



Report and recommendations of the Environmental Protection Authority



Yeelirrie Uranium Project

Cameco Australia Pty Ltd

Report 1574

August 2016

Public Environmental Review Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
15/12/2014	Level of assessment set	
10/04/2015	Final Environmental Scoping Document (ESD) approved	17
21/09/2015	Public Environmental Review (PER) document released for public review	23
14/12/2015	Public review period for PER document closed	12
14/06/2016	Final proponent Response To Submissions report received	26
23/06/2016	EPA meeting	1
24/06/2016	Outcome of EPA meeting provided to proponent	1
08/07/2016	Response from proponent regarding outcome of EPA meeting	2
29/07/2016	EPA report provided to the Minister for Environment	3
03/08/2016	Publication of EPA report (three working days after report provided to the Minister)	3 days
17/08/2016	Close of appeals period	2

Timelines for an assessment may vary according to the complexity of the project and are usually agreed with the proponent soon after the level of assessment is determined.

In this case, the Environmental Protection Authority met its timeline objective in the completion of the assessment and provision of a report to the Minister.



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Chairman

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Summary and recommendations

This report provides advice and recommendations to the Minister for Environment on the Environmental Protection Authority's environmental impact assessment of a proposal by Cameco Australia Pty Ltd (Cameco).

Cameco proposes to develop an open-pit mine for uranium ore at Yeelirrie in the Northern Goldfields region of Western Australia (WA), approximately 420 kilometres (km) north of Kalgoorlie-Boulder, and 70 km south-west of Wiluna. The proposal is to mine up to 7,500 tonnes of uranium oxide concentrate (UOC) per year over 22 years, to be transported by road for export through the Port of Adelaide. Infrastructure would include two open pits, processing facilities, roads, accommodation, and stockpile and laydown areas.

Background and context

The *Environmental Protection Act 1986* (EP Act) requires that the EPA's report on the outcome of its assessment sets out key environmental factors identified in the course of the assessment, as well as the EPA's recommendations as to whether or not the proposal may be implemented and, if so, the conditions and procedures that should apply. The EPA may also include any other information, advice and recommendations in the assessment report that it deems fit.

Cameco referred the proposal to the EPA on 12 November 2014. On 15 December 2014, the EPA set the highest possible level of assessment for the proposal – a Public Environmental Review (PER) with a 12-week public review period. The PER was released on 21 September 2015, attracting 169 submissions and 2,946 pro forma submissions.

Public submissions

Key issues raised in the public submissions included:

- potential impacts to subterranean fauna;
- potential impacts to the Threatened Flora *Atriplex yeelirrie* (*A. yeelirrie*);
- potential radiological impacts to human health and non-human biota;
- potential impacts on Short Range Endemics (e.g. Shield-backed Trapdoor Spider);
- concerns with dust and air quality;
- potential problems with how the release of solutes from the tailings storage facility (TSF) had been simulated;
- concerns about the water usage for a region of poor water supply and poor water security;
- concerns regarding the transport of uranium;

- potential impacts to livelihood as a result of living near the proposed mine;
- concerns regarding the consideration of Aboriginal Heritage; and
- consideration of cumulative environmental impacts of uranium projects; and limited presentation of Management Plans with the PER document.

In assessing the proposal and considering the response to public submissions, the EPA noted Cameco had sought to avoid and minimise environmental impacts associated with the proposal. The EPA's highly complex assessment included extensive public consultation, a site visit, ongoing communication with Cameco and the careful and rigorous examination of key environmental factors.

Key environmental factors and principles

The EPA's assessment identified the following nine key environmental factors:

1. **Subterranean Fauna** – potential impacts from loss of habitat due to dewatering and excavation;
2. **Flora and Vegetation** – direct impacts from the clearing of flora and vegetation and indirect impacts on vegetation from groundwater drawdown and reinjection, and changes to surface water flows;
3. **Terrestrial Fauna** – potential impacts from the loss of habitat for conservation significant species from the clearing of vegetation;
4. **Human Health** – potential impacts from the increase in exposure to radiation on human health of workers, residents at nearby sensitive receptors and along the transport route;
5. **Hydrological Processes** – potential impacts from drawdown and reinjection of groundwater, and potential changes in surface flow regimes;
6. **Inland Waters Environmental Quality** – potential changes in water quality from changes in surface flow regimes and seepage from the TSF;
7. **Heritage** – potential impacts to Aboriginal heritage related to the physical and biological aspects of the environment;
8. **Rehabilitation and Decommissioning** (integrating factor) – potential long-term impacts if rehabilitation and closure of the TSF is unsuccessful, and potential long-term impacts to aquifer water quality from seepage from the TSF; and
9. **Offsets** (integrating factor) – to counterbalance the significant residual impacts to threatened flora.

Assessment and conclusion

Of the nine factors assessed, one – Subterranean Fauna – was unable to meet the EPA's environmental objectives. The other eight factors, including potential impacts to Flora and Vegetation and to Human Health, as well as Rehabilitation and Decommissioning, met the objectives.

Subterranean Fauna

Subterranean fauna ('below ground fauna') are generally of two types: stygofauna, which occur below the water table, and troglofauna, which occur below ground but above the water table. The proposal has the potential to directly impact subterranean fauna by the removal of habitat during mining and temporary removal of habitat (stygofauna) during dewatering.

The EPA notes that Cameco has addressed the policy and guidance considered relevant for this factor. It has applied the mitigation hierarchy consistent with the WA Government's Offsets Policy by identifying measures to avoid, minimise and rehabilitate environmental impacts through a range of proposed actions. These include preserving 10.5 ha of the ore body to retain troglofauna habitat, avoiding impacts to subterranean fauna habitat within the north-west palaeo-channel beyond the influence of the proposal, developing a Subterranean Fauna Management Plan, and through pumping optimisation and the strategic location of abstraction wells. The proponent has also proposed to ensure that groundwater drawdown is not greater than what was predicted. It also proposes that 57 per cent of the priority ecological community (PEC) subterranean habitat (by volume) would remain.

The EPA considers that suitable evidence for a wider distribution was not available for all the species (11 stygofauna taxa and one troglofauna taxa) apparently restricted to the Impact Area and therefore uncertainty still remains when predicting the distributions of species. The EPA notes further that three of the 11 stygofauna species only known from the Impact Area had relatively high capture rates, which provides a greater degree of certainty that these species may be restricted and may not be an artefact of sampling. The EPA is of the view that there remains too great a chance of a loss of species that are restricted to the Impact Area and therefore considers that the impact is such that the proposal should not be implemented.

The EPA concludes that the proposal cannot be implemented to meet its environmental objective in relation to Subterranean Fauna having regard for the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity* and the *Principle of intergenerational equity*.

Flora and Vegetation

The EPA notes that the proponent has addressed the policy and guidance relevant to this factor. It considers that the impacts on Flora and Vegetation are acceptable and that the proposal can be managed to meet the EPA's objective for this factor provided conditions are imposed. These include avoidance of direct and indirect impacts to the Eastern population of *Atriplex yeelirrie*, the fencing and de-stocking of cattle, avoidance where possible of Priority 1 flora

species, and minimisation of impacts to Priority 3 flora species and some vegetation units. An offset condition to counterbalance the significant residual impact of the loss of 84,510 *A. yeelirrie* plants was considered to be appropriate by the EPA.

Human Health

The EPA notes that there is an extensive technical guidance framework for assessing radiological impacts on human health. The proponent undertook an assessment of radiation exposure to permanent residents located up to 62 km from the proposed mine site, to a person in a car travelling behind a shipping container with uranium oxide concentrate (UOC) and to a person standing on the side of a road as every truck transporting UOC passes in a year. The radiation doses from radon decay products, and from dust containing radionuclides which may be inhaled, were predicted using air quality modelling. The doses from radionuclides that may be ingested were calculated, using the assumption that locally produced plant and meat was consumed for a full year. As such, the EPA concluded that radiation exposure to mine-site workers and members of the public would be well within regulatory dose limits and radiation could be adequately regulated.

Rehabilitation and Decommissioning

The EPA notes that the proponent has addressed the current policy and guidance considered to be relevant for this factor. It considers that the proposal can be managed to meet its objective for Rehabilitation and Decommissioning provided a Mine Closure Plan is prepared, regularly updated, effectively implemented, and made publicly available. Other conditions would require further research on the tailings storage facility such as the updating and refining of groundwater transport models and landform evolution (erosion) models.

Other advice

Whilst the EPA concludes that the proposal cannot be implemented, it remains at the EPA's discretion to offer other advice in the event that the Minister decides that the proposal may be implemented.

In this context, if the Minister determines that the proposal may be implemented, the EPA advises that the Ministerial approval should be subject to those conditions set out in Appendix 6 of this report for the following key environmental factors: Flora and Vegetation; Terrestrial Fauna; Hydrological Processes; Inland Waters Environmental Quality; Heritage; Rehabilitation and Decommissioning; and Offsets.

The Ministerial approval should also include appropriate conditions regarding the impacts on subterranean fauna.

Uncertainty surrounding the potential for serious or irreversible damage to subterranean fauna species may be mitigated by further scientific investigation, research and study to determine if the restricted species either extend beyond the Impact Area of the proposal, or a compelling case is made that their habitat is continuous and extensive well beyond the Impact Area.

The EPA considers that an industry-funded research program with the long-term aim of reducing uncertainty surrounding the conservation of subterranean fauna species in the presence of mining may assist with improving the currently limited scientific understanding of subterranean fauna across the State and inefficient sampling methods. A commitment by the proponent to support such a program could potentially and indirectly offset the local impacts it might have on subterranean fauna at Yeelirrie to the broader benefit of subterranean fauna conservation state-wide.

Finally, in relation to Flora and Vegetation, the EPA advises that the establishment of a Conservation Area over the Eastern population of the Threatened Flora species *A. yeelirrie* should be investigated to determine the best option to ensure its long-term protection.

Recommendations

That the Minister for Environment notes:

- the report on the key environmental factors of Subterranean Fauna, Flora and Vegetation, Terrestrial Fauna, Human Health, Hydrological Processes, Inland Waters Environmental Quality, Heritage, Rehabilitation and Decommissioning, and Offsets, set out in Section 3;
- that the EPA has concluded that the proposal cannot meet the EPA's environmental objectives for Subterranean Fauna, having regard to the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity*, and the *Principle of intergenerational equity* and therefore should not be implemented;
- the EPA's other advice presented in Section 5 and Appendix 6 about conditions, should the Minister determine that the Proposal may be implemented.

1. Introduction and background

This report provides the advice and recommendations of the EPA to the Minister on outcomes of the EPA's environmental impact assessment of the proposal by Cameco Australia Pty Ltd to mine and process uranium ore at Yeelirrie. The Minister has nominated Cameco Australia Pty Ltd as the proponent responsible for the proposal.

Section 44 of the EP Act requires that the EPA prepare a report on the outcome of its assessment of a proposal and provide this assessment report to the Minister. The report must set out:

- what the EPA considers to be the key environmental factors identified in the course of the assessment; and
- the EPA's recommendations as to whether or not the proposal may be implemented and, if the EPA recommends that implementation be allowed, the conditions and procedures that should apply.

The EPA may also include any other information, advice and recommendations in the assessment report as it thinks fit.

The aims of environmental impact assessment and the principles of environmental impact assessment considered by the EPA in its assessment of this proposal are set out in the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2012*.

Cameco referred the proposal for the Yeelirrie Uranium Project to the EPA on 12 November 2014. On 15 December 2014, the EPA set the level of assessment at Public Environmental Review (PER) with a 12-week public review period. The Environmental Scoping Document (ESD) for the proposal was approved on 10 April 2015 and the PER was released for public review from 21 September 2015 to 14 December 2015.

It was determined to be a controlled action due to its potential impacts on the following Matters of National Environmental Significance (MNES):

- Listed threatened species and communities (section 18 & 18A);
- Listed migratory species (section 20 & 20A); and
- Nuclear actions (section 21 & 22A).

The proposal is being assessed as an accredited assessment under Section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Appendix 7 contains a summary of submissions from the public review period and the proponent's response to submissions (on CD at the back of this report and at www.epa.wa.gov.au). It is included for information only and does not form part of the EPA's report and recommendations. Relevant significant

environmental issues identified from this process have been taken into account by the EPA during its assessment of the proposal.

This report provides the EPA advice and recommendations in accordance with section 44 of the EP Act.

2. The proposal

2.1 Proposal summary

Cameco Australia Pty Ltd (the proponent) proposes to develop an open pit mine for uranium ore and associated processing facilities at Yeelirrie in the Northern Goldfields region of Western Australia, approximately 420 kilometres (km) north of Kalgoorlie-Boulder, and 70 km south-west of Wiluna (Figure 1).

The proposal, if approved, would be located within a 4,875 hectare (ha) development envelope (Figure 2), in which there would be 2,422 ha of direct disturbance. There would be two open pits totalling approximately nine kilometres in length, up to 1.5 km wide and up to 15 metres (m) deep (Figure 2). The open pits would be dewatered, mined and backfilled progressively throughout the life of the mine. Prior to commencement of processing, abstracted water from dewatering of active mine areas would be reinjected into areas to be mined in the future. Once processing commences, the output from dewatering would be used to supplement process water supply instead of being reinjected.

The ore and waste rock would be stockpiled near the open pit. Ore would be processed within the metallurgical plant, and waste rock backfilled into the pit. The metallurgical plant would use an alkali tank leaching process, followed by direct precipitation, to produce up to 7,500 tonnes per year of uranium oxide concentrate (UOC) for containerised road transport and export from Port Adelaide. All tailings generated during the metallurgical processing of the ore would be returned to the tailings storage facility (TSF) constructed within the two open pits.

The proposal includes the construction and operation of infrastructure (Figure 3) required to support mining and processing, including the supply of water (from pit dewatering and a borefield) and electricity, workforce accommodation and infrastructure to transport the product.

At the completion of operations, the pit would be backfilled and capped with an engineered cover, development infrastructure would be decommissioned and removed, and the site would be rehabilitated.

The main characteristics of the proposal are summarised in Tables 1 and 2 below, consistent with Environmental Assessment Guideline (EAG) No. 1 *Defining the Key Characteristics of a Proposal*. A detailed description of the proposal is provided in section 6 of the PER document (Cameco 2015).

Table 1: Summary of key proposal characteristics

Proposal Title	Yeelirrie Uranium Project
Short Description	<p>The proposal is to mine uranium ore from the Yeelirrie deposit, approximately 70 km south-west of Wiluna, and the construction of associated mine infrastructure, including ore processing facilities, water (includes borefield and corridors) abstraction and reinjection infrastructure, roads, accommodation, offices and workshops, stockpile and laydown areas and evaporation pond. Tailings would be discharged into the mine open pit.</p> <p>Export of the uranium oxide concentrate (UOC) would be through a port outside of Western Australia permitted for the export of UOC.</p>

Table 2: Location and proposed extent of physical and operational elements.

Element	Location	Authorised Extent
Mine open pit	Pit extent in Figure 2	Clearing of no more than 726 ha within a 4,875 ha development envelope
Associated infrastructure	Figure 3	Clearing of no more than 1,696 ha within a 4,875 ha development envelope
Tailings disposal	Within Pit – Figure 3	Disposal of no more than 3.0 Mtpa in pit
Water abstraction	Dewatering of pits and production from bore field	Abstraction of no more than 4.9 GL/a
Water reinjection		Reinjection of no more than 1.3 GL/a

Definitions: ha – hectare; Mtpa – million tonnes per annum; GL/a – gigalitre per annum

The potential impacts of the proposal on the environment and their proposed management are summarised in Table E-3 (Executive Summary) in the PER document (Cameco 2015).

