the existing access road through the proposed Gardiner Range proposed conservation area will be kept to a minimum required for safe operations.	Given the distance to the nearest conservation areas from the proposal, the potential impacts are not likely to be significant. There are few or no other similar proposals in the vicinity. It is considered likely that if standard management methods are implemented, then the potential for significant impacts arising from the upgrading of the existing access track though the proposed Gardiner Range proposed conservation area will be low. **Impacts to conservation areas is considered a 'other' factor**
POLLUTION MANAGEMENT				
Air Quality	To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land use by meeting statutory requirements and acceptable standards.	The sensitive receptors for this factor will be on-site personnel. The Proposal has the potential to adversely affect air quality through the creation of dust via • wind erosion from stockpiles, TSF and WRLs; • land clearing and construction activities; • blasting, handling and haulage/conveying of ore and overburden; • crushing and grinding at the process plant; • exhaust emissions from vehicles, machinery and	Dust management measures will be implemented to minimise uplift of dust during mining activities and from the TSF. Monitoring and reporting measures will be implemented throughout the life of the Proposal. The rehabilitation of cleared areas will be undertaken progressively to minimise exposed soil, where ever possible. Review and continuous improvement programmes will be	It is considered likely that if appropriate management methods, including those listed here, are implemented then the impacts to air quality will not be significant. Air quality monitoring and assessment are being undertaken and will provide an adequate level of confidence in predicting impacts. Statutory processes (eg. *Mining Act 1978*, *Mines Safety and Inspection Act 1994*) exist to regulate air quality in the workplace. Potential impacts of air emissions associated with ore

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
		processing infrastructure; • wheel-generated dust from traffic movements.	implemented	processing and other project elements requiring a works approval and licence would be assessed through Part V of the EP Act. Secondary impacts (e.g. mobilisation of radionuclides within dust) will be considered through radiation management and mine closure and rehabilitation, both of which are considered see below. **Air quality is considered a 'secondary' factor.**
Surface Water (Quality and Quantity)	To maintain the quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.	The Proposal has the potential to result in adverse impacts to surface water quality and quantity through: • seepage and/or erosion of contaminants from the TSF and WRLs; • leaks and spills during operations resulting in contamination of surface water; • the formation of permanent pit lakes at cessation of mining; • changes to the surface water flow regimes; and • modification to sediment transport, erosion and deposition patterns.	Surface water diversion bunding will be designed and constructed to control and divert surface water within and around mining domains, whilst minimising potential impact to natural surface water flows. WRLs and TSFs will be engineered to minimise erosion and prevent seepage or runoff of contaminated water. Hydrocarbon and dangerous goods storage and handling procedures will be implemented to minimise contamination of surface water.	In view of the current state of knowledge concerning surface water systems in the Project area, Northern Minerals has adopted a precautionary approach and nominated potential impacts on surface water quality and/or surface hydrology as a "preliminary key factor". **Surface water quality and quantity is considered a 'preliminary key' factor**.
Groundwater (Quality and Quantity)	To maintain the quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.	The Proposal has the potential to result in adverse impact to groundwater quality and quantity through • seepage of contaminants from the TSF and WRLs; • leaks and spills during operations resulting in contamination of groundwater; • the formation of permanent pit lakes at cessation of mining; and • alterations to the groundwater table (i.e. via drawdown from groundwater abstraction).	A groundwater monitoring programme will be established to monitor volumes of water abstraction and monitor groundwater quality. Hydrocarbon and dangerous goods storage and handling procedures will be implemented to minimise contamination of groundwater.	In view of the current state of knowledge concerning groundwater systems in the Project area, Northern Minerals has adopted a precautionary approach and nominated potential impacts on groundwater quality and/or geohydrology as a "preliminary key factor". **Groundwater quality and quantity is considered a 'preliminary key' factor.**

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Soil Quality	To ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria.	The Proposal has the potential to permanently modify the landscape and result in loss of soil quality, through increased soil erosion and sedimentation.	Suitable materials will be identified and strategically placed for construction and rehabilitation purposes. Topsoil stockpiles will be reseeded as soon as practical, to minimise loss of topsoil through dispersion and erosion. Rehabilitation of disturbed land will be carried out progressively	It is considered likely that if standard management methods, including those listed here, are implemented then the impacts to soil quality will not be significant. Assessments of soil along with closure planning will provide adequate confidence to predict impacts. Statutory decision making processes (under the *Mining Act 1978*) exist to regulate rehabilitation. There are few or no other similar proposals in the vicinity. Impacts to soil quality and management of those impacts will be considered under 'Mine Closure and Rehabilitation' (see below), which is considered a preliminary key environmental factor.
Noise	To protect the amenity of nearby residents from noise impacts resulting from activities associated with the Proposal by ensuring the noise level meet statutory requirements and acceptable standards.	The Proposal has low potential to impact on noise sensitive premises (mine accommodation village and Ringer Soak) and to disturb to fauna as a result of the following activities: • movement of vehicles and mobile equipment; • operation of an airstrip to transport personnel; • blasting, crushing and screening operations; and • transport of ore, reagents, fuels, other consumables.	Appropriate location of infrastructure and installation of noise mitigation measures to minimise potential noise emissions on sensitive receptors. Construction works to be carried out in accordance with relevant legislation and standards.	Noise will not create any significant impacts and will be managed through standard management practices. There are no similar operations in the vicinity nor any planned. Noise generated by the Proposal will comply with statutory noise and safety regulations. **Noise is considered an 'other' factor.**
Radiation	To ensure that radiological impacts to the public and the environment are kept as low as reasonably achievable and comply with acceptable standards.	The Proposal has the potential to release radioactive emissions to the air during processing and to groundwater as part of seepage from the tailings system.	Development and implementation of a design controls and an appropriate Radiation Management Plan (RPM) and Radioactive Waste Management Plan (RWMP) that will take into account: • potential worker and public exposures, • management of waste rock landforms, • tailings management, • management of dust emissions that may contain radioactive materials.	The ore, waste rock and tailings arising from the Proposal are not defined as radioactive, and it is considered likely that with good design and standard management methods that radiological impacts will not be significant. **Radiation management is considered a 'secondary' factor.**
Light	To avoid or manage potential impacts from light overspill and comply with acceptable standards.	The Proposal has low potential to impact local sensitive receptors (mine accommodation village, local fauna)	Appropriate location of infrastructure to minimise light emissions on sensitive receptors and installation of light to Australian Standards.	Lighting from the Proposal is not expected to result in significant impacts to sensitive environmental receptors or the visual amenity of local communities. There are no light-emitting operations nearby. Levels of light from the Project and the fauna in the area will be well understood and there will be a high level of confidence in any impact assessment. Lighting will conform to relevant guidelines and legislation. **Light is considered an 'other' factor.**

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Greenhouse Gases	To minimise emissions to levels as low as practicable on an ongoing basis and consider offsets to further reduce cumulative emissions.	The Proposal includes processing of up to 750,000 tpa of ore to produce 4,000 tpa of mixed rare earth oxide. Further engineering investigation will be undertaken to quantify the volume of emissions to be expected.	Completion of air quality and baseline emission assessment, and establishment of GHG emission targets will be undertaken. Development of operational monitoring programme for both air quality monitoring and GHG emissions.	The power demand for the project is modest (6MW) and accordingly, the total GHG emissions are not considered a significant impact on a regional scale. There are few or no other proposals in the area. There is a high level of confidence in any impact assessment as the emissions from the proposed operations are well understood. There are existing guidelines and a legislative framework (eg. *National Greenhouse and Energy Reporting Act 2007* (Cwth)). **Greenhouse gases are considered an 'other' factor.**
SOCIAL SURROUNDINGS				
Heritage	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	The Proposal has the potential to impact on cultural heritage aspects via the disturbance of archaeological and ethnographic site and artefacts and preventing access of traditional owners to the sites of cultural heritage significance.	Indigenous stakeholders will be actively engaged during planning, construction and rehabilitation phases of the Proposal to ensure that cultural values of the land in or near the Proposal are not adversely affected.	It is considered likely that if standard management methods, including continuous liaison, are implemented then impacts to Aboriginal heritage will not be significant. However, given the proximity of the Proposal to Indigenous land and communities, the impact of the proposal on Aboriginal heritage is expected to be of community interest. **Aboriginal cultural value is considered a 'secondary' factor.**
Visual Amenity	To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.	The Proposal has the potential to impact on the visual amenities of a relatively undeveloped and remote area through poor management and rehabilitation of disturbed areas, however, the area is rarely visited and there are few sensitive receptors for visual amenity.	Progressive rehabilitation will be implemented to ensure that disturbed areas are returned to stable landforms and minimise visual impacts.	It is considered likely that if standard management methods, including those listed here, are implemented then impacts to visual amenity will not be significant. Mine closure planning will provide adequate confidence to predict impacts. Statutory decision making processes (under the Mining Act 1978) exist to regulate closure, landform design and rehabilitation, including visual amenity. Impacts to visual amenity and management of those impacts will be considered under 'Mine Closure and Rehabilitation' (see below), which is considered a preliminary key environmental factor.
Recreation	To ensure that existing and planned recreational uses are not compromised.	The area in which the Proposal is located is not currently used for recreational purposes	Progressive rehabilitation and best practices management programmes will be implemented to ensure that disturbed areas are returned to stable landforms and prevent loss of potential future recreational value of the land.	The Proposal is not expected to have a significant impact on the recreational value of the area. **Recreation is considered an 'other' factor**.

Environmental Factor	EPA Objective	Potential Environmental Impacts of Proposal	Preliminary Management and Mitigation Actions	Assessment of Significance
Mine Closure and Rehabilitation	To ensure, as far as practicable, that rehabilitation achieves a stable and functioning landform which is consistent with surrounding landscapes and other environmental values.	Inadequate mine rehabilitation and closure practices would have the potential to result in legacy issues which could adversely affect the environment.	A Mine Closure Plan will be developed in accordance with the Department of Mines and Petroleum's *Guidelines for Preparing Mine Closure Plans* (DMP 2011), with the aim of minimising impacts of early closure, poor decommissioning or failure of rehabilitation actions implemented as part of the Proposal.	It is considered likely that if standard management methods, including the preparation and implementation of a Mine Closure Plan are implemented then the post-mining landforms will be stable, functioning and consistent with surrounding landscapes. Given the location of the Proposal, the relatively undisturbed surrounding environment and proximity to Indigenous communities and lands, **mine closure and rehabilitation is considered a 'preliminary key' factor**.

5.1. Preliminary Key Factors

On the basis of information currently available, Northern Minerals has identified three preliminary key factors as being of potential significance for the Proposal. They are:

- Impacts to short range endemic fauna and the habitats that support them
- Management of surface water and groundwater
- Mine rehabilitation and closure

Management of each of the three preliminary key factors is discussed below.

5.1.1. Short-Range Endemic Terrestrial Invertebrate Fauna

5.1.1.1. Aspects and Impacts

Two habitat types with medium or high potential to support SRE terrestrial invertebrate fauna species have been observed close to the Proposal area. There is a potential for direct and indirect impact to fauna habitat significant for the maintenance of SRE terrestrial invertebrate fauna. The main aspect which could give rise to impacts on SRE habitat is direct clearing. On the basis of current knowledge, it appears unlikely that mining would occur in the areas where SRE habitat of restricted occurrence is present, however there is potential for other disturbance (for example, for development of waste rock dumps or linear infrastructure) to affect these areas. Alteration to surface hydrology could, in theory, result in adverse impacts to vegetation in these areas, which could in turn affect SRE populations.