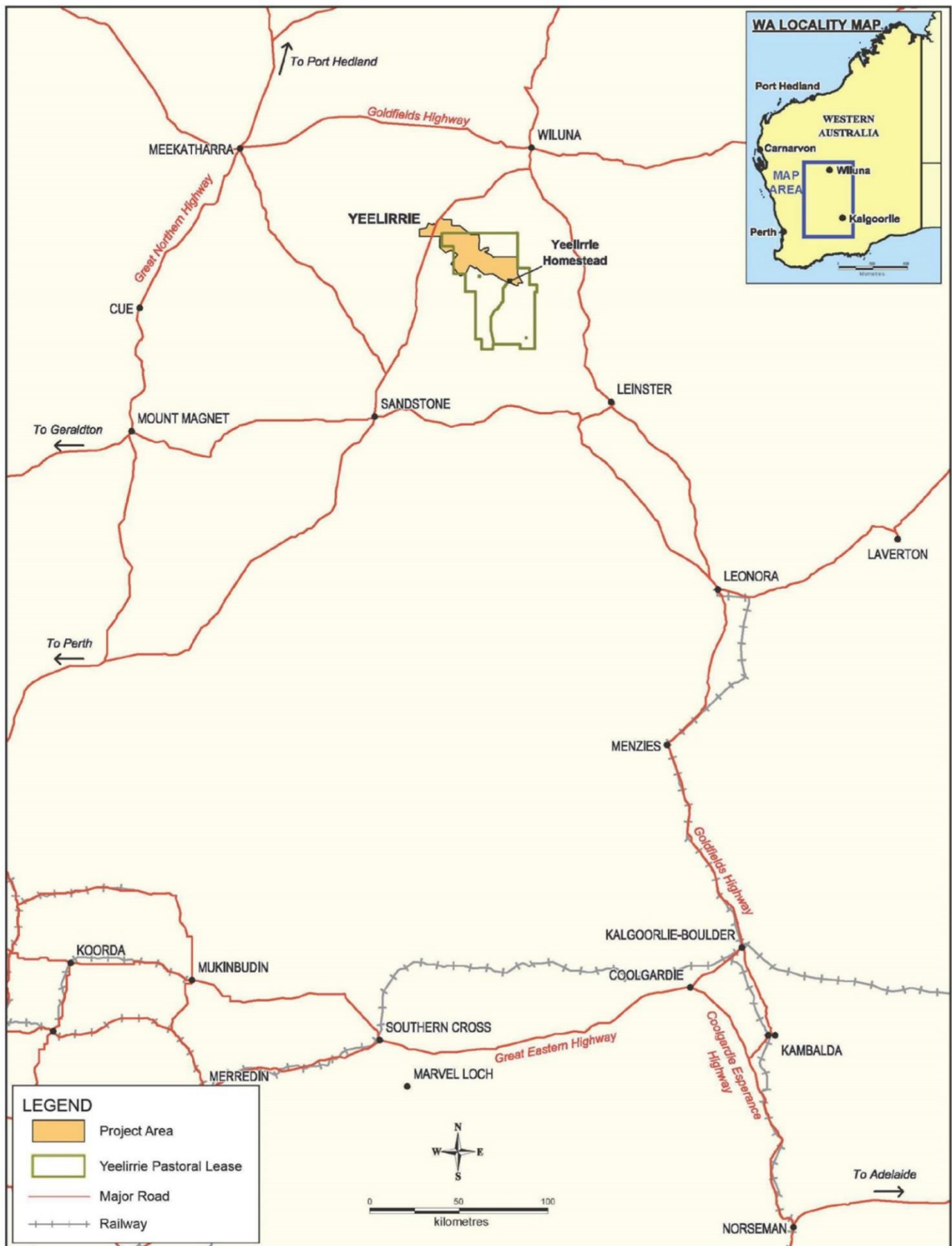


Figure 1: Proposal location

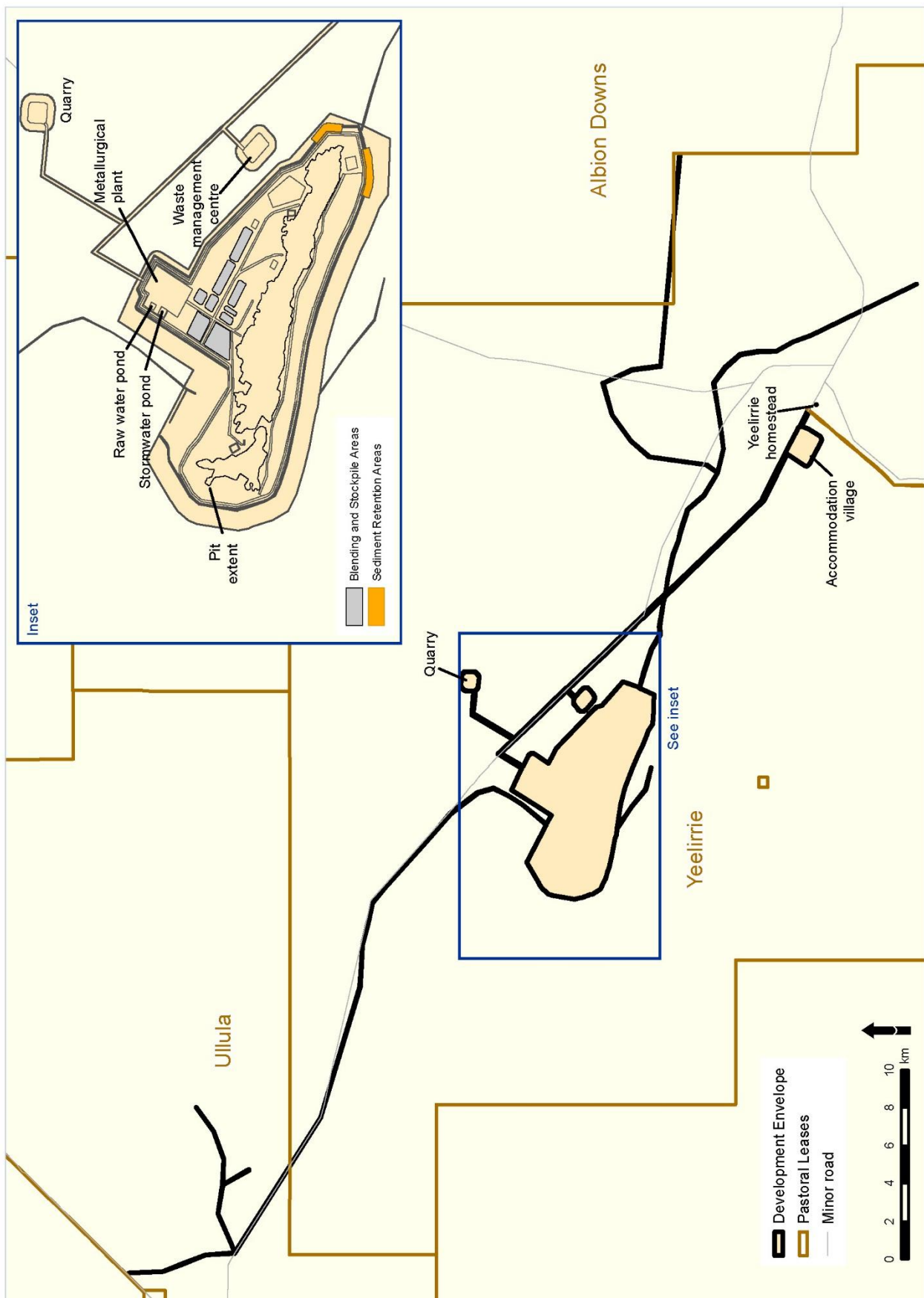


Figure 2: Development Envelope

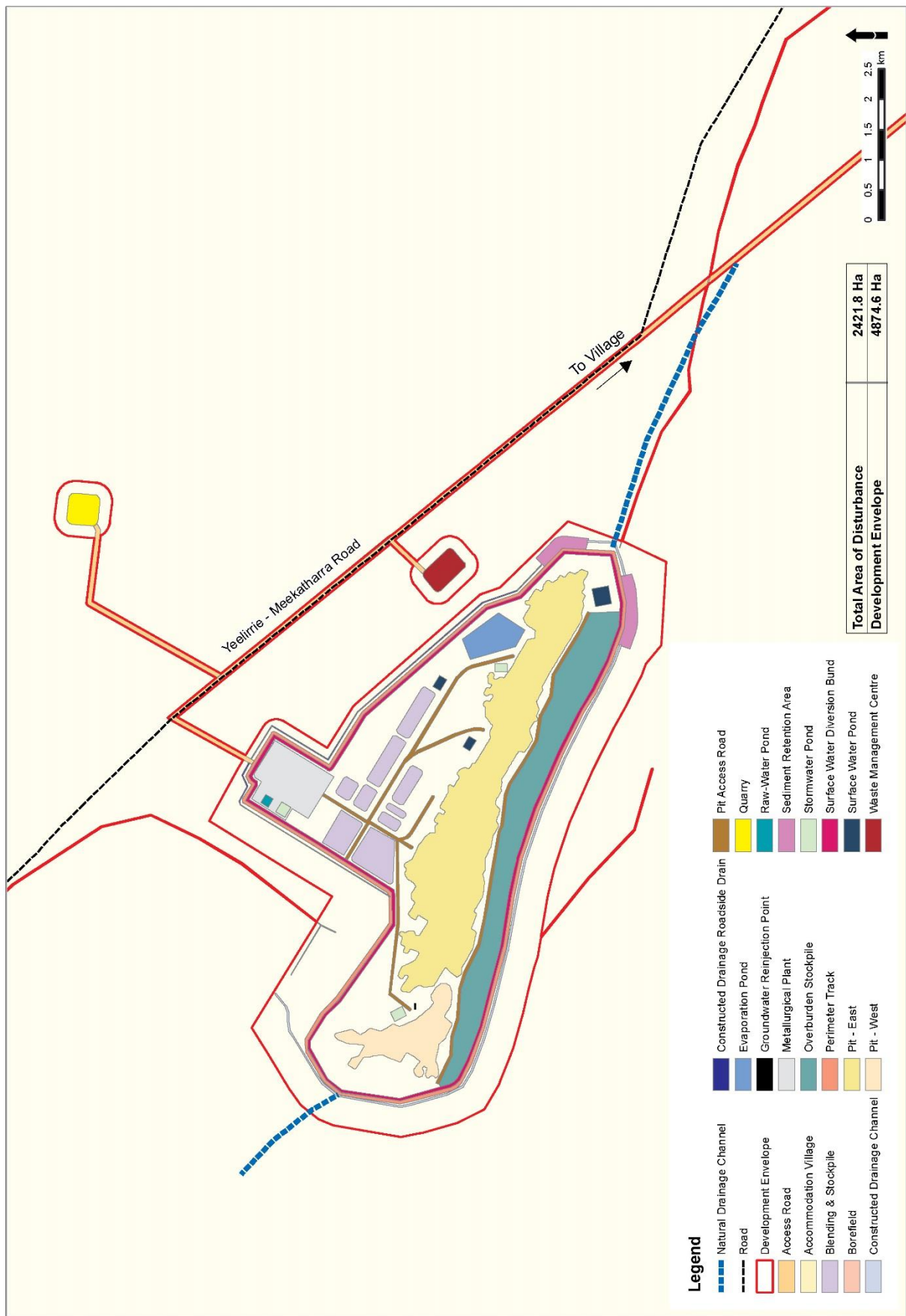


Figure 3: Indicative Footprint

2.2 Consultation

Nine agency submissions, 169 public submissions, and 2,946 pro forma submissions were received during the public review period. The key issues raised relate to:

- potential impacts to subterranean fauna, noting the potential loss of species;
- potential impacts on the Rare Flora *Atriplex yeelirrie* (previously known by the phrase name *Atriplex* sp. Yeelirrie Station (L. Trotter & A. Douglas LCH 25025));
- potential radiological impacts to human health and non-human biota;
- potential impacts on Short Range Endemics (e.g. Shield-backed Trapdoor Spider);
- concerns with dust and air quality;
- potential problems with how the release of solutes from the TSF had been simulated;
- concerns about the water usage for a region of poor water supply and poor water security;
- concerns regarding the transport of uranium;
- potential impacts to livelihood as a result of living near the proposed mine;
- concerns regarding the consideration of Aboriginal Heritage;
- the consideration of cumulative environmental impacts of uranium projects; and
- the limited presentation of Management Plans with the PER document.

Issues raised were addressed by the proponent in the Response to Submissions document received by the EPA on 14 June 2016 (Cameco 2016, Appendix 7).

In assessing the Proposal and considering the submissions, the EPA also notes that the proponent has sought to avoid and minimise environmental impacts associated with the Proposal by:

- avoiding unnecessary clearing and minimising habitat loss in accordance with a Flora and Vegetation Management Plan;
- avoiding and reducing impacts to the eastern population of *A. yeelirrie* by implementing a management plan;
- avoiding additional ground disturbance by using mined-out pits as tailings storage facilities;
- avoiding unnecessary radiation exposures by implementing 'as low as reasonably achievable' radiation management measures;

- minimising erosion of tailings and radon emissions by storing tailings below ground and partly below the water table;
- minimising impacts to subterranean fauna by avoiding the location of abstraction wells in the palaeo-channel to the north-west of the mine pit;
- developing a Surface Water Management Plan to minimise impacts on surface water and avoid release of contaminants to the environment; and
- rehabilitating the site by demolishing and removing equipment and implementing a Mine Closure Plan that includes rehabilitation objectives and completion criteria developed in consultation with key stakeholders.

2.3 Regional context

The proposal is located in the Murchison bioregion and in the Eastern Murchison (MUR1) subregion. Land use in the area surrounding the proposed site is typical to the Northern Goldfields area and consists predominantly of mining activities, pastoral stations and conservation reserves.

In the PER document the proponent addressed the regional and cumulative impacts of other project in the vicinity with the potential to impact the same receptors. This analysis concluded that there are no operating mining projects within a 50 km radius of Yeelirrie, while a number of operating mines (including Mt Keith, Leinster and Agnew) and a number of proposed projects (including the Extension to the Wiluna Uranium Project) are within 150 km of Yeelirrie.

Potential regional and cumulative impacts may relate to Flora and Vegetation in the Murchison bioregion. The EPA notes that the proposed cumulative impact to the Cosmo, Cunyu, Melaleuca and Mileura Land Systems from the proposal and the Mount Keith, Barrambie Vanadium, Wiluna Uranium, and the proposed Extension to the Wiluna Uranium Project are expected to be less than 1.5%. The threatened flora species of *Atriplex yeelirrie* proposed to be impacted by the proposal is only known from within the Yeelirrie Pastoral Lease. Noting the proposed impacts above, EPA considers that cumulative and regional impacts from the proposal, should it be implemented, are not significant.

3. Key environmental factors

In assessing this proposal and preparing its report and recommendations, the EPA has had regard for the object and principles contained in s4A of the EP Act to the extent relevant to the particular matter being considered. Appendix 3 provides a summary of these principles and how the EPA applied them.

Having regard to:

- the proponent's PER document;
- public and agency comments on the PER document;

- the proponent's response to submissions;
- the EPA's own inquiries;
- EAG No. 8 *Environmental Principles, Factors and Objectives* (EPA 2015a); and
- EAG No. 9 *Application of a Significance Framework in the Environmental Impact Assessment Process* (EPA 2015b),

the EPA identified the following key environmental factors in its assessment:

1. **Subterranean Fauna** – potential impacts from loss of habitat due to dewatering and excavation of mine pits;
2. **Flora and Vegetation** – direct impacts from the clearing of flora and vegetation and indirect impacts on vegetation from groundwater drawdown and reinjection, and changes to surface water flows;
3. **Terrestrial Fauna** – potential impacts from the loss of habitat for conservation significant species from the clearing of vegetation;
4. **Human Health** – potential impacts from the increase in exposure to radiation on human health of workers, residents at nearby sensitive receptors and along the transport route;
5. **Hydrological Processes** – potential impacts from drawdown and reinjection of groundwater, and potential changes in surface flow regimes;
6. **Inland Waters Environmental Quality** – potential changes in water quality from changes in surface flow regimes and seepage from the TSF;
7. **Heritage** – potential impacts to Aboriginal heritage related to the physical and biological aspects of the environment.

The EPA also identified the following integrating factors during its assessment:

8. **Rehabilitation and Decommissioning**– potential long-term impacts if rehabilitation and closure of the TSF is unsuccessful, and potential long-term impacts to aquifer water quality from seepage from the TSF; and
9. **Offsets**– to counterbalance the significant residual impacts to threatened flora.

Other environmental factors relevant to the proposal, which the EPA determined were not key environmental factors, are discussed in the proponent's PER document (Cameco 2015).

Appendix 3 contains the environmental factors identified in the assessment and the EPA's evaluation concerning key environmental factors. This includes those identified as preliminary key environmental factors at Level of Assessment which were included in the ESD and addressed in the proponent's PER document.

The EPA's assessment of the proposal's impacts on the key environmental factors is provided in Sections 3.1 - 3.9. These sections outline the EPA's conclusions as to whether or not the proposal can be managed to meet the EPA's objective for a particular factor and, if so, the recommended conditions and procedures that should apply if the proposal is implemented.

In assessing this proposal, the EPA has also considered relevant published EPA policies and guidelines. Appendix 4 lists the relevant policies and guidance documents for each of the key environmental factors for this assessment and identifies the relevant matters discussed in, and principles derived from, each policy and guidance document. The EPA has discussed the application of the relevant policy and guidance for each factor in Section 3.

The EPA notes that the following policy and guidance relating to the key environmental factors replaced or amended policy and guidance since the ESD was released in April 2015:

- EAG No 8 *Environmental Principles, Factors and Objectives* (EPA 2015a);
- EAG No. 9 *Application of a Significance Framework in the Environmental Impact Assessment Process* (EPA 2015b);
- *Guidelines for preparing mine closure plans* (DMP & EPA 2015);
- Environmental Protection Bulletin No. 19 EPA involvement in mine closure (EPA 2015e).
- EAG No. 17 *Preparation of Management Plans under Part IV of the Environmental Protection Act 1986* (EPA 2015d).
- EAG No. 11 *Recommending environmental conditions* (EPA 2015c).
- Environmental Protection Bulletin No. 24 *Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process* (EPA 2015f).