5.1.1.2. Proposed Management

Habitat known to support SRE terrestrial invertebrate fauna species will be avoided where practicable. In the event that habitat known to support terrestrial invertebrates is not avoidable and will be impacted directly or indirectly, the following management actions are proposed:

- where SRE species are only known from habitat which is likely to be restricted to the Proposal area, maintain an appropriate disturbance buffer around these sites until the species has been demonstrated to not be thus restricted;
- define and mark clearing boundaries in the field (by Northern Minerals environmental personnel or suitable representatives);
- adopt designs to minimise and mitigate alterations to the surface hydrology in habitats with the potential to support SRE species;
- in the event that potential SRE habitat is bisected by road or pipelines, establish culverts within close proximity to where the SREs have been identified to facilitate dispersal of species (e.g. wandering male mygalomorph spiders and male scorpions); and
- implement a fire prevention strategy which will include all vehicles being fitted with fire extinguishers and all personnel trained in their use.

5.1.1.3. Expected Residual Impacts

The outer limit of the Wolverine pit will be located approximately 300 metres to the west of the restricted internal drainage habitats in which the SRE species *Aganippe* ‘MYG260’ and *Aname*

'MYG258' were recorded (Outback Ecology 2013c). Internal drainage that recharges this restricted habitat area will not likely be altered by the positioning of the Wolverine pit and will not result in secondary impacts to this habitat area or its ability to recharge.

The Wolverine pit will require the clearing of approximately 10 ha of the 'seasonal drainage surface' habitat. The SRE species *Aname* 'MYG258' was identified in this restricted habitat type. Clearing for the Wolverine pit would remove approximately 10% of the total 'seasonal drainage surface' habitat area known within the Proposal area (Outback Ecology 2013c). An additional targeted survey for Mygalomorph spiders is currently being undertaken to search for occurrences of *Aganippe* 'MYG260' and *Aname* "MYG258' outside the potential impact areas; to further define the habitats where these two restricted SRE species were collected; and to evaluate the occurrence of these habitats in the surrounding landscape, including internal drainage habitat occurring outside the Proposal area. Information from this targeted survey will be used to further assess the impact of the Proposal on these SRE species (Outback Ecology 2013c).

It is considered that the implementation of the above management measure and additional targeted surveys for Mygalomorph spiders will help to minimise the effect of the Proposal on SRE terrestrial invertebrate fauna species and that any direct or indirect impact can be managed or mitigated appropriately.

5.1.2. Surface water and groundwater

5.1.2.1. Aspects and Impacts

The following Project aspects have the potential to affect the quality of surface water or groundwater:

- Storage and use of waste rock and tailings.
- Fuel and reagent spills.
- Dewatering of mine workings.
- Abstraction of water for project water supply.
- Development of permanent pit lakes in mined out voids.
- Construction and use of evaporation ponds.

As the proposed mining and mineral processing operation is located near a surface water divide, and is not expected to intercept flows from large upstream catchments, the likelihood of significant impacts on surface water flows is low. There are no permanent watercourses or surface water bodies in the Project area. Similarly, it is not expected that the abstraction of up to 1.5 GLpa of groundwater will significantly affect environmental systems, including the culturally significant Banana Springs, located approximately 15 km to the west of the proposed Area 5 operations area. There are no known users of groundwater in the area. Notwithstanding this, Northern Minerals acknowledges that the following proposed activities could alter surface water flows and/or groundwater levels:

- Construction of waste landforms, tailing storage facilities, linear infrastructure and other structures (such as drainage works or flood protection bunds) that could change flow

quantities, flow directions or flow rates.

- Dewatering of mine workings.
- Abstraction of water for project water supply.

5.1.2.2. Proposed Management

The following management actions will be implemented during construction and operational activities to protect surface and groundwater quality:

- Project infrastructure will be sited and designed to avoid existing drainage lines where possible. Where impacts to drainage lines are unavoidable, diversion drains and bunding will be constructed to divert nature surface water flow around the Project area;
- The tailings disposal facility and any evaporation ponds will be designed,constructed and operated so as to minimise the potential for seepage;
- Construction will be carried out during dry periods, where possible;
- All fuel and chemicals will be stored in accordance with dangerous goods legislation and licence requirements;
- Potentially contaminated water run-off from the workshop areas and washdown facilities will be directed to a non-discharging sump that is fitted with an oil separator and gross pollutant trap;
- Regular inspections (visual observation of spills and leaks) of fuel and reagent storage areas, workshops and tailings pipelines will occur. If spills or leaks are observed, remediation actions will be implemented and measures will be put in place to reduce the potential of reoccurrence;
- Tailings pipelines will be buried or bunded to capture any spills or leaks;
- Waste rock landforms will be designed to limit erosion. During the operating life of the mine, runoff from waste landforms and other disturbed areas will be directed to appropriately sized detention basins to limit migration of sediment in runoff;
- Inspections of mine site infrastructure and surrounding areas will be carried out after significant rainfall to identify any pooling or damage done as a result of surface flows;
- Groundwater monitoring bores and production bores will be established in consultation with the Department of Water, Department of Mines and Petroleum and Department of Environment and Conservation; and
- Water quality monitoring will be implemented in accordance with any Department of Water and Department of Environment and Conservation licence requirements.

The following actions will be implemented to avoid, manage or mitigate potential adverse effects arising from changes to surface or groundwater hydrology:

- Infrastructure will be designed and located so as to minimise impacts on existing flow regimes, both during the active life of the mine and in the post-closure period;
- Ecological water requirements, including the needs of water dependent biota, will be taken into account when developing the project water supply strategy;
- Efficient use of water will be explicitly considered when developing the project water supply strategy;
- Access and haul roads will be constructed with floodways, culverts and spur drains to direct surface flow;
- Monitoring of groundwater levels around mining activities will be undertaken to assess the progress of dewatering and pit wall stability; and
- Monitoring of groundwater levels around the borefield for water supply will be undertaken; Groundwater dependent vegetation in proximity to predicted groundwater drawdown cones from pit dewatering or other water abstraction activities will be monitored regularly during dewatering activities.

5.1.2.3. Expected Residual Impacts

It is considered likely that if proper design and standard management methods, including those listed above, are implemented then the impacts to surface and groundwater quality and quantity from the Proposal will not be significant.

5.1.3. Mine Closure and Rehabilitation

5.1.3.1. Aspects and Impacts

Implementation of the Browns Range Proposal would result in the creation of permanent waste rock landforms, pit voids (potentially with permanent pit lakes) and permanent above-ground tailings storage facilities. The Project would also give rise to land disturbance associated with infrastructure and support facilities that would be removed at mine closure. Accordingly, the Proposal would have potential to result in impacts to the environment and to future land users.

The Proposal has the potential to reduce soil quality through contamination or increased erosion and sedimentation rates. The Proposal also has the potential to impact public safety and/or visual amenity of a relatively undeveloped and remote area.

5.1.3.2. Proposed Management

Northern Minerals will develop and implement a Mine Closure Plan in accordance with the Department of Mines and Petroleum's *Guidelines for Preparing Mine Closure Plans* (DMP 2011), with the aim of minimising impact of early closure, poor decommissioning or failure of rehabilitation actions implemented as part of the Proposal.

Northern Minerals will ensure that disturbed areas will be progressively rehabilitated to minimise impact to the surrounding environment and ensure that disturbed areas are returned to a stable landform and minimise visual impacts. Suitable rehabilitation material will be identified and

strategically placed for construction and rehabilitation purposes. Topsoil stockpiles will be re-seeded as soon as practicable to help minimise loss of topsoil through dispersion and erosion.

Waste rock landforms and the TSF will be designed and constructed to ensure they are safe, geotechnically and erosionally stable, and provide appropriate containment of materials which require special management to prevent their release into the environment. To the extent practicable, permanent landforms will be designed to blend with the surrounding natural landscape.

5.1.3.3. Expected Residual Impacts

It is considered likely that if standard management methods are implemented, including continuing engagement with key stakeholders and the implementation of a Mine Closure Plan developed in consultation with stakeholders, then mine closure can be effected so as to meet agreed post-mining land use requirements.

5.2. Secondary Environmental Factors

This section identifies the aspects that are not expected to be significantly impacted by the Proposal but for which further studies are planned to verify this expectation. Management of each of the five secondary factors is discussed below.

5.2.1. Flora and Vegetation

5.2.1.1. Aspects and Impacts

Implementation of the Browns Range Proposal could result in clearing of up to 925 ha of native vegetation. Direct clearing and alteration of drainage patterns and groundwater levels have the potential to modify vegetation communities and to adversely affect any groundwater dependent ecosystems. Increased traffic movements in the Project area have the potential to increase weed distribution and to cause localised impacts on vegetation as a result of increase dust deposition in proximity to unsealed roads. Increase traffic movements and some operational activities (hot work) have the potential to increase fire risk during construction and operation of the mine.

5.2.1.2. Proposed Management

Management actions to minimise impacts to flora and vegetation communities will include as a minimum:

- clearing for infrastructure and operations kept to the minimum required for safe operations;
- dust suppression measures on unsealed surfaces, including access roads, haul roads and tailing storage facilities;
- development and implementation of programmes to monitor vegetation health and weed occurrence;
- training and site inductions to explain the importance of minimising vegetation clearing and use of correct dust suppression techniques to minimise impact of water spray;
- restriction of vehicles to designated roads and regulation of speed limits; and
- implementation of progressive rehabilitation.

5.2.1.3. Expected Residual Impacts

An initial flora and vegetation survey has indicated that while there are flora species of conservation significance in the Proposal area, these exist in large populations. These populations are well represented outside of the Proposal disturbance area, as are the vegetation communities observed to date. No protected ecological communities have been identified within the Proposal area. The proposed area of clearing is considered small in comparison to the extent of the vegetation communities.

A second flora and vegetation survey is due to be completed in May 2013 for the Proposal area to further define the occurrence of any conservation significant species and communities. This will be followed by a detailed impact assessment of the Proposal on the flora and vegetation in the Proposal area and surrounding environment.

It is considered likely that if appropriate management methods, including those listed above, are implemented then the impacts to flora and vegetation will not be significant.

5.2.2. Subterranean Fauna

5.2.2.1. Potential impacts

The main project activities which have the potential to affect stygofauna are the removal of habitat during mining of the Browns Range orebodies and reduction in subsurface habitat as a result of groundwater abstraction during pit dewatering and also as a result of water abstraction from the proposed borefield. Other aspects of the Proposal which could affect subsurface habitats include alterations to groundwater quality, arising from spillage of fuels or reagents or seepage of contaminated water from tailings storage facilities or other waste storages, including water evaporation ponds.

5.2.2.2. Proposed Management

The following management measures will be implemented to minimise impacts to stygofauna during construction and operational activities:

- minimising direct and indirect disturbance to habitat that supports stygofauna species during mining activities; and
- monitoring of groundwater levels around mining activities and water supply abstraction will be undertaken to assess the progress of dewatering and impacts on stygofauna habitat as per Section 5.1.2.