The proponent considered the current policy and guidance in its PER and the EPA considered the above current policy and guidance in its assessment.

The EPA notes that other published policies and guidelines were also considered.

As the EPA is assessing the Proposal on behalf of the Commonwealth Government as an accredited assessment under Section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), this report also addresses Matters of National Environmental Significance (MNES) in Section 4. Commonwealth policy and guidance also applies to the accredited assessment of this proposal. Appendix 4 outlines the survey guidelines, conservation advice, species-specific recovery plans, and threat abatement plans for species listed under the EPBC Act that are relevant for this assessment, consistent with the requirements of the ESD for the proposal (see also Section 4 Matters of National Environmental Significance). In its assessment, the EPA had regard

to the relevant Commonwealth guidelines, policies and plans relating to this proposal.

3.1 Subterranean Fauna

EPA objective

The EPA's environmental objective for Subterranean Fauna is *to maintain representation, diversity, viability and ecological function at the species, population and assemblage level.*

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Subterranean Fauna for this assessment and the relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 54a – *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*, (EPA 2007); and
- Environmental Assessment Guideline No. 12 – *Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013).

EPA assessment

The EPA notes that the proponent has addressed the policy and guidance considered relevant for this factor in the PER document.

Subterranean fauna ('below ground fauna') are generally of two types: stygofauna, which occur below the water table, and troglafauna, which occur below ground but above the water table. The proposal has the potential to directly impact subterranean fauna by the removal of habitat during mining. Subterranean fauna might also be affected by surface disturbance that disrupts nutrient inputs, process chemical spills and changes to groundwater levels or quality.

Stygofauna

The proposal intersects the Priority 1 priority ecological community (PEC) No. 49 known as '*Yeelirrie calcrete groundwater assemblage type on Carey palaeo-drainage on Yeelirrie Station*', which is considered to have unique assemblages of invertebrates that have been identified in the groundwater calcretes. There are no threatened ecological communities (TECs) for subterranean fauna in the vicinity of the Development Envelope.

In its Response to Submissions document (Cameco 2016), Cameco proposed a boundary for PEC No. 49 following advice from the Department of Parks and Wildlife (Parks and Wildlife) (Figure 4). Parks and Wildlife advised that the

boundary appears to be reasonably logical in relation to the core distribution of subterranean fauna.

Seventy-three stygofauna species have been recorded within the Subterranean Fauna Study Area (refer to Figures 5 and 6) at Yeelirrie, with:

- three species also known from other calcretes in the Yilgarn region;
- possibly one of the species of *Halicyclops* cf. *eberhardi* (most likely sp. A) also known from other calcretes located outside the Development Envelope;
- 16 species found only inside the calcrete area;
- eight species found only inside the inferred playa area;
- 18 species common to the calcrete and playa areas; and
- 27 species found only in the sandplain areas (alluvium and colluvium around the calcrete).

The EPA considers that sampling and survey methods used for subterranean fauna for this proposal were consistent with the requirements of Environmental Assessment Guideline 12 and Guidance Statement 54a.

The calcrete bodies in the palaeo-valleys of the Yilgarn are rich in stygofauna. Stygofauna occur in a range of habitats in the Yilgarn beyond palaeo-valleys, but sampling to date suggests that species richness in other habitats is lower than in the calcrete and associated alluvium and colluvium found in palaeo-valleys (Cameco 2015).

Calcrete is considered to be the main stygofauna habitat found within the Subterranean Fauna Study Area at Yeelirrie. The calcrete is considered to represent a subterranean 'island' and species dispersal to other calcrete systems may be low. The 73 stygofauna species represent the greatest stygofauna richness known from the Yilgarn (Cameco 2015). This is likely to be partly due to the high level of sampling effort there.

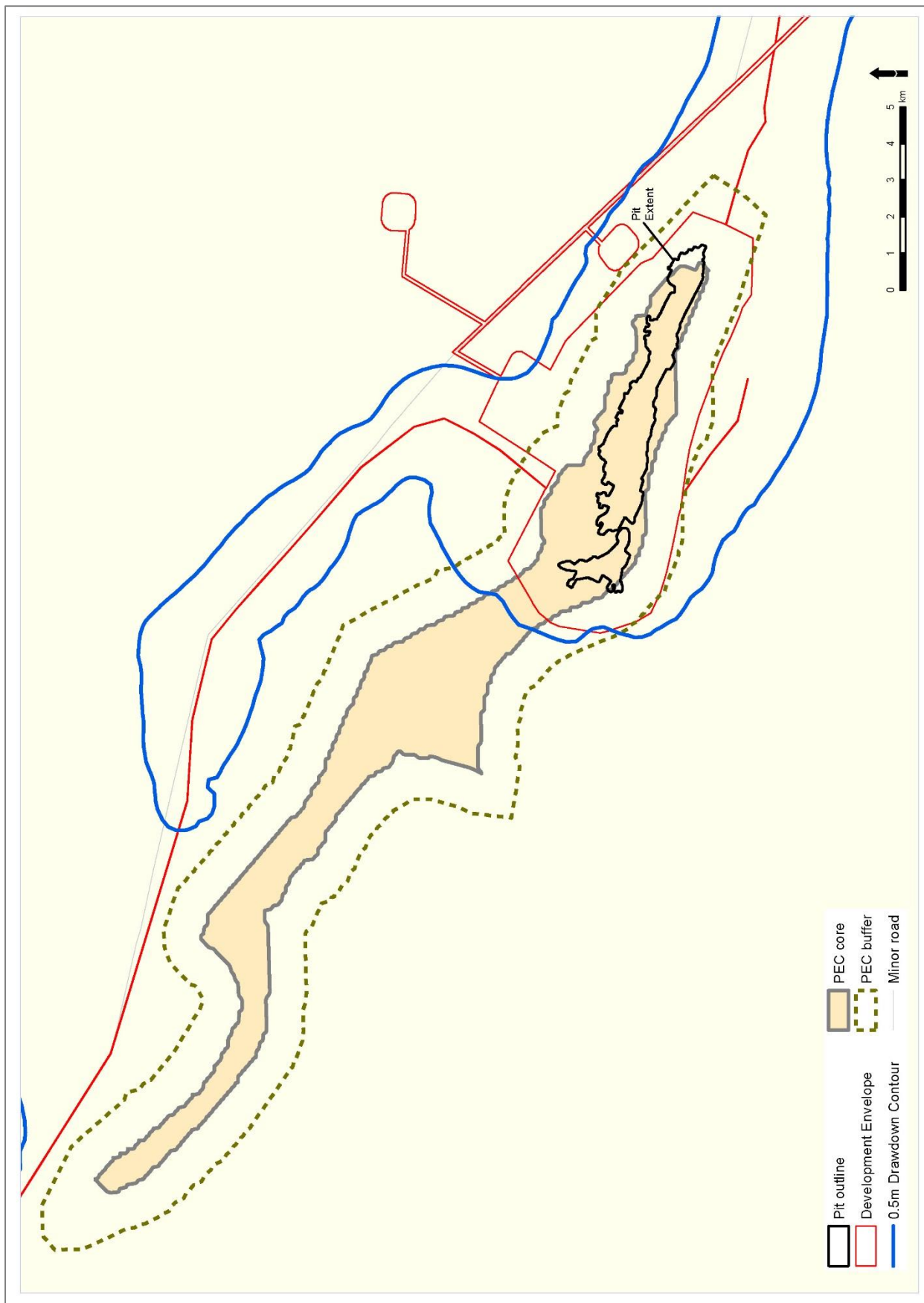


Figure 4: Proposed extent of the Yeelirrie PEC

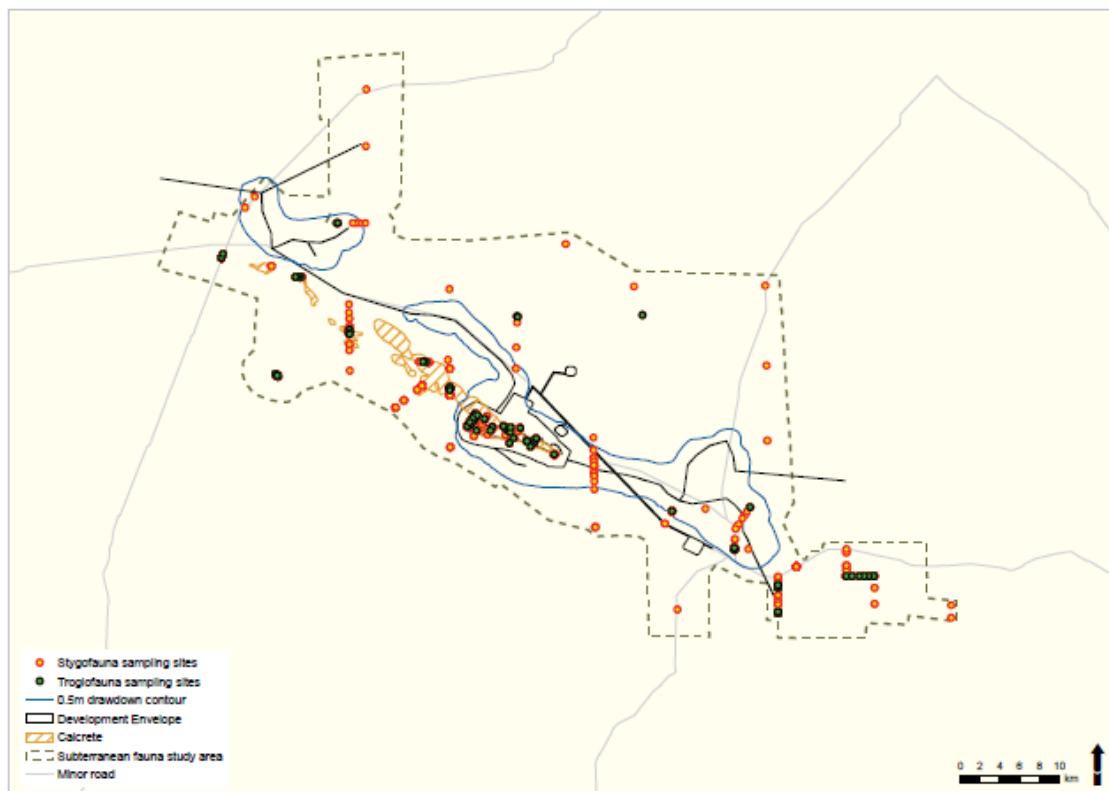


Figure 5: Subterranean Fauna Study Area

Cameco (2015) reported that several factors combine to create a highly variable, three-dimensional mosaic of subterranean microhabitats within the Development Envelope (Cameco 2015). Important factors include physical structure (comprising a complex structure with variable sized voids), chemistry (especially salinity which varies both horizontally and vertically), hydrological processes (annual and seasonal changes in groundwater levels, flows, recharge, and discharge) and interaction with the ground surface (e.g. infiltration, availability of vegetation roots and other organic matter, and level of nutrients and oxygen).

Depth to the water table is about five metres in the area of the proposed mine pit and about 10 m north-west of the mine pit. The thickness of saturated calcrete where stygofauna may occur (stygofauna habitat) is mostly three to five metres but reaches 13 m in the north-west, while some other small parts of the Development Envelope have very little saturated calcrete. Figure 7 shows the predicted change in groundwater level and the fraction of the aquifer (potential stygofauna habitat) that is expected to be impacted or lost. The modelled drawdown fraction is 100 per cent of the aquifer thickness for some six kilometres of the palaeo-channel and reaches 30 per cent about 2.5 km up-flow and 23 per cent about 10.5 km down-flow of the pits. Overall, the modelled Yeelirrie palaeo-channel extends for about 48 km. Groundwater recovery is predicted in 50 to 100 plus years after mining finishes (see Section 3.5 of this report). The EPA notes that while removal of habitat through the development

of the pits would be permanent, it is unclear if the restoration of groundwater levels would result in the re-establishment of subterranean fauna habitat.

Natural annual fluctuations of groundwater levels recorded during the 2011–2015 period have been low, with a variation of less than 0.1 m. It was noted, however, that recharge after a cyclonic event in early 2015 increased water levels about 2.5 m in the eastern part of the palaeo-channel but resulted in little change in the west (Cameco 2015). Given that the thickness of saturated calcrete is mostly two to five metres, Cameco has adopted a precautionary threshold of greater than 0.5 m of groundwater drawdown as the level that may result in adverse impacts to subterranean fauna taxa. Parks and Wildlife noted in its submission that the proposed 0.5 m drawdown threshold is five times greater than natural variation, and drawdown in the vicinity of the 0.5 m contour would affect areas with very limited habitat thickness. In noting that large flooding events may have a greater impact on natural variations of groundwater levels, the EPA considers the threshold of greater than 0.5m groundwater drawdown to be reasonable in assessing the impact to stygofauna.

Of the 73 stygofauna species recorded, 11 species are currently only known from the Impact Area (where the drawdown is greater than 0.5 m, including the mine pits) (Figure 6).

The proponent, in its Response to Submissions document (Cameco 2016), considers that each of the species restricted to the Impact Area may actually have ranges wider than the Impact Area, based on its evaluation of biological surrogates and habitat evidence. Cameco's analysis includes inferences that species similar to those recorded within the Impact Area are known to have broad ranges in other settings, that similar species tolerate a range of salinity levels, and that the Yeelirrie habitat types occur elsewhere and thus species now known from a limited area may also occur in those other habitats.

The EPA notes that the reference to surrogates in the proponent's response to submissions is not consistent with the use of surrogates in EAG 12 (EPA 2013). The EPA notes that there is a level of uncertainty remaining when predicting the distributions of the species apparently restricted to the Impact Area. The EPA further notes that three (*Halicyclops* cf. *eberhardi* sp. B, *Novanitocrella 'araia linec'* ssp. n., and *Kinnecaris lined*) of the 11 stygofauna species only known from the Impact Area, had higher capture rates (100 plus specimens) which provides a greater degree of certainty that these species may be restricted and may not be an artefact of sampling.

Submitters considered that the impact of the mine and groundwater dewatering pose an unacceptable risk that could see a number of subterranean fauna species become extinct. Submitters also stated that, given the larger number of surveys undertaken compared to other projects with stygofauna, if species were more widespread, they would surely have been found.

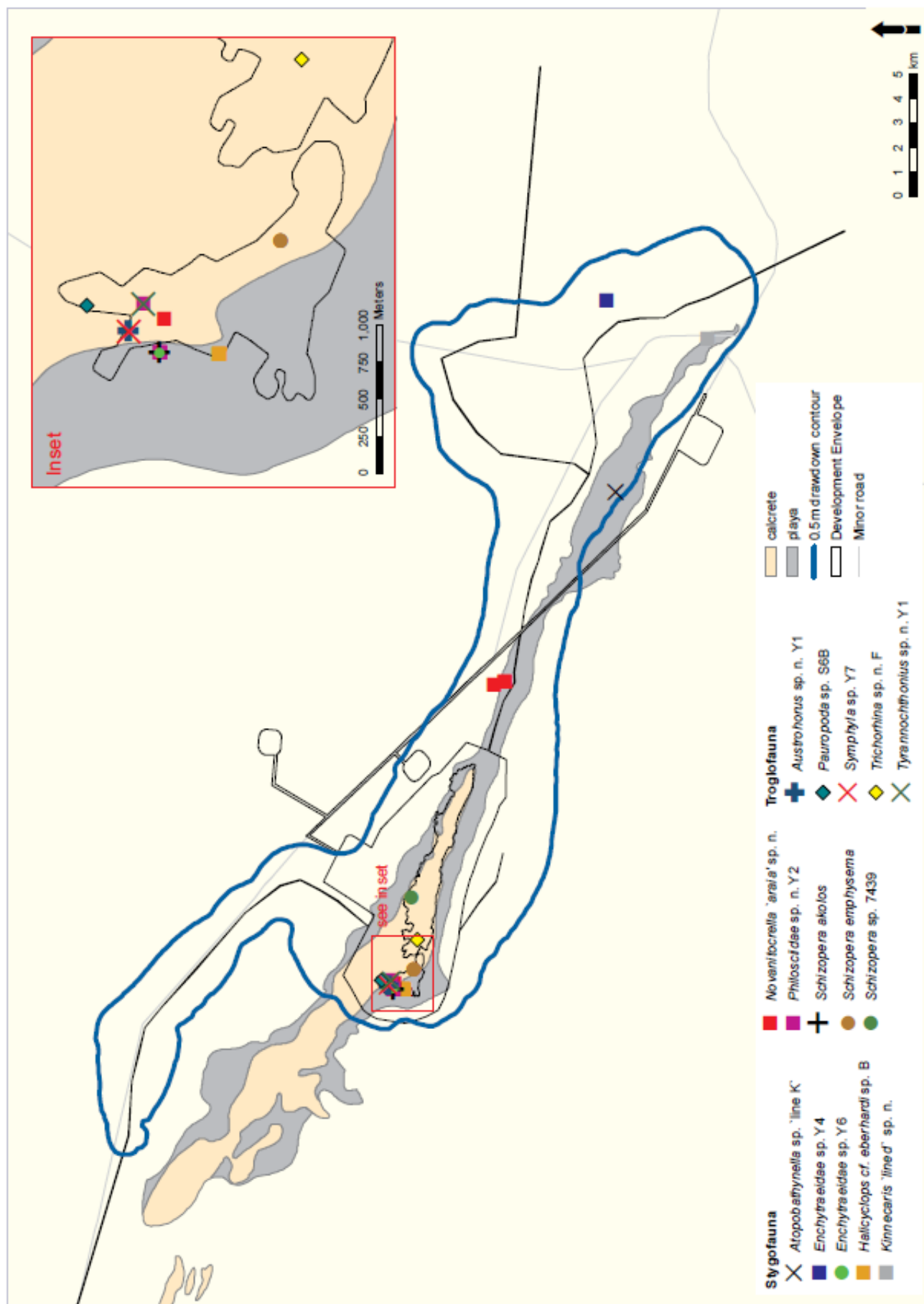


Figure 6: Subterranean fauna species only known from the Impact Area

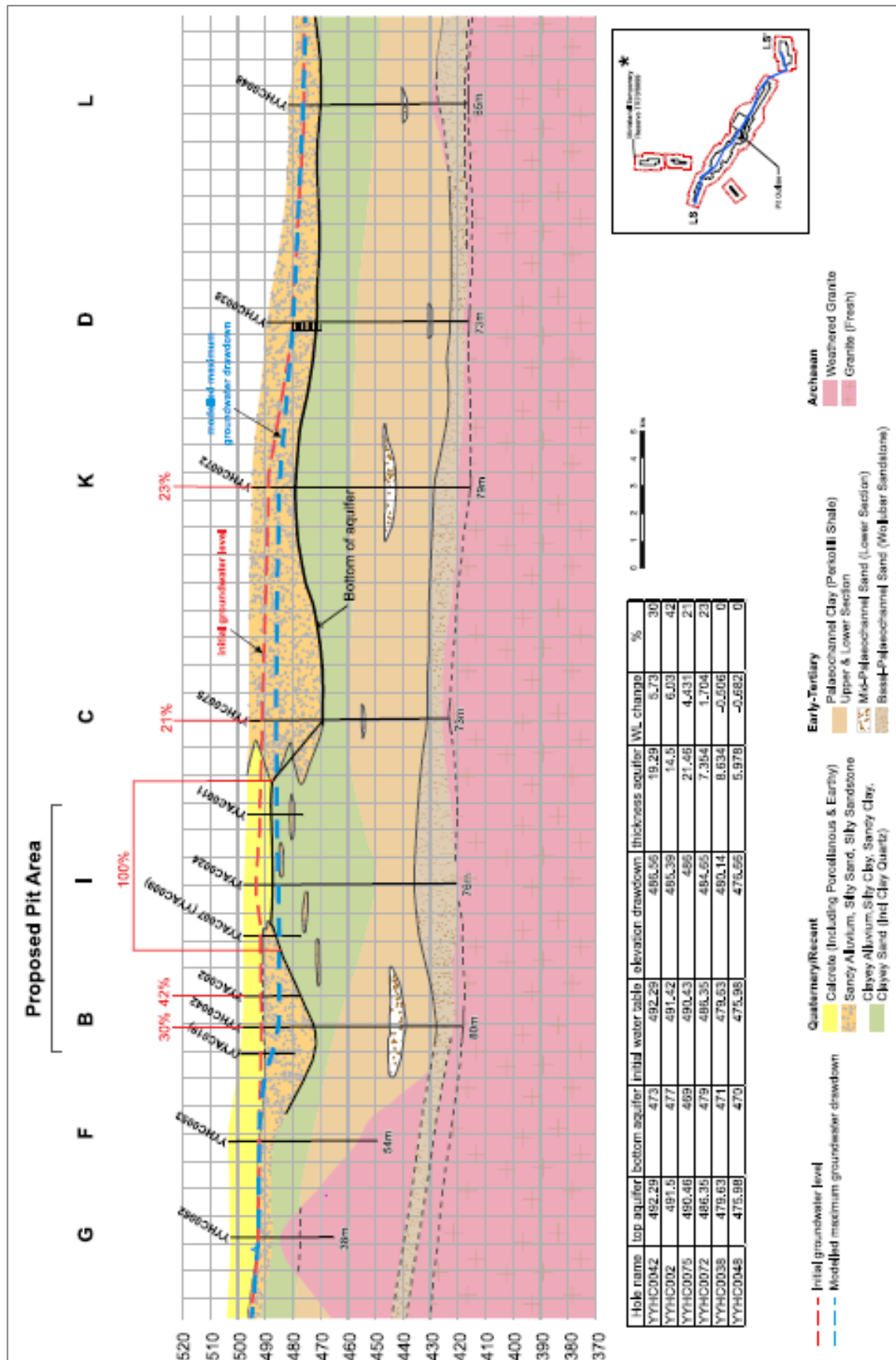


Figure 7: Longitudinal cross section showing predicted change in groundwater level and aquifer thickness

The EPA notes that Cameco has presented well considered mitigation and management strategies given the uncertainty with the assessment of stygofauna impacts. In regard to a commitment by the proponent to protect stygofauna habitat within the north-west palaeo-channel, away from the influence of the proposal, the EPA notes that it is uncertain if the proposed protection of stygofauna fauna habitat within the north-west palaeo-channel would be adequate to mitigate the impacts to all species recorded only within the Impact Area, and to maintain the diversity of the assemblage associated with the Yeelirrie Proposal area.

Stygofauna community and habitat

Thirty-five stygofauna species were recorded within the PEC. The impacts to the stygofauna community (PEC No. 49) and habitat are summarised in Table 3 below. The data in Table 3 were provided by the proponent in its response to submissions made on the PER (Cameco 2016) and are included in Appendix 7 of this report.

Table 3: Area and volume of potential loss of habitat of PEC No. 49 covered by excavated pit and >0.5 m groundwater drawdown contour as a result of the Proposal

	Area	Area	Volume
PEC No. 49	4,184 ha	100%	100%
Excavated pit	721 ha	17%	20%
0.5 m drawdown*	1,056 ha	25%	23%
Pit + 0.5 m drawdown	1,777 ha	42%	43%

* Area and volume of >0.5 m drawdown contour that is not occupied by the pit.

In considering the data in Table 3 above and noting the complex nature of the habitat, the stygofauna species occurring in PEC No. 49 would not be expected to be evenly distributed throughout the PEC and different species may be confined to various areas across the PEC. There are no guidelines for what portion of a subterranean habitat may be lost while still retaining reasonable certainty that species dependent on that habitat can be conserved. As a result, the EPA considers that there is less certainty that protecting the remaining 57 per cent of the PEC habitat (volume) will mitigate impacts to species that may be restricted to the Impact Area.

Troglofauna

Forty-five troglofauna species have been recorded within the Subterranean Fauna Study Area at Yeelirrie (Bennelongia 2015), with:

- 11 species found only inside the inferred calcrete area;
- three species found only within the inferred playa area;
- eight species common to both the calcrete and playa areas (shown in Figure 6);
- 19 species found only in the sandplain areas (alluvium and colluvium around the calcrete);
- three species common to the calcrete and sandplain areas; and
- one species common to the playa and sandplain areas.

Troglofauna occur widely, at moderate species richness but in low abundance, in mineralised rocks of the Yilgarn. They may be abundant in the unsaturated zone of calcretes and may also occur in lower abundance in adjacent coarse alluvium. Troglofauna, like stygofauna, may be restricted to calcrete islands in the Yilgarn.

Troglofauna habitat in calcrete extends upwards from the water table to a point below the ground surface where relative humidity levels begin to decline and surface soil animals become abundant. This is considered likely to be two to three metres below ground surface at Yeelirrie, although troglofauna habitat may extend closer to the surface. Assuming conditions become suitable for troglofauna two to three metres below ground surface, troglofauna habitat is probably two to three metres thick across most of the calcrete and thicker in the north-west, where it may be up to 10 m thick. During periods of flooding, when the water table rises, the volume of troglofauna habitat would contract (Bennelongia 2015).

Initially five species of troglofauna were only known from the Disturbance Area (Figure 6) which includes the mine pits and other mine components as shown in Figure 3. However, with the commitment by Cameco (Cameco 2016) to establish a Troglofauna Protection Area (Figure 7), one troglofauna species (*Trichorhina* sp. n. F) is now only known from the Disturbance Area. The EPA notes that this species is restricted to the centre of the mine pit area (shown in Figure 8) outside the proposed Troglofauna Protection Area and, while its restriction may be an artifact of sampling, further work would be required to confirm a wider distribution.

The proposed Troglofauna Protection Area provides a minimum 50 m buffer to the known location of each of the four species protected by it. Covering an area of 10.5 ha, the protection area would be maintained for the life of the mine unless additional habitat mapping confirms that suitable habitat extends beyond the area of impact for these four species of troglofauna. If, based on scientific information that is sound and robust, additional habitat mapping demonstrates range extensions for the four species beyond the area of impact, then Cameco would seek approval to mine the additional 10.5 ha.

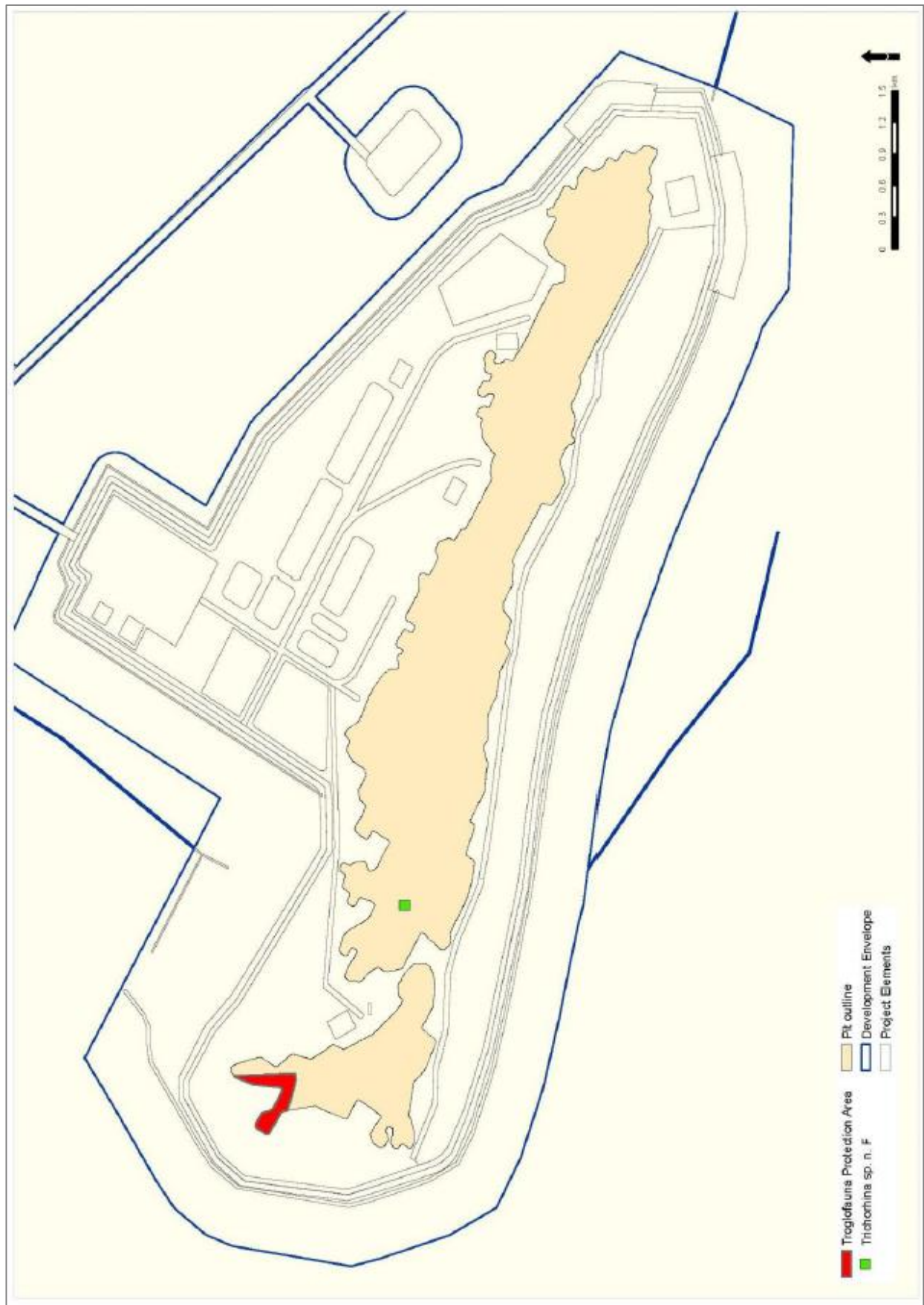


Figure 8: Troglafauna Protection Area

Management

Cameco has proposed the following management measures for Subterranean Fauna:

- the establishment of a Troglofauna Protection Area;
- protection of subterranean fauna habitat within the northwest palaeo-channel, outside the influence of the Proposal;
- the preparation and implementation of a Subterranean Fauna Management Plan (integrated closely with a Groundwater Management Plan), in accordance with EAG 17. The plan would include:
 - location of production and monitoring bores;
 - a detailed monitoring program for both water quality and groundwater levels;
 - collection of baseline data for both water quality and absolute water levels at the monitoring bore locations;
 - internal trigger criteria and threshold criteria for subterranean fauna management;
 - associated contingency actions; and
 - regulator reporting requirements.
- groundwater drawdown of 0.5 m not to extend beyond the 0.5 m drawdown contour as presented in Figure 9-17 of the PER document; and
- a commitment to investigate whether the impact on stygofauna species and suitable habitat can be further reduced through pumping optimisation and the strategic location of abstraction wells.

The EPA notes that the proponent has provided some analysis within its PER document (Cameco 2015) and its response to submissions document (Cameco 2016) to support the possibility that each of the 12 subterranean fauna species so far found only within the Impact Area (the pit and the surrounding >0.5 m groundwater drawdown contour) may have a wider distribution, based on the difficulty of sampling subterranean fauna, and an analysis of surrogate species.

The EPA concludes that a level of uncertainty remains as to whether a number of subterranean fauna species, particularly the three stygofauna fauna with higher capture rates that were confined to the Impact Area, may be found outside the Impact Area, assuming development within the proposed Troglofauna Protection Area is excluded from operations. As such, the EPA considers that there is too great a chance of a loss of species that are restricted to the Impact Area.

In having regard to the principles under section 4A of the EP Act, the EPA considers that the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity*, and the *Principle of intergenerational equity* are particularly relevant to the assessment of this factor. The EPA is of the view that the Proposal is not consistent with these

principles, due to the threat of serious and irreversible damage, and the degree of uncertainty that biological diversity would be conserved.

Summary

Having particular regard to the:

- (a) relevant EPA policy and guidance pertaining to Subterranean Fauna;
- (b) proponent's proposed avoidance, management and minimisation measures and its recognition of the need for offsets set out in its the PER document;
- (c) environmental issues raised in the public submissions;
- (d) subterranean fauna currently only found within the mine pit and surrounding >0.5 m groundwater drawdown contour (Impact Area excluding the Troglifauna Protection Zone) considered likely to be threatened by the proposal;
- (e) proponent's case for the potential for species currently only found within the Impact Area to be found elsewhere, based on its analysis of surrogate species;
- (f) EPA's conclusion that the proponent's analysis of surrogate species is not consistent with EAG 12 and other acceptable arguments for surrogates have not been made; and
- (g) uncertainty regarding whether the estimated 57 per cent of the habitat (volume) of PEC No. 49 proposed to be retained outside the Impact Area is sufficient to conserve all species dependent on that habitat,

the EPA considers that there is too great a chance of a loss of species restricted to the Impact Area. As a result, and having regard the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity* and the *Principle of intergenerational equity*, the EPA is of the view that the proposal cannot be managed to meet the EPA's objective for Subterranean Fauna, and therefore should not be implemented.

Subsequently, the EPA has not provided any conditions addressing the impact on subterranean fauna. Should the Minister determine that the proposal may be implemented, the EPA can provide advice on appropriate conditions to assist in addressing this impact (see Section 5 Other advice).