Further assessment of potential impacts of project implementation on the stygofauna assemblage will be carried out following the analysis of results from field survey work carried out at Browns Range in April 2013.

5.2.2.3. Expected Residual Impacts

Preliminary evidence indicates that stygofauna habitat is contiguous at least five kilometres beyond the proposed area of impact. There are few or no other similar proposals in the vicinity. The potential for significant impact to subterranean fauna is considered low and further survey will increase the level of confidence in predicting impacts.

5.2.3. Air Quality

5.2.3.1. Aspects and Impacts

The project aspects which have the potential to impact air quality include:

- Land clearing.
- Handling, transport and stockpiling of overburden, ore and waste rock.
- Crushing/ grinding of ore.
- Burning of diesel fuel to generate power.
- Heating and/or drying of ore to extract minerals.

- Above ground storage of tailings.
- General movement of light vehicles and mining machinery on unsealed roads.

These activities are commonly associated with:

- Increased levels of airborne dust.
- Increased levels of deposited dust.
- Emissions of “priority pollutants”, including sulphur dioxide and nitrogen oxides.
- Emissions of carbon dioxide.

The potential impacts of increased dust and/or emissions of priority pollutants include:

- Impacts on human health.
- Reduced amenity (haze, nuisance dust).
- Smothering of vegetation by dust.
- Contamination of the land surface by minerals, salts or radionuclides contained in dust.

5.2.3.2. Proposed Management

As a minimum, the following management controls will be implemented to avoid or mitigate potential adverse impacts on air quality:

- Progressive clearing and rehabilitation, to limit the areas of exposed surface at any given time;
- Materials handling and stockpiling systems to be designed and operated to limit fugitive dust emissions;
- Water suppression and enforcement of speed limits to minimise wheel-generated dust on access and haul roads;
- Gases from the dryer and emissions from the sulphation bake and oxalate calciner will pass through appropriately designed scrubbers before release to atmosphere. All pollution control plant will be commissioned and operated in accordance with DEC works approvals and licences;
- Permanent landforms, including waste rock dumps and tailings storage facilities will be designed and rehabilitated so as to as to limit wind erosion;
- Annual estimates of greenhouse gas emissions and other airborne pollutants (NPI) will be prepared and reported in accordance with State or Commonwealth reporting requirements; and
- Results of ambient air quality monitoring and emissions monitoring will be reviewed regularly to assess the effectiveness of air quality management practices.

5.2.3.3. Expected Residual Impacts

Providing the management controls outlined above are implemented consistently, no significant adverse effects on air quality are likely to arise from the implementation of the Browns Range Proposal.

5.2.4. Radiation Management

5.2.4.1. Aspects and Impacts

The Proposal will produce ore, waste rock and tailings that contain naturally elevated levels of radionuclides, although at concentrations less than the definition for a radioactive material. There is a potential for radioactive contaminants to be released to the surrounding environment via dust emissions, erosion or seepage from waste rock landforms and the tailings facility; or from accidental release of in-process materials from the process plant or hydrometallurgical plant. These could impact air, soil, groundwater or surface water quality.

5.2.4.2. Proposed Management

Northern Minerals will include radiological control considerations in design and develop an appropriate Radiation Management Plan (RMP) and Radioactive Waste Management Plan (RWMP) for construction and operational activities that will include the management of radioactivity in the processing facilities, waste rock landforms and the TSF.

5.2.4.3. Expected Residual Impacts

It is considered likely that the impacts of radiation will not be significant, and proactive design considerations and the implementation of the RMP and RWMP will reinforce this conclusion.

5.2.5. Aboriginal Cultural Values

5.2.5.1. Aspects and Impacts

The Proposal has the potential to impact on cultural heritage aspects via the disturbance of archaeological and ethnographic site and artefacts and constraining access of Traditional Owners, the Jaru People, to areas that may currently be used for hunting, ceremony or other customary uses.

5.2.5.2. Proposed Management

Through early stakeholder engagement, Northern Minerals has developed a good working relationship with the Traditional Owners, the Jaru People. In conjunction with the Traditional Owners, Northern Minerals has undertaken archaeological and ethnographic heritage surveys for various areas within the Proposal area. A number of Aboriginal heritage sites have been identified within the Browns Range exploration tenements. At the date of this referral, Northern Minerals has no expectation that any known site will be disturbed by the Proposal. However, the entire project area has not yet been comprehensively surveyed. Northern Minerals will continue consultation with the Jaru People and will conduct further archaeological and ethnographic assessments of possible project impacts on Aboriginal sites and other aspects of the area which are important to the Jaru People.

Northern Minerals will ensure that Aboriginal heritage is managed in accordance with all relevant legislation and guidance statements throughout the life of the Project.

Cultural awareness training and site inductions will be provided to all mine site personnel and contractors that are involved in ground disturbing activities, detailing the importance of respecting cultural heritage and reporting any of potential or newly discovered heritage sites.

5.2.5.3. Expected Residual Impacts

Northern Minerals intends to continue to develop and foster this relationship with the Jaru People through continuous engagement and identification of possible opportunities to design project infrastructure footprints to alleviate impacts to Aboriginal cultural heritage.

It is considered likely that through the implementation of standard management methods, including continuous liaison, then impacts to Aboriginal cultural heritage will not be significant.

6. EPA PRINCIPLES

The EPA has identified a series of principles for environmental management. Northern Minerals has considered these principles in relation to the development and implementation of the Browns Range Proposal.

Table 11: EPA principles for environmental management

Principle	Application
1. Precautionary principle Where there are threats of serious irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and b) an assessment of the risk-weighted consequences of various options.	Northern Minerals will make use of the results of environmental and biological impact assessments (as described in the attached draft environmental scoping document) to identify and assess the environmental risk of the Project's implementation. Environmental risks will continue to be considered when finalising options for product and reagent transport and other key project design choices. As part of managing any radiological impacts, Northern Minerals will apply the internationally recognised ALARA principle as recommended by the ICRP.
2. Intergenerational equity The present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.	A Mine Closure Plan prepared for the Browns Range Project will ensure that the conditions of post-mining land use is consistent with agreed future beneficial uses (including ecosystem function).
3. Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integration should be a fundamental consideration	The final environmental impact assessment document prepared for the Project will address the potential impacts (direct, indirect and cumulative) on biological diversity, ecological function, viability of threatened species or ecosystems and connectedness of significant habitat. Northern Minerals proposes to avoid and mitigate impact on biodiversity and ecological integrity through implementation of key commitments made within the final submitted document.

4. Improved valuation, pricing and incentive mechanisms a) environmental factors should be included in the valuation of assets and services; b) the polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. c) the users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. d) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which benefit and/or minimize costs to develop their own solutions and responses to environmental problems.	The cost of greenhouse gas emissions and energy use, water use and management, and mine rehabilitation are being estimated as part of the financial and technical studies that form part of project optimisation. Northern Minerals will also establish minimum design standards to control and manage environmental and occupational impacts.
5. Waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. Wastes should be managed in accordance with the following order of preference: 1. avoidance; 2. re-use; 3. recycling; 4. recovery; 5. treatment; 6. containment; 7. disposal	Waste minimisation principles will be reflected in project designs and environmental management plans. For example, the principles will be applied to waste rock management, process water re-use, domestic and office waste and waste water treatment.

7. STAKEHOLDER CONSULTATION

To date, Northern Minerals has engaged widely with local communities, industry as well as Local, State and Federal Governments on its exploration and proposed development plans at Browns Range. Northern Minerals has built a strong association with the local Ringer Soak community, where it works to identify development and employment opportunities and provides support for community initiatives.

A key focus for Northern Minerals has been to build and grow relationships with the Traditional Owners, the Jaru People, as well as key representative groups such as the Kimberley Land Council and KRED Enterprises. Northern Minerals has also held a number of meetings with local government, in particular, the Shire of Halls Creek, in order to keep them informed on the development of the project, work on local infrastructure issues and to identify any community issues and opportunities.

A stakeholder consultation register outlining consultation completed to date regarding the proposal, and comments received is outlined in Table 12.

Table 12: Northern Minerals stakeholder engagement summary February 2013

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
Office of the Minister for Regional Development WA	24/4/2012	Principal Policy Advisers	• Project overview, discussion on community investment in East Kimberley.
WA Department of Mines and Petroleum (DMP)	14/5/2012; 02/10/2012; 23/10/2012; 08/04/2013	Director General; Deputy Director General - Strategic Policy; General Manager – Tenure and Native Title; Deputy Director General Approvals; Senior Environmental Inspector, Minerals Branch; A/Principal Policy Officer Approvals; Assistant Director, Geological Survey; Liaison Officer, Kimberley Region	• Project briefing and exploration update. • Discussed environmental assessment and mining approvals process and time line. • DMP to decide if lead agency to be implemented. • Support for decision to co-locate hydrometallurgy plant at project site. • Discussion on tenure requirements and timing

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
Coordination meeting involving: DMP, WA Department of Environment and Conservation (DEC), WA Radiological Council and Department of Health (DoH)	03/04/13	DMP: Senior Advisor, Senior Environmental Officer; Team Leader Environment; Minerals Manager - North Division, Mineral Titles Executive Director; DEC: Environmental Officer; Radiological Council: Council Secretary; DoH: Health Physicist	• Briefing on proposed project development, operations including matters such as mine closure planning, environmental impact assessment and tenure. • Mine closure plan will be assessed under Mining Act by DMP during Mining Proposal stage. • Suitability of physical properties of mine waste for closure to be assessed. • Discussed Native Title and Cultural Heritage. • Ore, tailings and final product expected to be below State and National definition of radioactive material. • Assessment required on the fate of the uranium and thorium daughters in the hydrometallurgical plant.
Office of the Minister for Mines and Petroleum WA	07/05/2012	Principal Policy Adviser	• High level briefing and overview of the Project and discussion around mining titles and Native Title.
WA Environmental Protection Authority (EPA)	03/10/2012; 12/03/2013	Director - Assessment and Compliance, Manager - Mining and Industrial Assessments; Chairman	• Consultation on scope of the Proposal and de-coupling of the hydrometallurgical and beneficiation processes • Pre-referral briefing and project overview. • Discussed status of existing studies and proposed studies. • Discussion on approvals process and timelines for construction and production. • Ore, tailings and final product expected to be below State and National definition of radioactive material. • Discussed stakeholder consultation completed and planned.

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
WA Department of Water	27/03/2013; 08/04/2013	Executive Director Regional Delivery and Regulation; Director Regions; Senior Hydrologist – North West; Regional Manager Kimberley Region; Team Leader Planning Kimberley Region	• Project overview. • Discussion on ground and surface water studies and anticipated management measures. Groundwater potentially sourced from dewatering or water supply bores, quality needs assessment. • Potential impact on other groundwater users not considered a factor. • Proposal to determine risk of impacting on cultural and environmental receptors and provide management/mitigation if required • 3D Modflow modelling not required, analytical model with sensitivities sufficient. • Conduct assessment of the pit void water balance and the incorporation of the geochemical testing results. • Assess impacts on groundwater dependent ecosystems (GDE's) if present. • Surface water management, no significant concerns raised. • Regional office will undertake the assessment
WA Department of Transport	26/03/2013	Harbour Master (Wyndam); Deputy Harbour Master Operational Standard	• Project overview and possible supply import and product export. • Capacity or port sufficient to handle the small quantities. • Contamination could possibly be a concern if product was not containers.
Mains Roads WA	08/04/2013	Regional Manager Kimberley Region	• Project overview, focus on road transport, provided trucking estimates for transport of product and supplies. • Condition and category of Gordon Downs and Duncan roads to handle increased truck movement needs to be assessed. • No issues raised associated with increased vehicle movement on Great Northern Hwy.

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
WA Department of Environment and Conservation (DEC)	05/07/2012; 03/04/2013	Principal Environmental Officer / Area Manager North, Conservation and Developments Section Environmental Management Branch; Regional Leader Industry Regulations – Kimberley region; Environmental Officer; Environmental Regulation Division Acting Section Coordinator, EIA and Industry North, Environment Management Branch	• Project overview. • Discussed the EPA assessment and approvals process and also subsequent DEC approvals. • Discussed status of existing studies and proposed studies. • Discussed methodology of invertebrate fauna study. • Support for flora and vegetation survey methods and timing. • Stakeholder communication important, road impact could be seen as significant. • Proposal will be assessed by regional office.
Kimberley Development Commission (WA)	29/06/2012; 09/10/2012; 16/11/2012 08/02/2013	Chairman and CEO	• Project overview and site tour. • Discussion local training and shipping opportunities. • Support infrastructure requirements.
WA Department of Indigenous Affairs	25/07/2012	Director General; Senior Project Officer	• Project overview and discussion on challenges and opportunities for local community at Ringer Soak • Local employment and Kundat Djaru Corporation • Yaruman Arts Centre
Federal			
Federal government	10/8/2012	Federal Minister for Resources and Energy; Minister for Tourism and Policy Adviser	• Project overview and discussion on export options and Native Title. • Supportive of minerals processing in Australia.

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
Department of Sustainability, Environment, Water, Population and Communities (SEWPaC)	05/04/2013	Director and Senior Assessment Officer, North West Section, Environment Assessment and Compliance Division	• Project overview. • Discussed status of existing studies and proposed studies. • Discussed the requirements and triggers for the Proposal to be assessed under the EPBC Act.
Department of Resources, Energy and Tourism	05/04/2013	General Manager – Minerals Branch, Resources Division Manager – Mineral Commodities Section, Resources Division	• Project overview and discussion on funding, water, Indigenous community engagement, transport and export of product.
Northern Territory			•
NT Department of Mines and Energy	10/04/2013	Assistant Director/Chief Mining Engineer, Environmental Officer and Senior Environmental Officer, Mining Environmental Compliance Division	• Project overview and rare earths, discussion regarding NT tenements.
Darwin Port Authority	10/04/2013	General Manager Port Development	• Project overview and discussion on existing facilities and timelines, possible supply import and product export. • Available capacity at port.
Local			
Traditional Owners, Jaru People	Numerous	Representatives	• Overview and consultation on project. • Heritage surveys undertaken • Native title agreement negotiations commenced; agreement reached for negotiation protocol.

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
Shire of Halls Creek	21/06/2012; 4/12/2012; 07/2/2013	Chief Executive Officer; President Manager Environmental Health and Regulatory Services; Economic Development Officer; Community Engagement Officer Infrastructure and Assets Manager	• Project overview and discussion on requirements for planning approval and building permits. • Discussion on Duncan Road, Gordon Downs Road, Sturt Creek crossing - use, classification, upgrades, maintenance and funding. • Supply regular progress reports and future work plans.
Shire of Wyndham - East Kimberley	09/04/2013	Chief Executive Officer; Director of Community Development	• Project overview with a focus on increased traffic and import and export out of Wyndham port
Cambridge Gulf (operators Wyndam Port)	22/08/2012	CEO and Port Manager	• Project overview and discussion on existing facilities and timelines, possible supply import and product export. • Available capacity at port. • Other business options such as fuel supply.
Ord-East Kimberley Expansion Project	23/08/2013	Director	• Project overview. • Discussed Indigenous employment strategy and local contracting opportunities.
KRED	08/02/2013 21/02/2013 21/03/2013	Chief Executive Officer; General Legal Council	• Project overview and discussion of process to reach a mining agreement with Jaru People. • KRED arranges Heritage surveys
Kimberley Land Council	14/08/2012; 20/12/2012	Principal Legal Officer; Chief Executive Officer	• Project overview. • Engage with relevant anthropologists. • Local employment and business opportunities.
Heytesbury Cattle Company	10/04/2013	General Manger	• Project overview, • As pastoralist, discussed road use, transport and sharing of resources.
Kimberley Language Resource Centre	27/07/2013; ongoing	Research, Training and Development Manager	• Project overview. • Contracted to deliver local cultural awareness training – capacity building in Jaru community.

Stakeholder	Date/s	Stakeholder representative	Key issues discussed/raised
Local businesses operating around Halls Creek	Various	Various	• Project overview. • Local employment and contracting opportunities.
Local service providers in Ringer Soak community	Various	Various	• Ongoing support and updates on project status. • Assistance provided through sponsorship and sharing of resources.

8. ASSESSMENT TIMELINE

The assessment timeline below is based on the assumption that an API level of assessment decision is received from the EPA.

	2013								2014						
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
NM Submits Referral and draft ESD															
OEPA sets level of assessment															
NM prepares and submits ESD															
NM prepares and submits draft API document															
OEPA provides comment on draft API dcoument															
NM submits final API document															
OEPA assess API and request additional information															
NM provides additonal information to OEPA															
OEPA publishes report and submits to Minister															

9. CONCLUSION

The Project area is very remote and there was limited environmental data available for the surrounding region. Baseline technical studies completed by Northern Minerals to date have significantly contributed to the scientific knowledge of the area and have given Northern Minerals a well-developed understanding of the Proposal area, the surrounding environmental aspects and potential impacts.

Northern Minerals has engaged key stakeholders since the Project's inception in 2011 and intends to continue its engagement with interested persons and organisations as it completes environmental investigations and refines project design details.

Northern Minerals intends to complete a suite of additional impact assessments that will define potential impacts and inform detailed project planning, including design and preparation of management plans. The scope of additional impact assessments proposed are outlined in the draft Environmental Scoping Document (**Appendix B**).

The environmental issues associated with the Proposal are limited and able to be managed within the current environmental setting and hence are not expected to cause significant impacts. Potential environmental impacts and respective management commitments will also be identified through legislative mechanisms other than Part IV of the EP Act. An assessment of other legislation relevant to the environmental management of the Proposal has been included in **Appendix A**.

Based on the above, Northern Minerals does not expect that the Proposal will require public assessment and that it can be appropriately managed at an assessment level of ‘Assessment on Proponent Information (Category A)’.

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APPENDIX A

Legislation Relevant to Environmental Management of Proposal

Summary of factor and relevant regulatory control, relevant agencies and potential Part V EP Act permitting requirements

Factor	Sub-factor	General Management Requirement	EP Act, Part V- including Environmental harm provisions (DEC)	EP Act regulations (Noise, controlled waste, unauthorised discharge, native vegetation etc.) (DEC)	*Wildlife Conservation Act* (DEC)	*Contaminated Sites Act*	*Mining Act* - Mining Proposal (DMP)	*Mining Act* – Project Management Plan (DMP)	*Mining Act* - Mine Closure Plan (DMP)	*Rights in Water and Irrigation Act, Country Areas Water Supply Act* (DoW)	*Health Act* (DoH)	*Occupational Safety and Health Act* (DoC)	*Dangerous Goods Safety Act* and related regulations (DMP)	*Radiation Safety Act* 1975	*Planning and Development Act* – local Govt.	*Aboriginal Heritage Act* (DIA)	Comment/Rationale
SRE Terrestrial Invertebrate Fauna	Impacts to species	Minimise footprint and suitable location	X	X	X		X		X								An additional targeted survey for Mygalomorph spiders will be completed to further define fauna habitat areas and occurrence of SRE species outside of impact area; Impacts to SRE terrestrial invertebrate fauna will also be assessed through other legislative requirements, including Mining Proposal; and Works Approval applications.
	Loss of habitat		X		X		X		X								
Surface Water and Groundwater	Impact to local and regional groundwater aquifers	Maintain quality and quantity of groundwater aquifers	X			X	X		X	X			X				Impacts to surface water and groundwater to be assessed through additional legislative requirements, including Mining Proposal; Works Approval and Part V licence applications; Licence to take groundwate Permit to disturb bed and banks (if required); Mine Closure Plan; Dangerous Goods licensing
	Surface water quality and quantity	Maintain quality and quantity of surface water	X			X	X		X	X			X				
	Alteration to surface water drainage	Maintain integrity of ecological function and environmental values of surface water	X				X	X	X								
Radiation Management	Soil quality	Maintain soil quality via acceptable rehabilitation and storage	X				X	X	X		X	X	X	X			Development of Radiation Management Plan (RMP)and Radioactive Waste Management Plan (RWMP) Project to be subject to other legislative requirements such as: Project Management Plan Occupational Safety and Health Act 1984; and Mine Closure Plan. Radiation Safety Act 1975
	Atmospheric	Ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land use	X				X	X	X		X	X	X	X			

Factor	Sub-factor	General Management Requirement	EP Act, Part V- including Environmental harm provisions (DEC)	EP Act regulations (Noise, controlled waste, unauthorised discharge, native vegetation etc.) (DEC)	*Wildlife Conservation Act* (DEC)	*Contaminated Sites Act*	*Mining Act* - Mining Proposal (DMP)	*Mining Act* – Project Management Plan (DMP)	*Mining Act* - Mine Closure Plan (DMP)	*Rights in Water and Irrigation Act, Country Areas Water Supply Act* (DoW)	*Health Act* (DoH)	*Occupational Safety and Health Act* (DoC)	*Dangerous Goods Safety Act* and related regulations (DMP)	*Radiation Safety Act* 1975	*Planning and Development Act* – local Govt.	*Aboriginal Heritage Act* (DIA)	Comment/Rationale
	Water quality	Maintain quality and quantity of groundwater aquifers and surface water	X			X	X	X	X		X	X	X	X			
Aboriginal Cultural Values	Land access	To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.													X	X	Implementation of comprehensive stakeholder engagement has taken place to date. Completion of archaeological and ethnographic heritage surveys for all proposed ground disturbance areas; No disturbance to any site of significance will occur without appropriate consultation with the Jaru People and Ministerial consent.
	Impact to significant sites															X	
	End land use						X		X						X	X	
Mine Closure and Rehabilitation	Land (terrestrial)	Maintain the integrity, ecological function and environmental values of the soil and landforms.	X			X	X		X								Implementation of robust Mine Closure Plan in accordance with Guidelines for Preparing Mine Closure Plans will minimise significant impact risk; Proposal will be assessed by Department of Mines and Petroleum under the Mining Act 1978 via the submission of a Mining Proposal and Mine Closure Plan; Implementation of progressive rehabilitation, appropriate design of landforms and comprehensive stakeholder engagement will decrease risk of significant impacts occurring as a result of mine closure and rehabilitation.
	Air Quality	Ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land use	X				X		X								
	Soil Quality	Maintain soil quality via acceptable rehabilitation	X			X	X		X								