3.2 Flora and Vegetation

EPA objectives

The EPA's environmental objective for Flora and Vegetation is *to maintain representation, diversity, viability and ecological function at the species, population and community level.*

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Flora and Vegetation for this assessment and the relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 51 – *Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* (EPA 2004a);
- Position Statement No. 2 – *Environmental protection of native vegetation in Western Australia* (EPA 2000);
- Position Statement No. 3 – *Terrestrial biological surveys as an element of biodiversity protection* (EPA 2002); and
- *Technical Guide Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2015g).

EPA assessment

The EPA notes that the proponent has addressed the policy and guidance relevant to this factor in the PER document.

The EPA notes that impacts to vegetation would occur through direct clearing and indirect impacts could occur through dust deposition, radiation and groundwater drawdown.

Radiation

The proponent used the Environmental Risk from Ionising Contaminants (ERICA) software tool to calculate the potential radiation risk to plant types. The assessment found that the plant types most likely to be affected by radioactive dust were the lichens and bryophytes. The assessment showed that the expected dose rate for these types could be just higher than the screening level for plants of 10 microgray per hour ($\mu\text{Gy/h}$). The no-effect dose rate for lichens and bryophytes has, however, been estimated at approximately 125,000 $\mu\text{Gy/h}$. Since this effect rate is over 10,000 times the screening dose rate, no significant adverse effects of radiation on flora species would be expected from the Proposal (Cameco 2015).

Vegetation units

At the vegetation unit level, it is noted in the PER document that some vegetation communities could be impacted close to the extent that less than 30 per cent would remain through clearing and groundwater drawdown. The EPA notes that Cameco has undertaken additional work on these communities since the release of the PER document. The EPA considers, based on the newly defined likely extent of the communities, it is likely that impacts would not result in less than 30 per cent of each vegetation unit remaining, consistent with EPA Position Statement 2 (EPA, 2000).

No TECs or PECs based on vegetation values were recorded during surveys. Two Priority 1 flora species (*Rhagodia* sp. Yeelirrie Station and *Neurachne lanigera*), three Priority 3 species (*Bossiaea eremaea*, *Eremophila arachnoides* subsp. *arachnoides*, and *Euryomyrtus inflata*) and one threatened (Declared Rare Flora) species were identified.

Each of the Priority 3 flora species would be directly and indirectly impacted by the proposal, resulting in a loss of up to 26.5%, 15.6% and 0.3% of the known number of plants for *Eremophila arachnoides* subsp. *arachnoides*, *Bossiaea eremaea*, and *Euryomyrtus inflata*, respectively. One population (4.8% of the known number of plants) of *Rhagodia* sp. Yeelirrie Station may be indirectly impacted. If the proposal is to be implemented, the EPA recommends a condition be imposed requiring a Flora and Vegetation Management Plan to ensure that impacts to conservation significant flora and vegetation units are minimised.

The EPA considers that the survey methods undertaken to inform the PER document were consistent with the requirements of Guidance Statement 51.

Atriplex yeelirrie

Clearing for the proposal would cause the loss of plants of the threatened flora, *Atriplex yeelirrie*, previously known by the phrase name *Atriplex* sp. Yeelirrie Station (L. Trotter & A. Douglas LCH 25025). *A. yeelirrie* is present within the development envelope and is listed as Vulnerable under the Western Australian *Wildlife Conservation Act 1950*.

This species is also listed as Endangered under the Commonwealth EPBC Act, although it was listed after the proposal was determined to be a controlled action under that Act. As a result, the Commonwealth Department of the Environment¹ (DotE) has advised that it is not a statutory requirement for any Commonwealth approval to be consistent with the Commonwealth government recovery plans for this species. Nonetheless, it may still contain relevant information, and it would be good practice for the proponent to address the content of any such plan.

¹ On 19 July 2016, the Commonwealth Department of the Environment became the Department of the Environment and Energy, following the transfer of responsibility for energy policy.

A. yeelirrie is comprised of a Western and Eastern population (Figure 9). The species dominates the 'Atriplex sp. Yeelirrie Station Shrubland on Calcrete' (CApS) vegetation unit. While the two populations are genetically distinct, they have not been described as different species or sub-species by Parks and Wildlife as the species cannot be separated based on external morphology.

The Western population of *A. yeelirrie* lies wholly within the ore body and encompasses two sub-populations in close proximity to each other. The whole Western population occupies 76 ha, including a 10 m buffer, and comprises an estimated 84,510 plants. The condition of the plants within this population has been rated as Good to Excellent.

The Eastern population, located approximately 30 km south-east of the Western population, comprises ten sub-populations close to each other. This population occupies 130 ha, including a 10 m buffer, and comprises an estimated 190,656 plants. The condition of the plants within this population was rated as Degraded to Good. The proponent has noted that the poorer condition of the plants is most likely due to cattle grazing.

Additional minor populations of *A. yeelirrie* have been recorded within previously rehabilitated sites at Yeelirrie (Western Botanical 2015), as follows:

- 1) The Southern Stockpile area: An August 2014 count found 109 individuals, however a March 2015 study (Western Botanical 2015) found that mortality had reduced numbers by 27, leaving 82 plants.
- 2) Former BHP Billiton Communications Tower: A count in this area found six live (and four dead) individuals in a clump.
- 3) A single plant has also been found adjacent to a track leading to the rehabilitated Northern Stockpile Area.

The condition of the plants within these populations was rated as Degraded. The cause(s) of the mortality is unknown.

A study prepared for the proponent (SWC 2015) reported that *A. yeelirrie* occurs within the same micro-topographic or geomorphic position in clay pans. In all cases, plants of this species were positioned on slight rises (10 – 20 cm) above the surrounding clay pan surface, such that it likely remained dry following heavy rainfall or flooding. Detailed sampling and testing of the salinity of the soils within these rises and the adjacent clay pan revealed that soil salinity was significantly lower in areas supporting healthy *A. yeelirrie* plants.

Based on field observations and physical, chemical and hydraulic properties of the soils, *A. yeelirrie* may be susceptible to a combination of salinity and inundation, and therefore may occupy a niche habitat within clay pans. The available information suggests that inundation is likely to be the dominant limiting factor, as even if the salinity is below the apparently tolerable limit (i.e. a conductivity level of around 500 millisiemens per metre) any inundation appears to inhibit the establishment of this species (Cameco 2015).

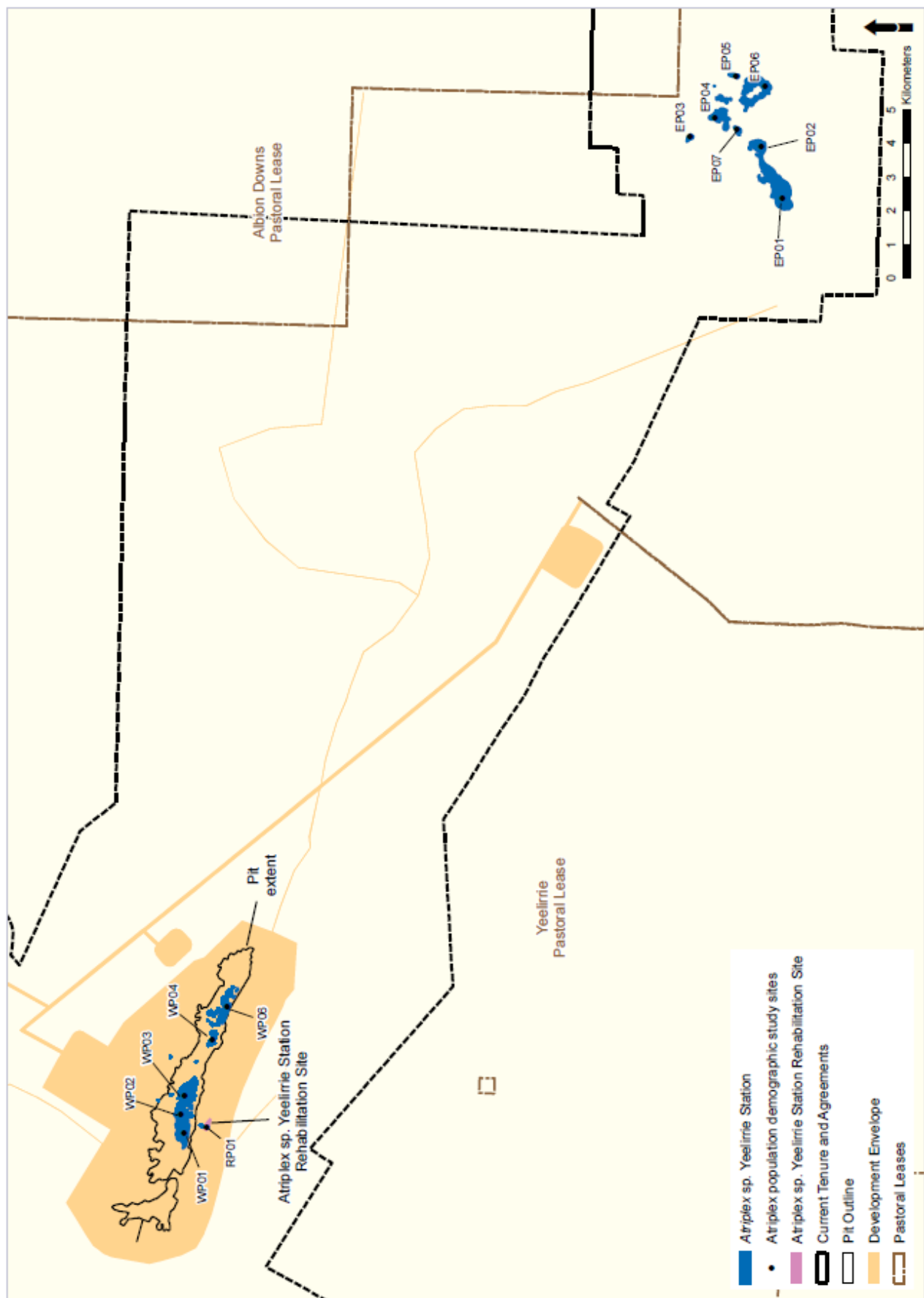


Figure 9: Locations of *Atriplex yeelirrie*

The proposal would result in the loss of the Western population. This represents:

- a 31 per cent loss of the known individual plants of *A. yeelirrie*;
- the loss of one of two known populations;
- a reduction in the known area occupied from 206 ha to 130 ha;
- a loss of genetic diversity, given the Western population is genetically distinct from the Eastern population; and
- a loss of 37 per cent of the known extent of the CApS vegetation unit.

Cameco has proposed the following mitigation measures for *A. yeelirrie*:

- fencing the Eastern population to exclude entry by livestock from neighbouring pastoral leases;
- a research and conservation program to address the following:
 - research activities to further understand the species and to support potential translocation including seed collection and propagation research and trials;
 - implementation of a targeted research and trials program on eco-physiology, seed biology and translocation;
 - development of an Interim Recovery Plan, leading to the development of a full Recovery Plan in consultation with Department of Parks and Wildlife; and
 - development of a Trial Translocation Plan in consultation with the Department of Parks and Wildlife,
- reintroduction of the Western population to approximately 104 ha of a back-filled mine void early in the mine development program;
- translocation to establish new population(s) of *A. yeelirrie* (Western population). Cameco asserts that features of the species that may make it amenable to translocation include:
 - individual plants hold seed over several seasons. Seed can be readily harvested and stored;
 - seed can be readily germinated;
 - as evidenced by the rehabilitation populations, the species can establish and grow in soil that differs from natural conditions, including soils that exhibit different salinity and profile characteristics to the soils of the natural populations; and
 - potential translocation sites at Lake Mason and Yakabindie (totalling ~220 ha) with similar soil and landscape characteristics to those supporting the existing population have been identified (Cameco 2016) and partially assessed,
- tenure options, including the establishment of a Conservation Area over the Eastern population, would be investigated to determine the best option to ensure long-term protection; and

- a plan to protect the translocated population on the rehabilitated mine pit to ensure it would not be cleared during mine development.

The potential impact of the loss of one of the two known populations of *A. yeelirrie* has been evaluated by the EPA. The EPA notes that removal of the Western population could not be avoided if the proposal were to proceed. It is also relevant that, despite recent genetic work indicating that the genetic differentiation is similar to that previously reported between subspecies in other *Atriplex*, the Western and Eastern populations did not warrant taxonomic separation into separate species. This was due to the morphological similarity and proximity between the two populations and that legislation allows for the two populations to be managed as separate conservation units. The EPA further notes that the loss of the Western population would mean that about 63 per cent of this species would remain which is consistent with EPA Position Statement 2.

Parks and Wildlife raised concern regarding the removal of the Western population and noted that the health of the Eastern population should not degrade further to maintain the status of the species. Parks and Wildlife have noted that creating an environment with a large enough number of translocated plants would be a challenge. Parks and Wildlife also noted that there would be value in further consideration of using soil from the pit areas to construct a suitable translocation soil profile near the mine.

The EPA acknowledges that Cameco examined a number of options to avoid, minimise, and offset the loss of *A. yeelirrie* and proposed an extensive program of mitigation actions, including a plan to re-establish (translocate) the Western population at two areas, totalling 104 ha, of the rehabilitated mine site (Cameco 2016). Cameco also proposes mitigation actions designed to translocate this species to other suitable sites, outside the Development Envelope, and to preserve seed and genetic material in secure storage for future use. The EPA notes the available evidence (Western Botanical 2015) which suggests that *A. yeelirrie* seed is amenable to collection and germinates readily, which has been demonstrated in the laboratory and in the field.

The EPA considers that the existence of apparently self-seeded plants that have persisted as small populations on disturbed sites at Yeelirrie since those sites were rehabilitated in 2004 is evidence that re-establishment in the field is feasible, even without particular management actions, such as optimal habitat and weed management, to favour the long term establishment of *A. yeelirrie*. Additionally, the EPA acknowledges there is evidence that other sites with similar soil types exist in the region and with appropriate research and proper attention to micro-relief and microhabitat, new populations may also be established elsewhere.

Cameco's commitments to an extensive array of research, management actions and offsets designed to protect the Eastern population and re-establish the Western population of *A. yeelirrie* are considered critical to the long-term viability and conservation of diversity of *A. yeelirrie*. Therefore, if this proposal were to be implemented, the EPA considers that it would be important to impose

conditions requiring adequate protection of the Eastern population, and a research and re-establishment program that continues for sufficient time to provide a high level of assurance that the Western population of *A. yeelirrie* is re-established in the field.

Summary

Having particular regard to the:

- a) relevant EPA policy and guidance pertaining to Flora and Vegetation;
- b) impacts to vegetation communities which are likely to meet the 30 per cent remnant thresholds in EPA Position Statement 2 (EPA 2000);
- c) greatest impact to Priority species is a loss of up to 26.5% of the known number of plants which is to the Priority 3 species *Eremophila arachnoides* subsp. *arachnoides*;
- d) Eastern and Western populations of *A. yeelirrie* being regarded as genetically different but comprising the same species;
- e) proponent's avoidance, management and minimisation measures and commitment to offsets set out in the PER document and its response to submissions, including actions to avoid and manage the Eastern population of *A. yeelirrie*;
- f) evidence which suggest *A. yeelirrie* seeds is amenable to collection and germinates readily;
- g) survival of plants in rehabilitation areas with sub-optimal conditions;
- h) the proposal to re-establish plants on the rehabilitated mine pit with appropriate habitat for *A. yeelirrie*;
- i) the proposal to re-establish plants, outside the development envelope where similar soils types exist;
- j) the EPA's assessment that there remains a significant residual impact, resulting from the clearing of 84,510 *A. yeelirrie* plants. This is capable of being offset, and this impact would be acceptable if offset appropriately,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objective for Flora and Vegetation, provided that:

- a condition is imposed which requires the avoidance of direct and indirect impacts to the Eastern population of *A. yeelirrie* and improvements through appropriate measures such as, but not limited to, fencing and de-stocking of cattle;
- a condition is imposed which requires the avoidance, where possible, of Priority 1 flora species and minimisation of impacts to Priority 3 flora species and some vegetation units; and
- a condition is imposed to counterbalance the significant residual impact of the loss of 84,510 *A. yeelirrie* plants (see Section 3.9 Offsets).

3.3 Terrestrial Fauna

EPA objective

The EPA's environmental objective for this factor is to *maintain the representation, diversity, viability and ecological function at the species, population and assemblage level.*

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Terrestrial Fauna for this assessment and the relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Position Statement No. 3 *Terrestrial biological surveys as an Element of Biodiversity Protection* (EPA 2002);
- Guidance Statement No. 56 *Terrestrial Fauna Surveys for Environmental Impact Assessment in WA* (EPA 2004b);
- *Technical Guide Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010); and
- Guidance Statement No. 20 – *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA* (EPA 2009).

EPA assessment

The proposal has the potential to directly impact on native terrestrial fauna through the clearing of 2,422 ha of potential fauna habitat, alterations to surface water flows resulting in localised flooding, and increased risk of vehicle strikes. In addition, the proposal has the potential to indirectly impact terrestrial fauna from increased dust emissions, feral predation, habitat fragmentation, weed infestation, altered fire regimes, and changes to groundwater hydrology.