Factor	Sub-factor	General Management Requirement	EP Act, Part V- including Environmental harm provisions (DEC)	EP Act regulations (Noise, controlled waste, unauthorised discharge, native vegetation etc.) (DEC)	*Wildlife Conservation Act* (DEC)	*Contaminated Sites Act*	*Mining Act* - Mining Proposal (DMP)	*Mining Act* – Project Management Plan (DMP)	*Mining Act* - Mine Closure Plan (DMP)	*Rights in Water and Irrigation Act, Country Areas Water Supply Act* (DoW)	*Health Act* (DoH)	*Occupational Safety and Health Act* (DoC)	*Dangerous Goods Safety Act* and related regulations (DMP)	*Radiation Safety Act* 1975	*Planning and Development Act* – local Govt.	*Aboriginal Heritage Act* (DIA)	Comment/Rationale
	Visual Amenities	To ensure that aesthetic values are considered and measures are adopted to reduce visual impacts on the landscape as low as reasonably practicable.	X				X		X						X		
	End Land Use	To ensure end land use is consistent with stakeholder expectations	X				X		X						X		
Flora and Vegetation	Vegetation communities	Minimise footprint and suitably located	X	X	X		X		X								Impact to Flora and Vegetation can be assessed under the Native Vegetation Clearing Permit process and conditions set; No Threatened Ecological Communities, Declared Rare Flora or Federally listed species have been identified to date; Very low risk of significant impacts arising due to Proposal; Further surveys will confirm low risk.
	Conservation significant species	Protect from direct and indirect impacts	X	X	X		X										
	Groundwater dependent ecosystems	Protect from direct and indirect impacts	X		X		X			X							
Stygofauna	Loss of habitat	Protect fauna habitat necessary for the continued maintenance of stygofauna species	X		X		X			X							Preliminary evidence indicates that stygofauna habitat is contiguous at least five kilometres beyond the proposed area of impact; The potential for significant impact to subterranean fauna is considered low and further survey will increase the level of confidence in predicting impacts; Very low risk of significant impacts

APPENDIX B

Draft Environmental Scoping Document

Northern Minerals Limited

Browns Range Rare Earths Project

Draft Environmental Scoping Document

May 2013

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Draft Environmental Scoping Document

Distribution:

Company	Copies	Contact Name
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Environmental Protection Authority	1 Electronic copy 1 Hard copy	Chairman EPA

Document Control:

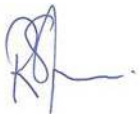
Document Status	Author	Reviewer	Signature	Date of Issue
Rev0 Report	Sarah Perry	Tristan Derham		24/04/2013
Final Report	Outback Ecology & Northern Minerals	R Jones		2 May 2013

Table of Contents

TABLES

FIGURES

1. INTRODUCTION

1.1. Background

Northern Minerals Ltd (Northern Minerals) has identified high value, heavy rare earth elements within xenotime mineralisation at the Browns Range Rare Earths Project (the Project). As a result of the strong market drive for the early development of rare earth deposits, in particular those hosting heavy rare earth elements, an accelerated programme is underway for resource definition, project design and environmental impact assessment of the Project.

The Project is located approximately 160 kilometres (km) southeast of Halls Creek, adjacent to the Western Australian/Northern Territory border. The Project is located on the Gordon Downs Pastoral Station in the Shire of Halls Creek.

1.2. Purpose of this Draft Environmental Scoping Document

This document has been submitted with a referral of the Project to the Environmental Protection Authority (EPA) under s38 of the Environmental Protection Act 1986 (EP Act) (the Proposal). If the EPA decides to assess the Proposal, then the level of assessment applied will be either Assessed on Proponent Information (API) or Public Environmental Review (PER). It is the view of Northern Minerals that the Proposal is best suited to be assessed at the level of API.

The Project area is very remote and there is limited environmental data from the region apart from those studies undertaken by or on behalf of Northern Minerals. These studies have significantly contributed to scientific knowledge of the area and have given Northern Minerals a unique understanding of the proposal area, the surrounding environmental aspects and the potential impacts. With the support of experienced environmental professionals, it is considered that Northern Minerals is well placed to complete an Environmental Scoping Document (ESD) for the Browns Range Rare Earths Project.

This draft ESD is submitted to provide an overview of the document that would be produced should Northern Minerals undertake the preparation of an ESD. A final ESD would contain more detail, if requested.

1.3. Proponent Details

Northern Minerals Limited (formerly Northern Uranium Ltd) (Northern Minerals) is an ASX listed company focused on the development of the Browns Range Rare Earths Project to produce rare earth elements.

All requests for information and other correspondence related to regulatory aspects of the Proposal should be forwarded by post, facsimile or e-mail to the following address:

Robin Jones
Project Manager
Northern Minerals Limited
PO Box 669 West Perth WA 6872
Telephone: (08) 9481 2344
Facsimile: (08) 9481 5929
Email: rjones@northernminerals.com.au

1.4. Project Study Team

Proponent team

Key Personnel	**Title**
Robin Jones	Project Manager
Lisa Chandler	Environmental Consultant

Environmental impact assessment documentation

Organisation	**Key personnel**	**Title**
Outback Ecology	Tristan Derham	Group Leader - Approvals
	Sarah Perry	Senior Environmental Geoscientist
	Kelly Boxall	Environmental Scientist

Specialist consultants

Field	**Organisation**
Flora, fauna, soil, mine closure	Outback Ecology
Radiation	Radiation Professionals JRHC Enterprises Pty Ltd
Groundwater, surface water	Klohn Crippen Berger Golder Associates Pty Ltd
Aboriginal heritage	Keogh Bay Consulting
Geochemistry	SRK Consulting
Air quality	Air Assessments
Stakeholder consultation	Cannings Purple

2. SUMMARY DESCRIPTION OF THE PROPOSAL

Northern Minerals proposes to mine xenotime mineralised ore from multiple open pits at the Browns Range site. The Browns Range dome, within which the rare earth deposits occur, extends into the Northern Territory, however, to date Northern Minerals has focussed its exploration activities within its Western Australian tenements. This Proposal relates to mining and processing within Northern Minerals' Western Australian tenements (Figure 1).

An on-site beneficiation plant would treat up to 750,000 tonne per annum (tpa) of ore to produce approximately 15,000 tpa of mineral concentrate. The beneficiation process, located at the site, includes crushing, grinding, magnetic separation and flotation of the xenotime ore. The concentrate produced by the beneficiation plant would then be further processed via a hydrometallurgical process to produce up to 4,000 tpa of high purity, mixed rare earth oxide for export overseas. The hydrometallurgical plant will be co-located on site and would involve a sulphation bake and water leach step using sulphuric acid to liberate and leach the rare earths into solution. This leach liquor would then be purified to remove any thorium and uranium present prior to precipitation of the rare earths using oxalic acid. The area earth rich oxalate precipitate would then be calcined to produce the mixed rare earth oxide

Waste products from the mining operation would include waste rock and tailings. The waste rock would be disposed of in above ground waste landforms and the combined tailings would be deposited in a purpose-built, engineered tailings storage facility (TSF).

In addition, the Project would involve the construction and use of:

- a borefield for water supply;
- access and haul roads; and
- support infrastructure, including an accommodation village, workshops and laydown areas, offices, stormwater management infrastructure (bunds, drains), water storage and evaporation ponds, telecommunications infrastructure and diesel power supply for the mine, plant and support facilities, and an extension of the existing exploration airstrip.

It is proposed that the mixed rare earth oxide will be transported from the site in shipping containers using public roads to either Darwin or Wyndham port for export. The proposed operational mine life is up to 10 years (not including construction and rehabilitation phases).

A detailed description of the Proposal is provided in the Supporting Information Document along with a description of the existing environment.