Detailed vertebrate fauna assessments of the Yeelirrie area were undertaken by Bamford Consulting Ecologists (BCE) in 2009 and 2010 and included desktop reviews, database searches and field investigations. In 2015, a second desktop assessment (including relevant database searches) was conducted to update the initial desktop assessment. A site inspection targeting conservation significant fauna was also conducted in March 2015 and focused on searches for Malleefowl, Slender-billed Thornbill, Striated Grasswren, Black-flanked Rock-wallabies and the Shield-backed Trapdoor Spider (BCE 2015).

During 2009 and 2010 invertebrate fauna assessments were conducted at Yeelirrie. Other surveys have been conducted in the region, including those at Rosslyn Hill (70 km north of Yeelirrie, BCE 2014), and near Wiluna (KLA 2012; Outback Ecology 2011). In 2015, BCE reviewed the existing information to revise and update species lists including changes in conservation status. An extensive four-day site inspection was undertaken in March 2015 with particular

emphasis on searching for signs of conservation significant invertebrate species within the study area (Cameco 2015). During this site inspection, locations where *Idiosoma* sp. (trapdoor spiders) had been found previously were targeted in order to characterise the environment with which this species is associated.

The EPA considers that the surveys conducted met the principles in Position Statement 3 (EPA 2002), were undertaken in accordance with Guidance Statement 56 (EPA 2004) and Guidance Statement 20 (EPA 2009), and adequately met the requirements of the Technical Guide (EPA 2010).

The surveys identified eight major vegetation and substrate associations (VSAs) supporting fauna habitats within the proposal Development Envelope (Figure 9). These included: Granite outcrops, Hardpan Mulga, Calcrete, Calcrete Outwash, Chenopod shrubland over Sandplain, Spinifex sandplain, Mulga over spinifex sandplain, and Acacia woodland over sparse Spinifex (Cameco 2015).

Vertebrate fauna

Based on desktop and field surveys, 295 vertebrate fauna species have a range that extends to the Development Envelope, including: 11 frog, 88 reptile, 157 bird and 30 native and nine introduced mammal species. Thirty-five of the species that could potentially occur in the region are of conservation significance, including species which are listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Western Australian Wildlife Conservation Act 1950* (WC Act), or are locally significant. Ten conservation significant species were confirmed present during surveys (Figure 10).

The Yeelirrie study area is expected to support resident populations of the following fauna:

- Malleefowl (*Leipoa ocellata*) listed as Vulnerable (EPBC Act) and Schedule 3 (WC Act);
- Black-flanked Rock-wallaby (*Petrogale lateralis*) listed as Vulnerable (EPBC Act) and Schedule 2 (WC Act);
- Peregrine Falcon (*Falco peregrinus*) listed as Vulnerable (EPBC Act) and Schedule 7 (WC Act);
- Brush-tailed Mulgara (*Dasycercus blythi*) listed as Priority 4 (Parks and Wildlife Priority list);
- Striated Grasswren (*Amytornis striatus striatus*) listed as Priority 4 (Parks and Wildlife Priority list);
- Inland Greater Long-eared Bat (*Nyctophilus major tor*) listed as Priority 4 (Parks and Wildlife Priority list);
- Bush Stone-curlew (*Burhinus grallarius*) listed as Conservation significance 3 (CS3) due to the pattern of distribution; and
- Square-tailed Kite (*Lophoictinia isura*) listed as CS3.

The Fork-tailed Swift (*Apus pacificus*), listed as Schedule 5 (WC Act) was also recorded during the 2015 survey and is considered to be an irregular visitor. Other conservation significant species that may occur in the region were either not found during surveys or are unlikely to be resident but may be vagrants or irregular visitors.

It is proposed that up to 2,422 ha of fauna habitat would be cleared as a result of the implementation of the project. The direct and potential indirect impacts to the VSAs within the 100,062 ha Study Area are set out in Table 4 below. The worst case impact is the sum of direct and all potential indirect impacts.

Table 4: Direct impact due to clearing and potential indirect impacts due to dust, groundwater drawdown and surface water flooding by Vegetation and Substrate Association within the Study Area

VSA type	Study area [#] (ha)	Direct impact (ha)	Potential indirect impact (ha)	Worst case [^] impact (%)
Granite Outcrops and Breakaways	1,866	17	135	8.2
Spinifex Sandplain	38,473	612	527	3.0
Hardpan Mulga	21,230	738	985	8.1
Calcrete	2,819	216	342	19.9
Calcrete Outwash	3,095	548	192	23.9
Chenopod Shubland over Sandplain	1,215	0	0	0.0
Acacia Woodland over Sparse Spinifex	17,178	64	4910	29.0
Mulga over Spinifex	14,186	145	926	7.6

Source: Table 9-32 Cameco PER (2015);

[#]The boundary of the mapped vegetation and substrate associations shown in Figure 10.

[^] Proportion of the total (direct and potential indirect) impacts of the known extent within the Study Area.

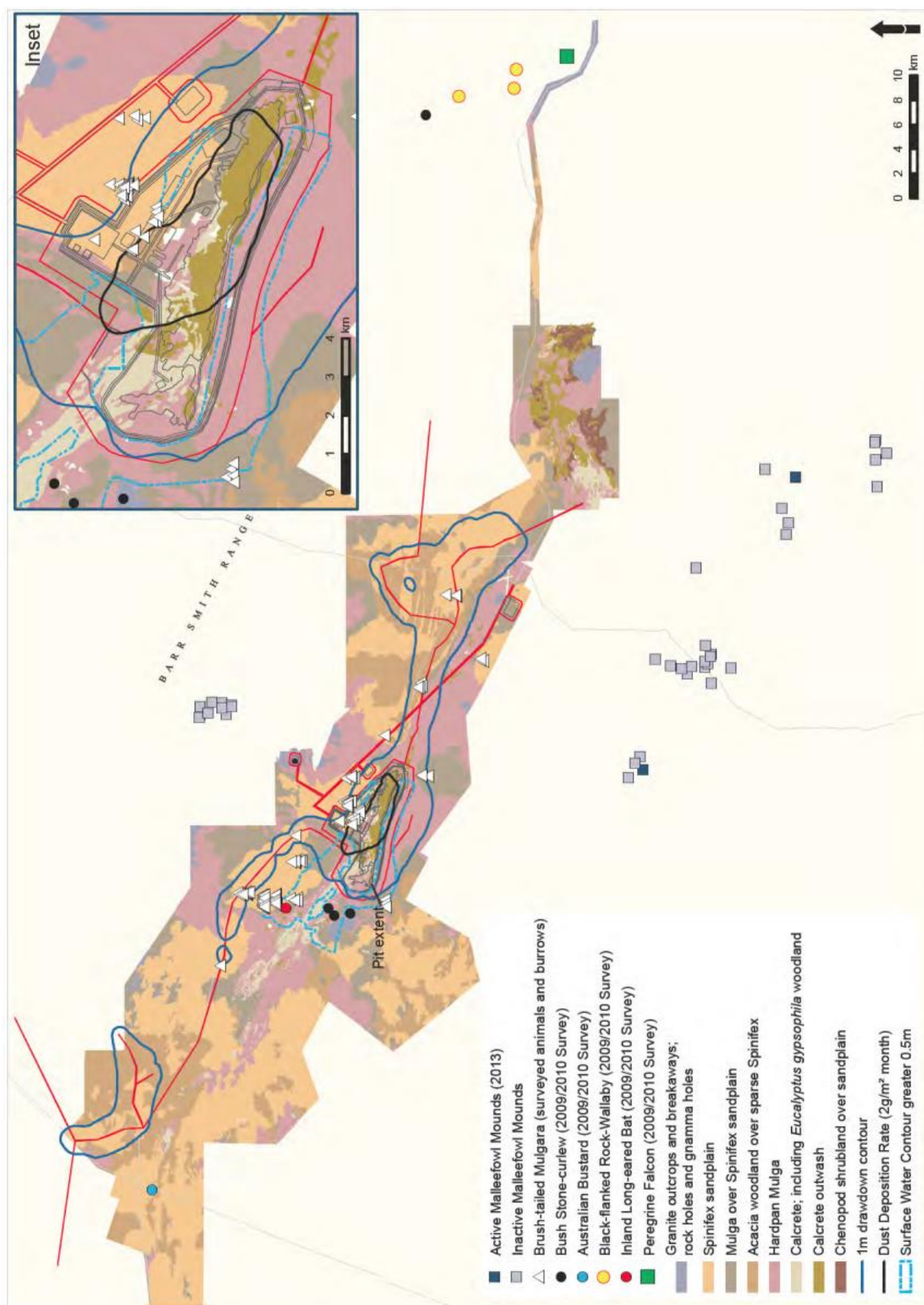


Figure 10: Vegetation and Substrate Associations and locations of recorded conservation significant species

One Malleefowl mound was recorded approximately two kilometres north of the mine pits. Other known Malleefowl mounds are situated away from the uranium orebody, within stands of dense Mulga woodland. A cluster of mounds are located approximately 10 km north and 20 km south of the orebody.

Anecdotal reports of the Black-flanked Rock-wallaby are known from the Barr Smith Range and a number of scats were recorded from a cave within the Range, approximately 40 km east of the Study Area. The Peregrine Falcon was also recorded along a cliff ledge in this range.

The Brush-tailed Mulgara was recorded extensively across the Study Area. It was most abundant within sandplain sites dominated by spinifex (and was absent from calcrete habitats). The majority of clearing for the proposal would occur on calcrete habitats and suitable habitat for the species extends outside the Development Envelope.

The Striated Grasswren was found outside of the Development Envelope, approximately five kilometres south of the orebody. It has a highly patchy and fragmented distribution due to reliance on mature spinifex grassland.

The Inland Greater Long-eared Bat was recorded during the surveys and may rely on tree hollows within the *Eucalyptus gypsophila* woodland. The woodland occurs both inside and outside of the Development Envelope.

The Bush Stone-curlew was recorded at several sites within the Study Area and occurs both within the orebody and along drainage systems near rocky habitats associated with the Barr Smith Range. The species is moderately widespread and was found inside and outside the Development Envelope for the proposal.

The Square-tailed Kite was considered to be of local conservation significance in the area. The species would not be limited to the Development Envelope.

In managing and mitigating impacts to vertebrate fauna, the proponent has committed to the development of a Fauna Management Plan. This plan would outline the management and mitigation actions to be taken to ensure that impacts are minimised. These actions would include the appropriate management of vehicle movements to reduce fauna strike deaths, the implementation of appropriate egress as well as fencing to minimise entrapment impacts and the implementation of a fire management to ensure appropriate management actions are undertaken to reduce the occurrence of fire related incidents. The EPA is of the view that management plans should aim for the avoidance of impacts to conservation significant fauna (for example, by retaining important habitat wherever practicable).

The EPA notes that there are likely to be localised impacts on vertebrate fauna through the implementation of the proposal. However, given the existence of continuous and extensive suitable habitat outside the Development Envelope and the proponent's management commitments, the EPA considers that these local impacts could be suitably managed and mitigated such that they would not be significant.

Invertebrate fauna

A total of 42 invertebrate species was collected during the baseline surveys. A review of field surveys and relevant databases revealed 18 conservation significant invertebrates have been recorded in the Yeelirrie Study Area. This includes one species, the Shield-backed Trapdoor Spider (*Idiosoma nigrum*), listed as Vulnerable under the EPBC and WC Acts, four confirmed short range endemic (SRE) species and 13 species with the potential to be SRE taxa.

Invertebrate species considered to be SREs are of conservation significance. Harvey (2002) defines invertebrates as SRE species if they have a distribution of <10,000 km², and notes that the majority of species that have been classified as SREs have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats.

The four species considered to be SREs for this assessment include:

- The Shield-backed Trapdoor Spider *Idiosoma nigrum*;
- A pseudoscorpion *Pseudolaureola* sp.;
- A slater in the family Platyarthridae or Barthytropidae; and
- The Tiger beetle *Pseudotetracha helmsi*.

The 13 taxa considered potential SREs include:

- Seven trapdoor spiders (*Aganippe* sp., *Aname* 'MYG170', *Aname* 'MYG212', *Kwonkan* 'MYG171', *Kwonkan* 'MYG172', *Kwonkan* 'MYG210', *Kwonkan* 'MYG211');
- An unidentified trapdoor spider in the Barychelidae family;
- A pseudoscorpion in the Cheridiidae family;
- Two isopods (*Cubaris* sp. 1, *Cubaris* sp. 2);
- A centipede (*Geophilida*); and
- The scorpion (*Urodacus* 'yeelirrie').

The locations where these SREs were recorded are shown in Figure 11.

Nine of the 17 SRE invertebrate taxa were only recorded within the Impact and Disturbance Areas of the Proposal. These included:

- A pseudoscorpion *Pseudolaureola* sp.;
- A slater in the family Platyarthridae or Barthytropidae;
- Four trapdoor spiders (*Aname* 'MYG170', *Kwonkan* 'MYG171', *Kwonkan* 'MYG172');
- An unidentified trapdoor spider in the Barychelidae family;
- A pseudoscorpion in the Cheridiidae family;
- An isopod (*Cubaris* sp. 1); and
- A centipede (*Geophilida*).

Potential impacts on the general invertebrate fauna assemblage may be greater in the Calcrete and Calcrete Outwash VSAs. The invertebrate fauna habitats (VSAs) where the species above were recorded are also found outside the Impact Area, where at least 76 per cent of each of the VSAs in the surveyed areas would remain undisturbed by the Proposal.

One of the dominant ecological processes potentially affecting invertebrate fauna in the Study Area is surface hydrology. Alteration of surface water regimes resulting in localised flooding events has the potential to affect invertebrate fauna species. Other processes including fire, feral species invasion, habitat degradation due to weed invasion, and loss of connectivity are also likely to have a degree of indirect impact. For example, long-unburnt habitats are likely to be important for some species, including the Shield-backed Trapdoor Spider.

To manage and mitigate impacts, the proponent has stated that loss of habitat from ground disturbing activities would be limited in accordance with a Flora and Vegetation Management Plan. Other mitigation measures include the suppression of dust, surface water management, restriction of vehicle traffic at the Yeelirrie Playa and the development of fire management practices to minimise the potential impact from altered fire regimes.

The EPA notes that the fauna habitats (VSAs) that support SRE invertebrate species are not restricted to the Impact Area. Some VSAs, such as the Mulga and Spinifex Sandplains, are considered widespread.

Parks and Wildlife's submission has raised concerns around potential indirect impacts on the Shield-backed Trapdoor Spider *Idiosoma nigrum*, (listed as Vulnerable under the EPBC and Wildlife Conservation Acts). This species was recorded from 17 locations. The Shield-backed Trapdoor Spider appears to occur at low densities but is widespread across the Yeelirrie Pastoral Lease, favouring Acacia shrublands with a sandy substrate. The species is absent from the grey loamy-clay soils around some calcrete areas and in the main Indicative Footprint. Given the extent of the vegetation habitat that this species is found in outside the Development Envelope, the EPA considers it unlikely that there would be significant effects on the species as a result of indirect impacts.

If the proposal is implemented, there are likely to be localised impacts on invertebrate fauna, particularly on those species found within calcrete habitats. However, given the continuous nature of suitable habitat outside the Development Envelope, and the proponent's management commitments in this regard, it is considered that these impacts could be suitably managed and mitigated to meet the EPA's objective for terrestrial fauna.