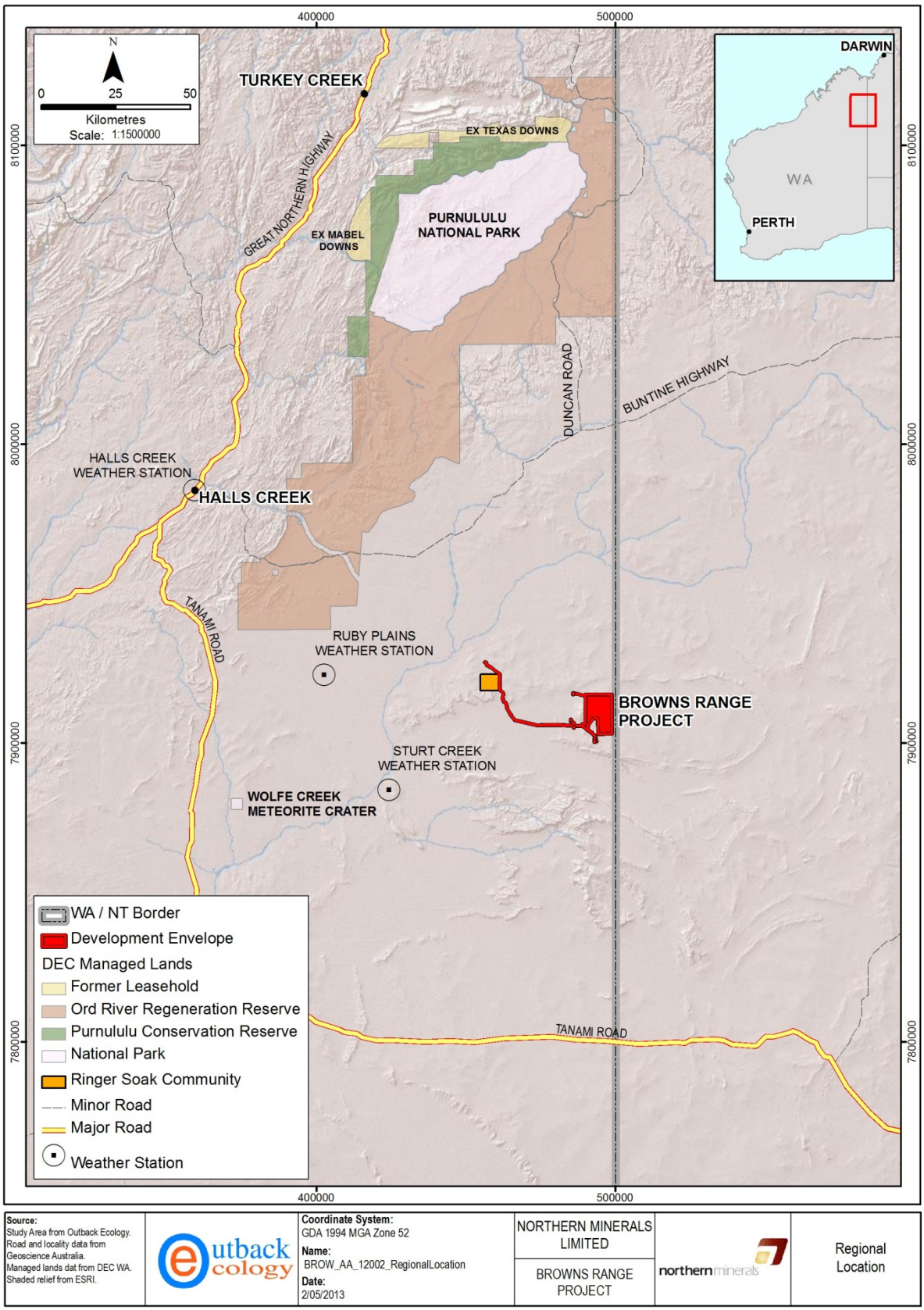


Figure 1: Regional location of Browns Range Rare Eaths Project

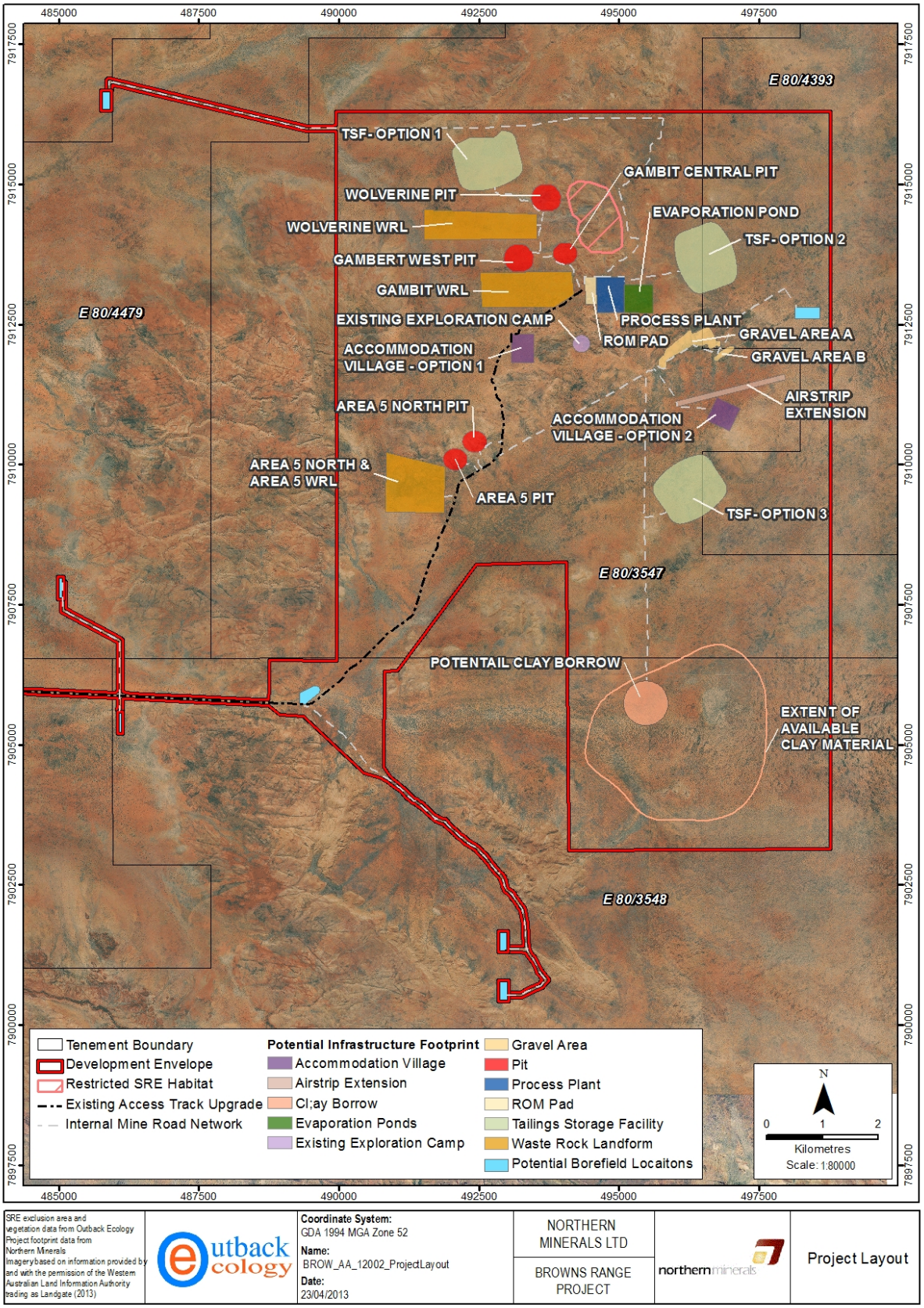


Figure 2: Browns Range Rare Earths Project Layout

3. LEGISLATIVE FRAMEWORK AND GUIDELINES

3.1. EPA Guidance

The following EPA guidance is applicable to the process of investigation and environmental impact assessment of the Project:

- Guidance Statement No. 6 - Rehabilitation of Terrestrial Ecosystems
- Guidance Statement No. 12 - Minimising Greenhouse Gases
- Guidance Statement No. 20 - Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia
- Guidance Statement No. 41 - Assessment of Aboriginal Heritage
- Guidance Statement No. 51 - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia
- Guidance Statement No. 54 - Consideration of subterranean fauna in groundwater and caves during Environmental Impact Assessment in Western Australia
- Guidance Statement No. 55 - Implementing best practice in proposals submitted to the environment impact assessment process
- Guidance Statement No. 56 - Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia
- Draft Guidance No. 54a - Sampling methods and survey considerations for subterranean fauna in Western Australia
- Environmental Assessment Guideline No. 1 – Defining the Key Characteristics of a proposal
- Environmental Assessment Guideline No. 6 – Timelines for Environmental Impact Assessment of Proposals
- Draft Environmental Assessment Guideline No. 4 - Towards Outcome-based Conditions
- Guidelines for Preparing Mine Closure Plans

Legislation applicable to the Project is described in the Supporting Information Document

4. POTENTIAL ENVIRONMENTAL IMPACTS

Three categories of environmental factors relevant to the Proposal have been identified: 'Preliminary key' factors have the potential to be significantly impacted by the Proposal; 'secondary' factors are not expected to be significantly impacted by the Proposal, but further studies are proposed to verify this expectation; 'other' factors are clearly not expected to be significantly impacted by the Proposal, and therefore no additional studies are planned. Environmental factors are described in the Supporting Information Document.

Preliminary key factors have been identified as:

- short range endemic (SRE) terrestrial fauna;
- management of surface water and groundwater quality and quantity; and
- mine closure and rehabilitation.

Secondary factors have been identified as:

- flora and vegetation;
- stygofauna;
- air quality;
- radiation management; and
- Aboriginal cultural values.

Other factors include:

- terrestrial vertebrate fauna;
- troglofauna;
- impacts to conservation areas;
- noise;
- light;
- greenhouse gases; and
- recreation.

4.1. Short Range Endemic Terrestrial Fauna

Two habitat types with medium or high potential to support SRE species were observed in the Proposal area. There is a potential that direct and indirect impact to fauna habitat significant for the maintenance of SRE terrestrial invertebrate fauna may occur, e.g. through clearing, changes to surface water flows, increased populations of introduced plant species or dust deposition.

4.2. Management of Water Quality and Quantity

The proposal has the potential to impact surface water and groundwater quality and quantity through alteration of surface hydrology, abstraction of groundwater, seepage and erosion of contaminants from the tailings storage facility (TSF) and waste rock landforms (WRLs) as well as leaks and spills during operations resulting in contamination of surface water and groundwater.

4.3. Mine Closure and Rehabilitation

There is the potential that any early or unplanned closure or failure to implement appropriate mine rehabilitation planning and procedures could result in impacts to the surrounding environment and / or to constraints on future land uses.

The Proposal has the potential to permanently modify the landscape and to reduce soil quality through contamination or increased erosion.

The Proposal also has the potential to impact on the visual amenity of a relatively undeveloped and remote area. However, the area is rarely visited and there are few sensitive receptors for visual amenity.

4.4. Management

Proposed management actions and likely residual impacts have been described in the Supporting Information Document.

5. PROPOSED STUDIES AND INVESTIGATIONS

A number of studies have been undertaken at the Project area and a substantial amount of baseline investigative work has been completed for the environmental impact assessment. Further work is proposed to define impacts and inform the development of appropriate environmental management controls.

5.1. Short Range Endemic Terrestrial Fauna

Following database searches and a literature review, a survey for SRE invertebrates was undertaken between January and March 2012. This is the optimal timing for SRE invertebrate surveys in the region (EPA 2009). The methods used for collecting SRE taxa during the survey aligned with those specified by the EPA (2009) and have been endorsed by SRE invertebrate specialists of the Western Australian Museum (WAM) and the Department of Environment and Conservation (DEC). Where possible, survey sites were established both inside and outside of the preliminary impact footprint, in representative habitats.

Two SRE Mygalomorph spider species, *Aganippe* 'MYG260' and *Aname* "MYG258', were collected from restricted habitats within the study area. The remaining 15 SRE species were collected from habitats that were not considered to be restricted within the study area and the nominal SRE status of these species may not represent a restricted distribution but rather an artefact of a lack of regional survey work (Outback Ecology 2013c).

An additional targeted survey for Mygalomorph spiders was carried out between December 2013 and March 2013 to search for the two restricted SRE species outside the potential impact areas; to further define the habitats where *Aganippe* 'MYG260' and *Aname* "MYG258' were collected; and to evaluate the occurrence of these habitats in the surrounding landscape, including internal drainage habitat occurring outside the Proposal area. The results of this survey are currently being analysed.

Results of the survey, along with proposed footprints and activities will inform an impact assessment undertaken by a SRE invertebrate specialist. This impact assessment will be presented in the Environmental Review Document.

5.2. Water Quality and Quantity

5.2.1 Groundwater

A scoping-level hydrogeological assessment has been undertaken, including:

- compilation and review of available hydrogeological information;
- interpretation of the site hydrogeological conditions; and
- preliminary groundwater supply and dewatering assessments for project operational requirements.

Following the scoping study, a non-intrusive geophysical survey was carried out using resistivity and magnetic methods to investigate subsurface geological features to aid in hydrogeological conceptualisation and drill target location for intrusive assessment.

The following studies will be completed prior to submission of an Environmental Review Document:

- hydrogeological baseline characterisation comprising groundwater level and quality collection from a total of 12 bores (across the Wolverine, Gambit, Gambit West and Area 5 deposits and regional exploration holes and production bores);
- water supply investigations comprising drilling and test pumping of up to 10 water supply targets;
- dewatering investigation comprising drilling and test pumping of up to four identified locations adjacent to the proposed deposits; and
- suitable hydrogeological modelling to estimate drawdowns associated with pit dewatering and operation of a borefield

Information gathered from the above studies will allow further hydrogeological conceptualisation based on site specific data, and support further assessments including:

- pit dewatering requirements and impacts;
- TSF and waste rock landform seepage; and
- dewatering impacts from water supply bores.

Results from these assessments will be used to assess impacts to groundwater quality and quantity and to guide water management strategies.

5.2.2 Surface water

A scoping level surface water study of the proposed mine site, access road and existing Shire road was completed in 2012 to develop an understanding of the dominant surface water and drainage systems in the Project area and to provide the basis for a high level assessment of surface water management risks and issues (Golder, 2012).

Opportunistic surface water sampling was carried out using two multi-level rising gauge samplers during the 2012/2013 wet season. Unfortunately, wet seasons flows to mid-March were well below average and only one set of water samples could be collected.

The following additional studies and investigations are proposed to enable more detailed assessment of potential impacts on surface water quality and surface hydrology:

- Development of a conceptual water balance
- Rainfall and runoff modelling to estimate extent and duration of seasonal flooding, especially in relation to large precipitation and/or flow events
- Estimation of flood protection and sediment control requirements
- Further characterisation of mine wastes and tailings to evaluate the environmental mobility of waste constituents.

These assessments will provide information for surface water control for operations and for mine closure planning. They will inform the assessment of impacts on surface water quality.

5.3. Mine Closure and Rehabilitation

A Mine Closure Plan (MCP) will be developed for inclusion in the Browns Range Mining Proposal once the Project details have been refined. The MCP will be submitted to the Department of Mines and Petroleum (DMP) for approval and will be developed in accordance with the joint *Environmental Protection Authority (EPA)* and *Department of Mines and Petroleum (DMP) Guidelines for Preparing Mine Closure Plans.*

The key components of mine closure and rehabilitation will be outlined in the Environmental Review Document, with closure details provided in the MCP. Northern Minerals has adopted a life of mine planning approach, incorporating closure and the development of a detailed MCP, the key features of which are outlined below.

5.3.1. Stakeholder Consultation

The Environmental Review Document will identify the key stakeholders, and a strategy for undertaking stakeholder consultation. Stakeholder consultation on the proposed post mining land use, proposed closure objectives and criteria, will be undertaken at a later stage (to augment a Mining Proposal), once the Project details have been further developed.

Initial discussions will be undertaken with key stakeholders, and a register detailing these discussions will be included in the Environmental Review Document.

5.3.2. Identification and Management of Closure Issues

Potential closure issues will be identified and presented within the Environmental Review Document. The knowledge base for each feature will be developed in the detailed MCP (to be developed at a later stage to augment the Mining Proposal).. A risk assessment will be conducted during the development of the detailed MCP.

5.3.3. Waste Rock and Tailings Characterisation

A preliminary geochemical testing programme has been carried out to provide an initial assessment of whether wastes generated by the proposed Browns Range rare earth project will have geochemical or

radiological properties which require special management in order to reduce the risk of unacceptable environmental or public health impacts during or after the active life of the project.

The initial programme has identified five waste rock or overburden types that will need to be managed. These are:

- transported overburden, comprising non-mineralised clays and sand, with a variable gravel content, occurring from approximately 0 – 6 metres below ground level (mBGL);
- mottled and variably ferruginised saprolite derived from the in-situ weathering of arenite occurring from approximately 6 - 20 mBGL;
- non-mineralised, weathered in-situ sedimentary rocks: silstones, arenites and arkoses;
- mineralised and commonly brecchiated or altered arkose; and
- non-mineralised footwall deposits, comprising arkose or arenite - rarely brecchiated

Testing completed to date includes:

- static acid-base waste characteristics (acid generating and acid neutralising capacity) of major waste (and ore) lithologies;
- total and water-leachable trace element composition in waste rock and tailings;
- electrical conductivity and pH of waste rock and tailings;
- selected radionuclides in waste rock and tailings and in leachate from a 1:5 water extract of these materials.

Representative wastes and tailings will be tested further to determine the dynamic geochemical behaviour of the materials as required. Geochemical characterisation of the hydrometallurgical tailings stream and radionuclide assessment of both the hydrometallurgical and beneficiation tailings streams will be undertaken. A supplemental leach test programme will be undertaken to obtain data describing the long term weathering characteristics of the materials

5.4. Flora and vegetation

An initial survey was conducted during excellent seasonal conditions in May 2012 to meet the requirements for a Level 1 assessment in line with EPA Guidance Statement 54a (Outback Ecology 2013b). A second survey will be completed for the main study area in May 2013 which combined with the results of the first survey will fulfil requirements for a Level 2 assessment. The survey will include the proposed access route using a buffer of 100 m along the proposed centreline. This will at least fulfil the requirements for a Level 1 survey in this area.

Following development of a detailed project description and footprint, an impact assessment will be undertaken by a flora and vegetation specialist prior to preparation of the Environmental Review Document.

5.5. Stygofauna

Following literature review and database searches, an initial stygofauna survey was conducted in May 2012 and involved the survey of two vertical bores. From this survey, only one bore was suitable for stygofauna sampling and resulted in the collection of one stygofauna specimen, identified as a *Parabathynellidae* (*Bathynellacea*) species. A second survey of 33 drill holes was undertaken in October 2012.

A total of six stygofauna species have been recorded for the Proposal area, including four Parabathynellidae species (all belonging to a new undescribed genus), one Bathynellidae species, and one Enchytraeidae species. Genetic analysis of the stygofauna specimens collected demonstrated that two species (*Parabathynellidae* OES17 and *Enchytraeidae* OES17) possess a wide distribution that extends at least five kilometres beyond the Project area.

One further round of survey was undertaken in April 2013 to meet the requirements for a Level 2 assessment, in line with Draft Guidance Statement 54a. The results, along with pit footprints and groundwater drawdown estimates will inform a risk-based impact assessment for stygofauna. This will be presented in the Environmental Review Document.

5.6. Air Quality

It is considered likely that if appropriate management methods are implemented then the impacts to air quality will not be significant. There are no similar operations in the vicinity nor any planned at this stage. Air quality monitoring and assessment is being undertaken. In order to evaluate the potential for adverse environmental or health impacts associated with emissions to air and to identify what management and mitigation measures may be required to achieve EPA air quality objectives, Northern Minerals proposes to complete the following work:

- Review of baseline meteorological data (from Bureau of Meteorology stations and on-site monitoring station). This information will be used in proposed air quality modelling.
- Review of baseline ambient dust concentrations and dust deposition rates, including laboratory results for radionuclides in dust.
- Develop an emissions inventory for the mining and mineral processing operation, using standard NPI emission factors and estimated operational data including: exposed areas, vehicle movements, tonnage of ore and waste moved for fugitive dust and exhaust flows and the likely emission concentrations in exhaust streams and stack parameters for the processing operations.
- Modelling of point source, area source and fugitive emissions to predict ground level concentrations of particulates, NOx, SOx and radon using the CALMET/CALPUFF dispersion modelling system or AERMOD, together with local terrain information and meteorological data.

Modelling will consider construction, operations and post-closure emissions scenarios. The modelled air quality predictions will be compared to NEPM criteria (e.g. PM10, NOX, SOX) and any other relevant health or environmental standards. Compliance with regulatory standards will be assessed at the nearest sensitive receptors, such as the mine accommodation village.

5.7. Radiation Management

Northern Minerals will conduct its radiological assessments and management in accordance with DMP guidance, specifically, *Managing naturally occurring radioactive material (NORM) in mining and mineral processing*.

Northern Minerals has previously established a baseline monitoring network which provides an indication of the naturally occurring radiation levels in the environment. It is intended that this monitoring continues and is used to identify any impacts once operations commence. The network will be expanded to include passive radon and thoron monitoring. Radionuclides in soil monitoring has been undertaken at the site to provide further baseline information for impact assessment.

The basis of the radiological assessment is the air quality impact assessment and estimates of radionuclide emissions from the Project will be made for this purpose. The air quality assessment also provides information which will be used to undertake a non human biota impact assessment using the internationally recognised ERICA software tool.

An occupational radiation exposure assessment will also be undertaken.

Management of radiation for the project will be detailed in a Radiation Management Plan (RMP) and Radioactive Waste Management Plan (RWMP), both of which would be provided to the appropriate authority for approval prior to commencement of the project.

5.8. Aboriginal Cultural Values

Through early stakeholder engagement, Northern Minerals has developed a good working relationship with the Traditional Owners, the Jaru People,. In conjunction with the Traditional Owners, Northern Minerals has undertaken archaeological and ethnographic heritage surveys for various areas within the Proposal area. A number of Aboriginal heritage sites have been identified within the Browns Range exploration tenements. At the date of this draft ESD, Northern Minerals has no expectation that any known site will be disturbed by the Proposal. However, the entire project area has not yet been comprehensively surveyed. Northern Minerals will continue consultation with the Jaru People and will conduct further archaeological and ethnographic assessments of possible project impacts on Aboriginal sites and other aspects of the area which are important to the Jaru People.

Northern Minerals intends to continue to develop and foster this relationship with the Jaru People through continuous engagement and identification of possible opportunities to design project infrastructure footprints to alleviate impacts to Aboriginal cultural heritage.

Northern Minerals will ensure that Aboriginal heritage is managed in accordance with all relevant legislation and guidance statements throughout the life of the Project.

5.9. Vertebrate Fauna

A terrestrial vertebrate fauna survey of the Proposal area was undertaken in May 2012. Habitat assessments and systematic, targeted and opportunistic sampling were undertaken across the Proposal area. Systematic sampling methods comprised pitfall, Elliott, funnel and cage trapping, hand searching, spotlighting and avifauna censusing. Targeted search methods comprised manual searching and the use of motion-sensor cameras and bat echolocation recording devices (Outback Ecology 2012).

Previous surveys in the vicinity of the Proposal area (by others) documented faunal assemblages slightly different to those reported by Outback Ecology (2012), and species accumulation curves for avifauna, and to lesser extent reptiles, did not reach asymptotes during the survey period. It is therefore unlikely that the field survey documented the entire suite of species present within the Proposal area at the time of sampling. However, between this study and those previously conducted, and with consideration of the low to moderate scale and impact of the Project with respect to the sensitivity of the receiving environment and the characteristics of the Project area, vertebrate fauna assemblages and habitats have been documented to the point that they can be considered to provide an adequate baseline.

No further vertebrate fauna investigation is proposed prior to impact assessment. The above results along with proposed activities and footprints will inform an impact assessment for vertebrate fauna. This will be presented in the Environmental Review Document.

5.10. Troglofauna

A relatively extensive troglofauna survey program, involving the deployment of more than 60 litter traps over three survey rounds, collected no troglofauna from the Proposal area. These results indicate that the Project area does not support a troglofauna assemblage. No further assessment will be undertaken.

5.11. Reserves and Conservation Areas

The closest Aboriginal reserves are Kundjat Djaru (Ringer Soak), located 40 km north west of the Proposal area, and the Northern Tanami Indigenous Protected Area, approximately 50 km east in the Northern Territory.

DEC-managed lands closest to the Proposal include the Ord River Regeneration Reserve, located approximately 100 km northwest of the Proposal and the Wolfe Creek Meteorite Crater National Park, located approximately 120 km to the west-southwest.

The proposed upgrade of the existing access track to Browns Range will occur within the northern extent of the proposed Gardiner Range Gardiner Range conservation area. The flora and vegetation assessment planned for May 2013 will assess impacts to vegetation in this area (**Section 5.4**). Given the distance to the nearest conservation areas from the Proposal, the potential impacts are not likely to be significant.

5.12. Noise and Vibration

Noise and vibration are very unlikely to create any significant impacts and will be managed through standard management practices. There are no similar operations in the vicinity, nor any planned at this stage. Noise and vibration generated by the Proposal will comply with statutory noise and safety regulations. There are no other investigations planned.

5.13. Greenhouse Gas Emissions

The total GHG emissions are not considered a significant impact on a regional scale. There are few or no other proposals in the area. Greenhouse emissions from the Proposal will be estimated and reported (if required) in accordance existing guidelines and the legislative framework set out in the *National Greenhouse and Energy Reporting Act 2007* (Cwth)). It is unlikely that greenhouse gas emissions for the Proposal will be significant. There are no other investigations planned.