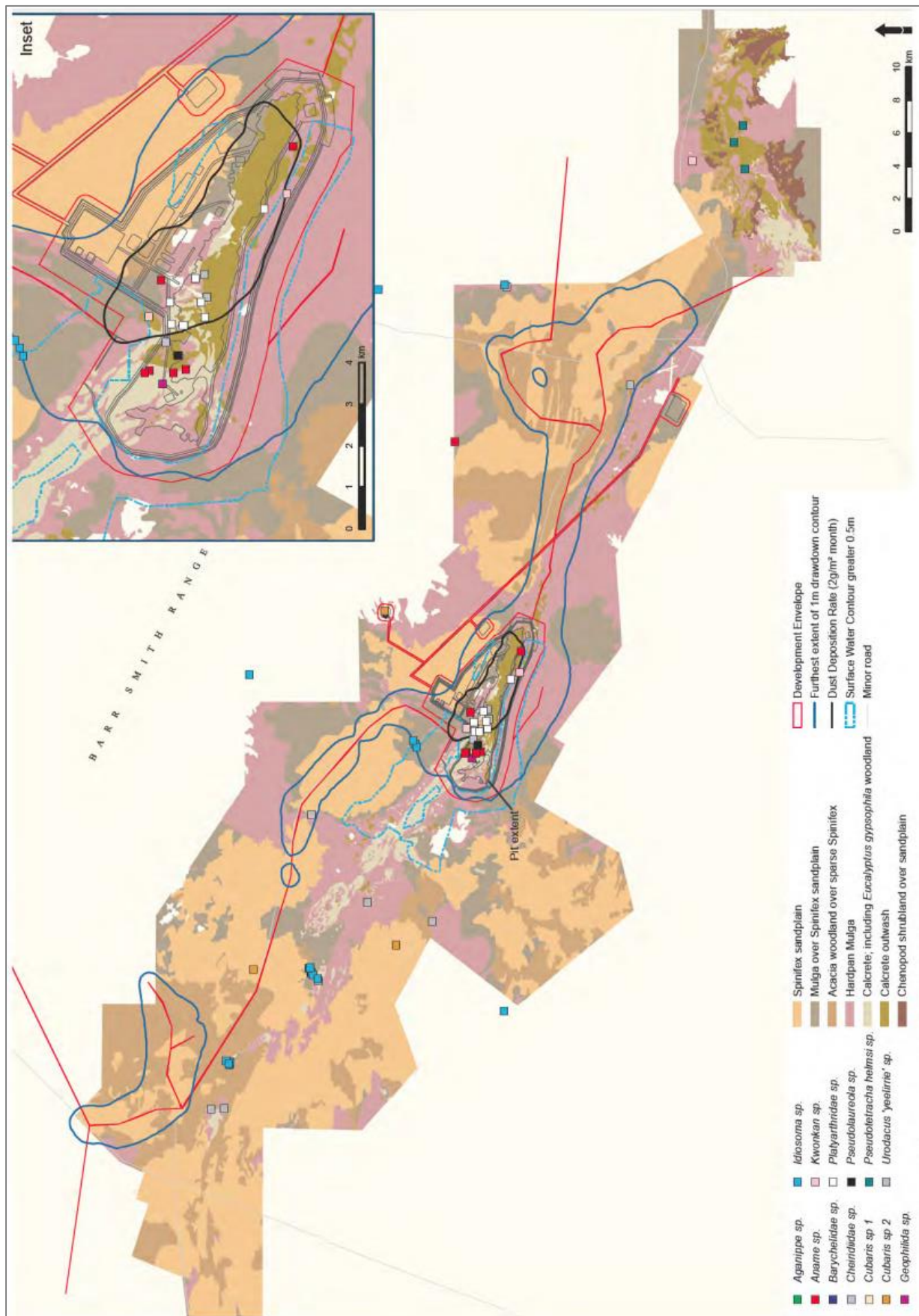


Figure 11: Short range endemic invertebrate fauna records

If the proposal is to be implemented, the EPA recommends a condition requiring the preparation and implementation of a Flora and Vegetation Management Plan and a Terrestrial Fauna Management Plan be imposed to ensure that impacts to terrestrial vertebrate and invertebrate fauna at the species and population level are minimised.

Impacts from radiation

The implementation of this proposal would have the potential to expose terrestrial fauna to radiation. The proponent was required to assess the potential radiological impacts to terrestrial fauna, using the ERICA method as outlined in the Commonwealth Terms of Reference for this assessment and set out in the document entitled *Assessment of potential radiation impacts on flora and vegetation using the Environmental Risk from Ionising Contaminants: Assessment and Management (ERICA) tool*. The Terms of Reference required that Australian specific data should be used where available.

A submitter was critical over the use of the ERICA model to determine the potential level of radiation exposure and considered that ground testing and assessments on individual species and pathways should be conducted.

The national authority on radiation matters in Australia is the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). ARPANSA considers ERICA to be an appropriate assessment tool for undertaking an assessment of radiological impacts to the environment and this is outlined in the recent publication *Radiation Protection of the Environment Guide G-1 November 2015*. ARPANSA has also published Australian species-specific data that can be used in an ERICA assessment.

The ERICA software is versatile and allows users to create their own reference species, where the default species are not appropriate for local species. The EPA notes that Cameco developed new geometry models where Australian species were of a substantially different shape to the default reference species shapes in ERICA and applied the ARPANSA published concentration ratios for Australian species, where available. ARPANSA has published concentration ratio data for uranium, radium, lead and polonium, but not thorium. Therefore Cameco used the default thorium concentration ratio for the reference species “large herbivore” from the ERICA system.

The proponent has acknowledged the limitations in the assessment tool as it relates to specific Australian fauna. However, the EPA considers the ERICA assessment and the geometry model that has been adopted is appropriate for determining potential impacts to local fauna species at Yeelirrie. The ERICA modelling indicated that the expected dose rate to fauna is likely to be below the screening level of 10 µGy/h. Given this, the EPA is of the view that it is unlikely that terrestrial fauna would be significantly affected by radiation exposure as a result of this project.

Summary

Having particular regard to:

- a) relevant EPA policy and guidance pertaining to Terrestrial Fauna;
- b) the proponent's avoidance, management and minimisation measures set out in the PER document;
- c) the large areas of surrounding habitat considered suitable for the fauna species and assemblages recorded within the study area, that would not be impacted by the Proposal; and
- d) low risk to terrestrial fauna from radiation,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objective for Terrestrial Fauna, provided that:

- a condition is imposed which requires a management plan to avoid and minimise impacts to significant terrestrial fauna; and
- a condition is imposed which requires a management plan to avoid and minimise impacts to vegetation communities (terrestrial habitat).

3.4 Human Health

EPA objective

The EPA's environmental objective for this factor is *to ensure that human health is not adversely affected*.

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Human Health for this assessment and the relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the proposal in relation to this factor:

- Guidance Statement No. 3 – *Separation distance between industrial and sensitive land uses* (EPA 2005); and
- Guidance Statement No. 55 – *Implementing best practice in Proposals submitted to the environment impact assessment process* (EPA 2003).

The EPA notes that a significant number of non-EPA policy and guidance is listed in the ESD for this factor. The application of these policies and guidance was considered to inform the radiological exposure assessments for the proposal. Noting advice received from the DoE, the Department of Mines and Petroleum, and the Radiological Council that the radiological assessments undertaken were adequate, the EPA considers that the proponent has addressed the policy and guidance relevant for this factor in the PER document.

EPA assessment

The EPA notes that the proponent has considered the policy and guidance considered relevant for this factor in the PER document.

The mining of uranium, treatment of ore to produce uranium oxide concentrate (UOC), stockpiling of ore and waste rock, storage of contaminated waste, uranium transport and mine closure activities all increase the potential for workers or the public to be exposed to radiation.

The cumulative dose of radiation through inhalation of radionuclides in dust and radon decay products, ingestion of radioactive material, and absorption of gamma radiation from the deposit, ore and UOC, may increase for mine workers, people living close to the mining operation, and members of the public along the transport route.

The proponent undertook an assessment of radiation exposure to permanent residences located up to 62 km from the proposed Development Envelope, to a person in a car travelling behind a product container and a person standing on the side of a road as every truck passes in a year. The radiation doses from radon decay products, and dust containing radionuclides which may be inhaled, were predicted using air quality modelling. The doses from radionuclides that may be ingested were calculated, using the assumption that locally produced plant and meat was consumed for a full year.

Regulatory and assessment framework: radiation

The EPA notes that there is an extensive technical guidance framework for assessing radiological impacts to human health. The framework involves the development of international guidance which is then made into national and state documents relevant to that jurisdiction and environment. The Department of Mines and Petroleum (DMP) advised that there were no issues with respect to the adequacy of radiological assessments undertaken to model radiation exposure and that the exposure risk to workers and the public is considered to be low and acceptable for a uranium mine. The Radiological Council also noted the proponent's radiological assessment was appropriate for this stage of assessment.

The proponent has proposed an "as low as reasonably achievable" (ALARA) approach to limit radiation exposure to workers. This approach is consistent with international, national and state guidance on managing radiation impacts. Doses to workers would be managed and monitored, and doses entered into the national dose register, so workers or contractors who work on multiple mines do not exceed the regulatory dose limit. Consistent with Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003), the proponent demonstrated through the ALARA approach that 'best practice' design optimisation, operational procedures and monitoring to control exposure to hazardous pollutants to the Maximum Extent Achievable, would be implemented. The Commonwealth DoE notes that the overall approach is

consistent with recommendations for best international practice of the International Commission on Radiological Protection.

The EPA understands that natural background doses of radiation to people living in Australia are between 1.5 and 2 millisieverts per year (mSv/yr). As outlined in Schedule 1 of the *Radiation Safety (General) Regulations 1983*, the regulatory public dose limit above background is 1 mSv/yr and the regulatory occupational dose limit is 20 mSv/yr above background.

Radiological impacts from the mine site

The distance between the nearest residence, located at Yeelirrie Pool, and the proposed mine site is approximately 10.2 km. The radiation doses to a permanent resident at Yeelirrie Pool from inhalation of radon decay products and dust containing radionuclides were modelled to be 0.21 mSv/yr and 0.003 mSv/yr respectively. The consumption of locally produced vegetables and meat for a full year is calculated to add a dose of 0.007 mSv/yr. The dose from gamma radiation is very small (0.03 μ Sv/y) in comparison to the previous two exposure pathways for a resident at this location. A conservative radiation dose, assuming consumption of bush tucker at Yeelirrie Pool for a full year, rather than locally produced vegetables and meat, estimates an annual dose of 0.04 mSv/yr from bush tucker.

The estimated average annual dose for a mine site worker is 4.3 mSv/yr from gamma radiation, 2.6 mSv/yr from inhalation of radon decay products, approximately 3.6 mSv/yr from dust, resulting in a total of approximately 10.5 mSv/yr. The assumptions used in this assessment are very conservative. A minimal allowance for such factors as shielding of gamma radiation by heavy equipment has been allowed for and it is expected that a lower dust exposure due to cab air-conditioning would occur. In practice it is expected that the maximum probable dose would be approximately 5 mSv/yr.

The EPA notes that the estimated total dose of radiation at the closest permanent residence is estimated at 0.215 mSv/yr, which is below the regulatory public dose limit of 1 mSv/yr. As radiation decreases with distance from the source, the EPA expects the total dose of radiation at any sensitive receptor, such as homesteads and camp sites, located further than 10.2 km from the proposed mine site to be less 0.215 mSv/yr and therefore compliant with the regulatory public dose limit.

The EPA understands that the radiation exposure for a mine worker, with the relevant mitigation, is approximately 5 mSv/yr. This is similar to doses measured at other uranium mines and is below the regulatory occupational dose limit of 20 mSv/yr.

Noting that the estimated radiation dose to mine workers and members of the public are lower than the regulatory dose limits, the approach taken to assess radiological impacts is appropriate and advice from the DMP, the Radiological Council and the Commonwealth DoE, the EPA is of the view that radiation exposure from the mine site to workers and the public is within acceptable limits for human health.

The EPA notes that the proponent proposes to develop a Radiation Management Plan, which would be provided to DMP and the Radiological Council. The Radiological Council advised that the risks associated with radiation could be adequately monitored and managed under a radiation management plan. The EPA advises that the Radiation Management Plan would need to include appropriate dose constraints and limits. The plan would be regulated by the Radiological Council under the *Radiation Safety Act 1975*, and by the DMP under the *Mines Safety and Inspection Act 1994*.

Radiological impacts during transport

The proponent's preferred transport route for the project is from the mine to Adelaide port, shown in Figure 12. The EPA notes that the dried UOC product would be top-loaded into 205-litre steel drums and sealed with lids and ring clamps. The drum-filling station would be located in an airlock that maintained negative pressure to prevent uranium entering the work areas. The outside of the drum would be subsequently washed to remove any residual product from the lids and surfaces before labelling and loading into shipping containers for transport and export. The EPA further notes that in the event of an accident and an unlikely release of radioactive material, an emergency response plan (ERP) would be initiated. The priorities of the ERP are first aid and containment of any product spillage, including segregating the area and covering any spilled product.

The proponent has undertaken an assessment of radiation risk due to the transport of UOC to transport workers and members of the public. The estimated radiation dose to a driver would be approximately 0.5 mSv/yr. For a person standing one metre from the side of the road, where all trucks are passing for a year, the dose would be approximately 0.004 mSv/yr. The proponent states that the potential dose from exposure after a transport accident is expected to be low due to the relatively short exposure period.

The Radiological Council has advised that the transport assessment is acceptable for the PER process and that the transport of UOC in Western Australia would be regulated under the *Radiation Safety Act 1975* and its regulations, in particular the Radiation Safety (Transport of Radioactive Substances) Regulations 2002. A Transport Radiation Management Plan (known as a 'Radiation Protection Programme') would also be developed which would include an Emergency Response Assistance Plan.

In addition to the measures proposed, such as storing the UOC product in drums placed inside steel containers, to limit the risk of spills in the event of a transport accident, the EPA notes the advice from the Radiological Council and that the estimated radiation dose to the driver and members of the public are lower than the regulatory dose limits. In view of this, the EPA considers that the risk associated with transporting UOC is within acceptable limits for Human Health. The EPA notes that the Radiological Council would regulate the transport of UOC under the *Radiation Safety Act 1975* and its regulations, in particular the Radiation Safety (Transport of Radioactive Substances) Regulations 2002.



Figure 12: Proposed UOC transport route

Radiological impacts post-closure

Baseline monitoring established that naturally occurring radon emissions rates on top of the Yeelirrie deposit were 3.7 becquerel per metre squared per second ($\text{Bq/m}^2/\text{s}$). The proponent proposes to return waste rock, tailings and contaminated equipment and wastes to the open pit as part of the closure program for the mine. The Mine Closure Plan (MCP) includes covering the completed tailings cells with at least one metre of compacted coarse material and two metres of soil as a growth medium. The radon emission rate from the covered tailings was calculated as $0.08 \text{ Bq/m}^2/\text{s}$. The EPA notes that the radon emission rate after completion of mining is calculated to be below the baseline emission rate before mining.

The EPA notes that returning tailings below ground is considered best practice. Implementing best practice techniques is consistent with EPA Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003). Further details and assessment of mine closure is discussed under Section 3.8 Rehabilitation and Decommissioning.

Summary

Having particular regard to:

- a) relevant EPA policy and guidance pertaining to Human Health;
- b) the proponent's proposed implementation of 'best practice' design optimisation, operational procedures and monitoring to control exposure to hazardous pollutants to the Maximum Extent Achievable through the ALARA approach;
- c) the proponent's management measures that would be implemented to minimise emissions of radionuclide containing dust and radon decay products, and limit the risk of spills in the event of a transport accident;
- d) concerns about the potential for radioactive dust to affect neighbours;
- e) the proponent's assessment of radiation exposure to the public and transport workers indicating that exposure to radiation would be below the respective dose limits;
- f) the proponent's assessment of radiation to mine workers estimating a dose similar to other open cut uranium mines in Australia that is about a quarter of the occupation dose limit; and
- g) the DMP's advice that there were no issues with respect to the adequacy of radiological assessments undertaken to model radiation exposure and that the exposure risk to workers and the public is considered to be low and acceptable for a uranium mine,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objectives for Human Health.

The EPA notes that in this case, the Radiological Council and the DMP would regulate the monitoring of radiological conditions, and the implementation of as-low-as-reasonably-achievable management practices and compliance to regulatory public and occupational dose limits. This would occur under the Radiation Management Plan required as a statutory obligation under the *Radiation Safety Act 1975* and the *Mines Safety and Inspection Act 1994*. In addition, the Radiological Council would regulate minimisation of radiation exposure and the transport of UOC using the Transport Management Plan required as a statutory obligation under the Radiation Strategy (Transport of Radioactive Substances) Regulations 2002.

The EPA further notes that the DER and the Commonwealth DoE have legislation that can permit and regulate potential radiological impacts to human health, including exposure to radiological dust.

3.5 Hydrological Processes

EPA objective

The EPA's environmental objective for this factor is *to maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.*

This section focuses particularly on groundwater hydrological processes. Surface water processes are dealt with further in Section 3.6 Inland Waters Environmental Quality because surface water hydrological processes most directly affect surface water quality.

Relevant EPA policy and guidance

There is no specific EPA policy or guidance considered by the EPA to be relevant for this factor for this assessment.

Other policy

Other policy instruments relevant to this factor are:

- Operational Policy No. 5.12 – *Hydrogeological reporting associated with a groundwater well licence* (DoW 2009);
- Operational Policy No. 5.08 – *Use of operating strategies in the water licensing process* (DoW 2010); and
- Water licensing delivery series report No. 12 *Western Australian water in mining guideline* (DoW 2013).

The EPA generally considered these non-EPA technical documents in the assessment of this factor.

EPA assessment

The EPA notes that the proponent has considered the relevant matters of the above Department of Water policy in relation to this factor.

The proposal involves construction of a bund and channel to divert natural flows around the operations, mine pit dewatering, groundwater abstraction, groundwater reinjection, and surface water diversion. The proposed activities have the potential to affect the hydrological regimes of surface water and groundwater, and also affect the availability of groundwater for dependent ecosystems and other groundwater users.