5.14. Light

Lighting from the Proposal is not expected to result in significant impacts to sensitive environmental receptors or the visual amenity of local communities. There are no light-emitting operations nearby. Lighting will conform to relevant guidelines and legislation. There are no other investigations planned.

5.15. Recreation

The Proposal is not expected to have a significant impact on the recreational value of the area. There are no other investigations planned.

5.16. Social

The implementation of the Proposal has the potential to cause, or to contribute to, a range of social and economic changes, especially in the communities nearest to the proposed mine. The changes could include, for example:

- Increased employment and business opportunities.
- Increased income or changed income distribution.
- Increased payment of rates to the local government.
- Change in local demographics.
- Change in access to, or demand for, social services (for example, medical services, recreation, training/ education).
- Changes in community values, leadership, character.

- More frequent travel to, from or through the Ringer Soak area by people from outside the community.
- Improved road and air access to the Ringer Soak and Browns Range area.
- Constrained access to parts of the Browns Range tenements, potentially affecting customary uses of the land.
- Social and economic changes on cessation of mining.

In order to understand and assessment the social, economic and cultural aspects of implementing the Project, Northern Minerals proposes to conduct a social impact assessment (SIA).

The scope of the SIA and methods to be used in assessing potential impacts are proposed to be developed in consultation with key stakeholders, including Traditional Owners and their representative bodies. The stakeholder consultation and communication process as outlined in Section 6 forms an integrated part of the SIA process. The following tasks are likely to form part of the work of completing a social impact assessment:

- Identification of stakeholders.
- Development of a stakeholder engagement and consultation strategy – see Section 6.
- Review of literature and publicly available information to characterise social, cultural and economic factors which may be affected by project implementation.
- Field data collection and consultation with stakeholders.
- Data analysis and feedback to stakeholders.
- Development of follow up actions and monitoring strategies.
- Reporting.

6. STAKEHOLDER CONSULTATION AND COMMUNICATION

6.1. Stakeholder Consultation Plan

Northern Minerals is committed to undertaking transparent and collaborative community and stakeholder engagement throughout the Project's planning, construction, operation and closure phases.

Northern Minerals consultation approach is to maintain clear, accurate and consistent factual information and messages across all stakeholder groups. The key objectives include:

- developing and maintain strong relationships with all key stakeholders;
- building credibility and trust among key stakeholders; and
- ensuring that stakeholders are adequately and accurately informed about the rare earth mining and processing at the Project.

Extensive stakeholder consultation has already been undertaken as outlined in the Referral Supporting Information document and an ongoing community engagement strategy is in place which will further develop as project activities increase.

In 2013, Northern Minerals will expand its community engagement activities by conducting a two stage community consultation process in relation to the Project. Community information forums are scheduled to be held in the communities likely to be impacted by the Project, which are Halls Creek, Ringer Soak and Wyndham.

The first stage will be held in May 2013 to introduce Northern Minerals and the Project, outline environmental studies and project approvals, and to provide the opportunity for the community to voice concerns or comments directly with the Company. A second stage, similar to the first, will be undertaken in latter part of the year which will present the project design and results of the environmental impact assessment studies, report the findings from stage one forums and provide an additional opportunity for questions and comments.

To facilitate this process a number of communication tools have been developed such as Browns Range Rare Eaths Project fact sheets, a community and environment website page, a 1800 free call number, and a project overview presentation material. Presentation material and fact sheets have been duplicated in plain English format in order to reach out to the majority of the local community who are Indigenous. To promote the forums advertising has been scheduled in local community newspapers, community and commercial radio stations, through local area contacts and distribution of flyers and posters.

An ongoing stakeholder engagement process is also in place with state, local and federal governments and key industry bodies.

6.2. Outcomes of Previous Consultation

Table 12 in the Referral Supporting Information document provides a summary of the stakeholder consultation completed to date.

7. PRINCIPLES OF ENVIRONMENTAL PROTECTION

The EPA has identified a series of principles for environmental management. Refer to Table 11 in the Referral Supporting Information Document for Northern Minerals consideration of these principles in relation to the development and implementation of the Proposal.

8. SUMMARY AND CONCLUSION

The Project area is very remote and there was limited environmental data available for the surrounding region. Baseline technical studies completed by Northern Minerals to date have significantly contributed to the scientific knowledge of the area and have given Northern Minerals a well-developed understanding of the Proposal area, the surrounding environmental aspects and potential impacts.

Northern Minerals intends to complete a suite of additional impact assessments that will define potential impacts and inform detailed project planning, including design and preparation of management plans and mine closure. Together with the studies completed to date, these additional studies are expected to provide a sound basis for the development of environmental impact assessment and management documents and detailed design.

Table 1 summarises the environmental information currently available, as well as additional studies that will be undertaken and included in the Environmental Review Document.

Table 1 Summary of environmental information (existing and planned)

Factor & Environmental Objective	Completed Investigations	Proposed Further Investigations
Short range endemic invertebrates: To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	Following database searches and a literature review, a survey for SRE invertebrates was undertaken between January and March 2012.	An additional targeted survey for Mygalomorph spiders was carried out between December 2012 and April 2013 to search for the two restricted SRE species outside the potential impact areas; to further define the habitats where *Aganippe* 'MYG260' and *Aname* "MYG258' were collected; and to evaluate the occurrence of these habitats in the surrounding landscape, including internal drainage habitat occurring outside the Proposal area. Results of the survey, along with proposed footprints and activities will inform an impact assessment undertaken by a SRE invertebrate specialist.
Groundwater Quality and Quantity: To maintain the quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.	A scoping-level hydrogeological assessment has been undertaken, including • compilation and review of available hydrogeological information; • interpretation of the site hydrogeological conditions; and • preliminary groundwater supply and dewatering assessments for project operational requirements. A non-intrusive geophysical survey was carried out using resistivity and magnetic methods to investigate subsurface geological features to aid in hydrogeological conceptualisation and drill target location for intrusive assessment.	The following studies are proposed: • hydrogeological baseline characterisation comprising groundwater level and quality collection from a total of 12 bores (across the Wolverine, Gambit, Gambit West and Area 5 deposits and regional exploration holes and production bores); • water supply investigations comprising drilling and test pumping of up to 10 water supply targets; • dewatering investigation comprising drilling and test pumping of up to four identified locations adjacent to the proposed deposits; and • suitable hydrogeological modelling to estimate drawdowns associated with pit dewatering and operation of a borefield.

Factor & Environmental Objective	Completed Investigations	Proposed Further Investigations
Surface Water Quality and Quantity: To maintain the quality of water so that existing and potential environmental values, including ecosystem maintenance, are protected.	A scoping level surface water assessment has been undertaken for the Project area, including the mine site, proposed access road and existing Shire road	The following studies are proposed: • Development of a conceptual water balance • Rainfall and runoff modelling to estimate extent and duration of seasonal flooding, especially in relation to large precipitation and/or flow events • Estimation of flood protection and sediment control requirements • Further characterisation of mine wastes and tailings to evaluate the environmental mobility of waste constituents.
Flora and vegetation: To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	An initial survey was conducted during excellent seasonal conditions in May 2012 to meet the requirements for a Level 1 assessment in line with EPA Guidance Statement 54a (Outback Ecology 2013b).	A second survey will be completed for the main Proposal area in May 2013 which combined with the results of the first survey will fulfil requirements for a Level 2 assessment. The survey will include the proposed haul route using a buffer of 100 m along the proposed centreline. This will fulfil the requirements for at least a Level 1 survey in this area. Following development of a detailed project description and footprint, an impact assessment will be undertaken by a flora and vegetation specialist.
Stygofauna: To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	Following literature review and database searches, an initial stygofauna survey was conducted in May 2012 and involved the survey of two vertical bores. A second survey of 33 drill holes was undertaken in October 2012.	One further round of survey was undertaken in April 2013 to meet the requirements for a Level 2 assessment, in line with Draft Guidance Statement 54a. The results, along with infrastructure footprints and groundwater drawdown estimates will inform a risk-based impact assessment for stygofauna.
Air Quality: To ensure that emissions do not adversely affect environmental values or the health, welfare and amenity of people and land use by meeting statutory requirements and acceptable standards.	An air quality baseline assessment is underway, which includes; • assessment of the baseline conditions for dust concentrations and dust deposition; • development of an operational emission source inventory; • establishment of a meteorological station; and • air quality impact modelling	Estimates of point source and fugitive emissions during project construction and operations will be carried out to determine the year in which maximum emissions occur. The emission from this year will be used as input to an air quality model which will provide impact contours for dust (and radionuclide) concentrations and dust (and radionuclide) deposition rates. The impacts will be compared to the results of the baseline monitoring program.
Radiation Management: To ensure that radiological impacts to the public and the environment are kept as low as reasonably achievable and	A baseline air quality assessment was undertaken between December 2012 and March 2013, using a high volume dust sampler dust deposition gauges. Samples were assayed for radionuclides. A regional gamma survey has been undertaken.	The existing baseline monitoring program for dust concentration and dust deposition will continue. Baseline radon and thoron sampling will commence using passive samplers. The environmental radiological impact of the project will be assessed using the outputs of the air quality modelling to provide project impact dust and radon concentrations and radionuclide deposition rates. The deposition rates will also

Factor & Environmental Objective	Completed Investigations	Proposed Further Investigations
comply with acceptable standards.		provide data for a non-human biota impact assessment. The occupational radiological impacts will be assessed based on modelling and reviewing other projects with similar material and similar processes. Northern Minerals will develop a Radiation Management Plan (RMP) and Radioactive Waste Management Plan (RWMP) in accordance with DMP guidance.
Aboriginal Cultural Value: To ensure that changes to the biophysical environment do not adversely affect historical and cultural associations and comply with relevant heritage legislation.	Northern Minerals has undertaken archaeological and ethnographic heritage surveys for various areas within the proposal area. A number of Aboriginal heritage sites have been identified within the Browns Range exploration tenements. At the date of this referral, Northern Minerals has no expectation that the known sites will be disturbed by the proposed mining operations. However, the entire project area has not yet been comprehensively surveyed.	Northern Minerals will continue consultation with the Jaru People and conduct further archaeological and ethnographic assessments of possible project impacts on Aboriginal sites and other aspects of the area which are important to the Jaru People. Northern Minerals will ensure that Aboriginal heritage is managed in accordance with all relevant legislation and guidance statements throughout the life of the Project.

9. REFERENCES

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APPENDIX C
Supporting Information

Appendix C comprises a CD containing the following documents in electronic format:

- Level 1 Vegetation and Flora Survey, February 2013, Outback Ecology
- Terrestrial Vertebrate Fauna Baseline Survey, October 2012, Outback Ecology
- Terrestrial Short-range Endemic Invertebrate Fauna Baseline Survey, February 2013, Outback Ecology
- Baseline Soil and Landform Assessment, Outback Ecology, December 2012
- Subterranean Fauna Summary Report, February 2013, Outback Ecology
- Browns Range Rare Earth Element (REE) Project - Geochemical Data Review- Preliminary Geochemical Assessment, SRK Consulting, April 2013.

APPENDIX D

Electronic Copy of Supporting Information Document