There are a number of existing groundwater bores in the region, including pastoral wells, groundwater investigation and monitoring wells, and also production wells providing mine processing water from the Albion Downs Wellfield, which is located about 30 km east of the Yeelirrie deposit.

Prior to the commencement of processing, mine dewatering volumes would exceed the mine water demand. The proponent plans to re-inject the surplus water into the calcrete aquifer north of the proposed pit for temporary underground storage and subsequent re-extraction. The reinjection point is located within the open pit area and the area impacted by an increase in groundwater levels would be subject to groundwater drawdown from groundwater production wellfields. A production wellfield is then proposed to meet the water demands of the mine and processing plant.

Cameco developed a model of groundwater flow and solute transport (Cameco 2015a), consistent with the current proposal and based on investigations and earlier modelling dating back to the early 1970s. Modelling was used to predict the potential impacts of lower groundwater levels caused by groundwater abstraction for process water and by mine pit dewatering. Modelling was also used to predict potential impacts from increased groundwater levels caused by water re-injection (aquifer recharge) during the early years of mine dewatering. The hydrological impacts of the diversion bund on surface flows were also modelled. The impacts of solute transport are dealt with in Section 3.6 Inland Waters Environmental Quality.

The Department of Water (DoW) has advised that the hydrogeology of the area is well understood and that the conceptual hydrogeological model is consistent with several large-scale quantitative hydrogeological evaluations in the area. The DoW has also advised that the available hydrogeological studies are consistent with DoW Operational Policy 5.12 and provide sufficient rigor and accuracy to enable an adequate assessment of impacts on the environment, other users and the aquifer system and that it has no objections to the proposal.

Baseline surveys established that groundwater is predicted to move away from the mine, down the Yeelirrie valley towards Lake Miranda. The water table is generally deeper (10-20 m) near the catchment divide and on the adjacent slopes. In the palaeo-channel along the valley floor the water table is three to five metres from the surface with the range of groundwater fluctuation less than 0.2 m with no evidence of seasonal changes.

The presence of a diversion bund during operations is predicted to result in increases in flood heights from 0.1 m for a 1-year Annual Recurrence Interval (ARI) event to 1.5 m for a 100 year ARI event. Simulated hydro-periods upstream increase by about 200 hours for a 20-year ARI event and 500 hours for a 100-year ARI event, due to water backing up behind the bund. No changes in the hydro-period are predicted downstream. These changes are generally within the range of natural events and are considered unlikely to cause significant impacts on ecosystem maintenance.

The highest rate of groundwater reinjection is expected to occur in Year 3 of the project. ReInjection is predicted to cause groundwater levels near the injection bores to increase by a maximum of approximately one metre. The groundwater mound is expected to remain within the area of greater than 0.5 m drawdown from the operation of the production well field. ReInjection would cease at the beginning of Year 4 and modelling shows that the groundwater

mound would disappear by the end of that year. Given the limited scale, extent and duration of groundwater re-injection, it is not expected to result in significant environmental impacts.

Public submissions have raised concerns about the impacts to neighbouring bores from the proposed wellfields, including at Dempsey Bore and No-Ibla. The proponent states that groundwater modelling shows there would not be an impact on the availability of water from the proposed development on existing pastoral wells.

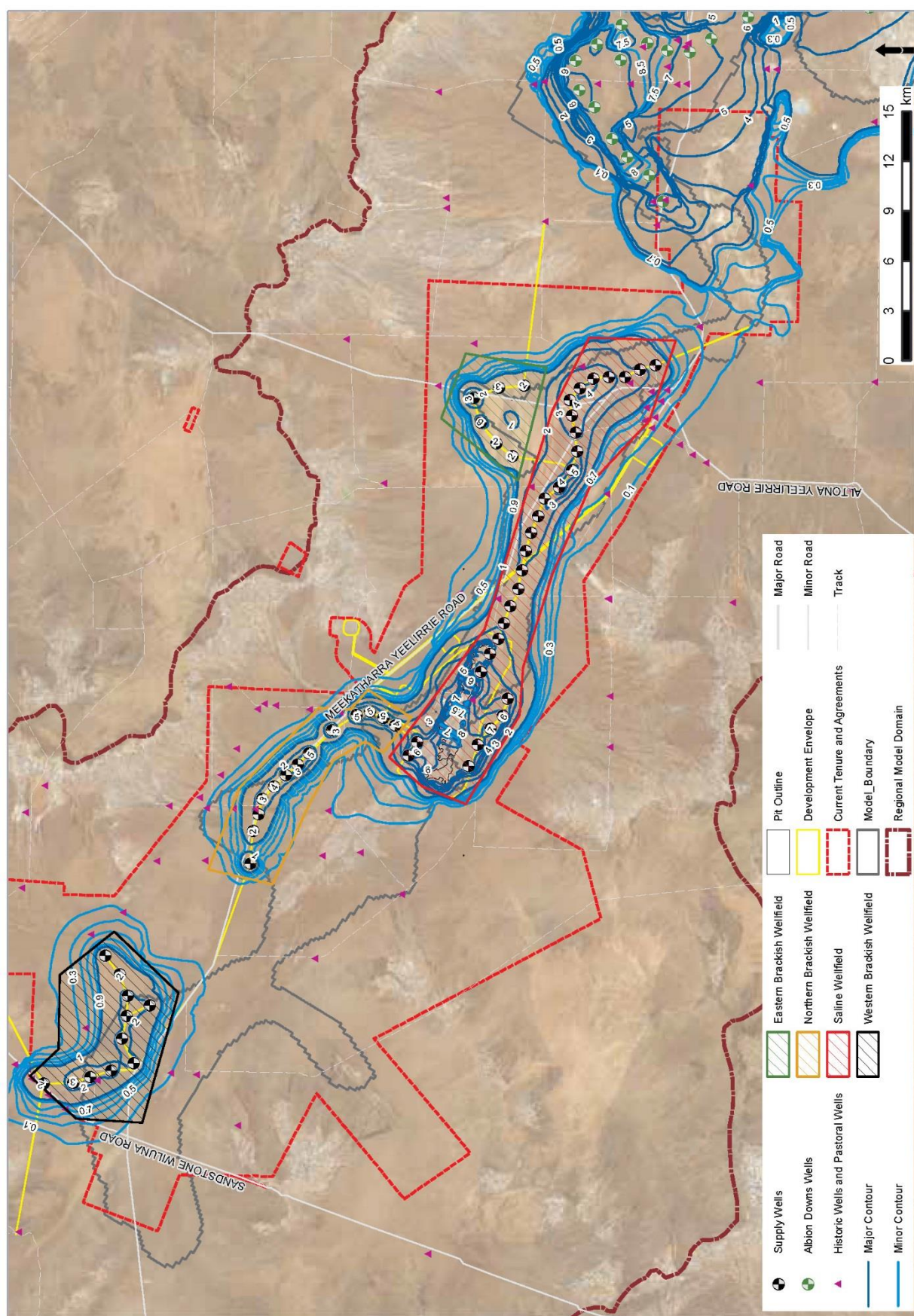
Modelling predicted that drawdown in the vicinity of the proposed wellfields would increase over time and be the greatest at the end of Year 18. Drawdown of two to three metres is predicted in a localised area within about one kilometre of proposed production bores in the south-west corner of Ullula Station. Drawdown is strongly attenuated with distance from the proposed abstraction bores and is predicted to be limited to 0.5 m or less beyond about two to three metres from the actual bores (Figure 13).

At its maximum extent at Year 18, the 0.1 m drawdown contour extends a few kilometres west of the Sandstone – Wiluna Road, which indicates that it is unlikely to have a significant effect on station bores west of this point. For example, Dempsey Bore and No-Ibla Bore are both about 6 km from the nearest modelled 0.1 m (10 cm) drawdown contour. Elsewhere, predicted drawdown below 0.5 m is confined to Yeelirrie Station. A predicted drawdown of 0.3 m is expected at the Yeelirrie Homestead at Year 18, with a residual 0.1 m drawdown remaining there for approximately 150 years following closure.

Groundwater drawdown immediately adjacent to the mine pit is typically expected to exceed seven metres. This drawdown is predicted to attenuate with distance, reducing to 0.5 m about three to five kilometres generally to the north and south of the pit and to the same level about one to two kilometres up flow (west) and about 25 km down flow (east). Model predictions indicate that drawdown below 0.5 m would be confined to locations that are within the boundaries of Yeelirrie Pastoral Lease.

From Year 12 of operations some slight overlap of drawdown from the proposed water supply wellfield is predicted with the water table drawdown cone caused by the existing Albion Downs wellfield. This assumes that production continues from the Albion Downs field.

The model predicted that groundwater levels are expected to return to baseline levels within 100 years, with the exception of residual drawdowns of 0.3 to 0.5 m in the nearby eastern and northern well field, which is expected to persist in the area for more than 200 years after project cessation. Significant effects are not expected on groundwater flows at the catchment scale.



Cameco proposes to develop a Surface Water Management Plan. It also proposes to develop a Groundwater Operating Strategy, including a Groundwater Management Plan as part of its application for a 5C groundwater licence regulated by the DoW consistent with its policies, including Operational Policy 5.12 and 5.08. In preparing these plans it is expected that Cameco would have regard to the consideration within the DoW's *Western Australian water in mining guideline* (DoW 2013).

The EPA notes that the proponent has committed to monitor groundwater abstraction rates to confirm predicted drawdown levels and to continue baseline monitoring of groundwater wells to increase levels of confidence around the response of groundwater to rainfall events.

Based on modelling indicating there is approximately six kilometres between the predicted 0.1 m drawdown and the No-Ibla Bore and Dempsey Bores, the EPA does not expect impacts to neighbouring bores to be significant. However, the EPA understands the importance of reliable water supplies to pastoralists and, noting the proponent's commitments to ongoing groundwater monitoring, it recommends that an independent expert regularly reviews the monitoring program prior to its implementation, and the results from that program with a particular focus on potential impacts on surrounding neighbouring bores. The EPA also recommends that the results of monitoring are integrated into a management plan to ensure that management and contingency actions are implemented should monitoring indicate potential impacts to No-Ibla and Dempsey Bores. In addition, the monitoring results and independent reviews should be made publicly available, especially to neighbouring pastoralists and other stakeholders.

Summary

Having particular regard to the:

- (a) results predicted by the proponent based on the hydrogeological and surface hydrological modelling;
- (b) monitoring and minimisation measures proposed, and the commitment to develop and implement a Surface Water Management Plan and a Groundwater Operating Strategy, including a Groundwater Management Plan; and
- (c) advice from the DoW that the hydrogeological modelling appears to be sufficient and accurate enough to determine groundwater drawdowns and impacts,

the EPA considers, in the event the Minister determines that the proposal may be implemented, it could be managed to meet its objective for Hydrological Processes, provided that conditions are imposed which require:

- an independent expert review of the groundwater monitoring program prior to its implementation, and the results from that program on a regular basis, with a particular focus on neighbouring (No-Ibla and Dempsey) water bores;

- that the independent expert reviews the monitoring results referred to in the dot point above are made publicly available in a timely way; and
- a management, monitoring and reporting plan to minimise impacts to surface waters and ground waters.

The EPA notes that, should the Minister determine that the proposal may be implemented, the DoW can regulate and manage impacts from licenced wells on the environment and other groundwater users under the *Rights in Water and Irrigation Act 1914* (RIWI Act) and regulations and policies relation to these impacts.

3.6 Inland Waters Environmental Quality

EPA objective

The EPA's environmental objective for this factor is *to maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.*

Relevant EPA policy and guidance

There is no specific EPA policy or guidance considered by the EPA to be relevant for this factor for this assessment.

Other policy

Other policy relevant to this factor is:

- Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) – *Australian and New Zealand guidelines for fresh and marine water quality. Volume 1.* (ANZECC/ ARMCANZ 2000).

The EPA generally considered this non-EPA technical document in this assessment.

EPA assessment

The EPA notes that the proponent has addressed the relevant matters of the above guideline identified for this factor.

The Yeelirrie uranium deposit occurs in the channel of the Yeelirrie valley. Ephemeral freshwater flows following episodic rainfall events are likely to be important to the establishment and maintenance of native vegetation and fauna in the Yeelirrie valley. Groundwater recharge is important to maintain groundwater supplies. Maintenance of adequate water quality is also important, including for stock water supplies. Changes in groundwater quality may have the potential to affect subterranean fauna habitat down flow from the mine and tailings storage facilities. Subterranean fauna is dealt with in Section 3.1 of this

report. Potential impacts on flora and fauna are dealt with in Sections 3.2 and 3.3 of this report respectively.

The DoW has advised that Cameco's hydrogeological studies for this proposal provide sufficient rigor and accuracy to enable an adequate assessment of impacts on the environment, other users and the aquifer system and that it has no objections to the proposal.

As reported in the PER document, the median levels of arsenic and molybdenum in soils in the area have been recorded as <20 parts per million (ppm) and <5 ppm respectively. Uranium levels depend on soil type, with a range from about 10 ppm in quartz-rich loam to about 480 ppm in calcrete. Vanadium levels in soils range between about 15 and 150 ppm. Salinity levels in surface and ground waters are naturally highly variable and uranium and other metals are naturally present in groundwater in the area. Background concentrations in natural groundwater of chloride and metal contaminants of concern that were modelled in studies for the PER document were sampled and reported on by the proponent. Some key results are listed in Table 5 below.

Table 5: Concentrations of selected species in background groundwater samples (All values are in mg/L)

Species	Range	Median	Average	Modelled plume threshold in addition to baseline
Arsenic	0.001-0.05	0.00	0.02	0.01
Chloride	81-43,900	4,985	9,115	+10
Molybdenum	0.002-0.62	0.06	0.11	0.01
Uranium	0.001-2.36	0.16	0.31	0.2
Vanadium	0.01-0.13	0.01	0.03	0.01

Data from Appendix M3 of the PER – 'Geochemical assessment of tailings and mine waste.'

The proponent has undertaken a considerable array of other baseline surveys and modelling of rainfall and flood events, surface and ground water quality and flows, and has modelled the impact of the proposal on these aspects. Those studies are reported on in the PER document and supporting appendices.

A surface diversion bund and associated channel is proposed to protect the mine site during operations from a 1,000 year ARI rainfall event. An engineered bund up to three metres high would also prevent discharge to the external surface environment of water from a 1,000-year ARI event. The operating mine is planned as a 'no release' site for all rainfall up to a 1,000 year ARI event. This means that contaminant spills on-site during operations would be contained and could be recovered and remediated without significantly affecting the external environment.

Surface flow diversion would alter the baseline hydrology during a significant flood event but the proponent's modelling predicts insignificant effects on modelled flow velocities, with changes of less than one metre per second (URS Australia 2015). Flood waters would back up upstream of the diversion bund during years 8-22 of the proposal, causing attenuation of flows, with minor changes in flows downstream. Up to 20-year ARI events, no changes in erosion and sedimentation are predicted as a result of the Proposal as no significant stream flow is predicted. Less frequent, more extreme events resulting in flow velocities of two metres per second are predicted to cause localised erosion along the southern part of the bund with sediment deposition downstream of the proposal site.

Cameco proposes to close the mine by back filling the pit with tailings and other fill and constructing an engineered cover to above the 100-year ARI flood level, followed by removal of the bund and establishment of a channel to carry 100-year ARI stream flows around the rehabilitated site without overtopping the backfilled pits. A 1,000-year ARI event is, however, predicted to inundate the backfilled pit area, with water potentially entering the contained tailings.

The proponent used solute transport modelling to predict the movement of contaminants from tailings stored in mined out pits for 15,000 years after closure. The contaminants of concern that were modelled were chloride, uranium, vanadium, arsenic and molybdenum. With a modelled recharge rate of 0.24 millimetre per year (mm/yr) into the TSF, chloride was predicted to travel up to 50 km eastward (down flow) and up to 600 m northward, with concentration increases typically less than 10 mg/L. Given the high concentrations of chloride that occur naturally (Table 5, above), predicted increases in chloride concentrations beyond about one kilometre eastward are considered negligible (Cameco 2015). At these levels, these changes are not considered significant.

With a modelled recharge rate of 0.24 mm/yr into the TSF, the front of the uranium plume (at a threshold of 0.2 mg/L in addition to baseline) was predicted to remain within the mine pit in the east-west direction. The front could travel 500 m northward and reach downward to the weathered granite. The vanadium, arsenic and molybdenum plumes (each at a threshold of 0.01 mg/L in addition to baseline) were predicted to remain within the pit in the east-west direction, travel 500-600 m northward, and down to the weathered granite. The vanadium plume could also travel 200 m southward.

With an increase in modelled recharge to six millimetres per year, no significant change in the extent of the chloride plume was predicted. At this recharge rate, the extent of the uranium, vanadium, arsenic and molybdenum plumes increased, to up to six kilometres eastward for uranium. At this distance the plume would still be well within the Yeelirrie Pastoral Lease boundary. The threshold levels used to denote the concentrations in addition to baseline at the plume fronts in the proponent's modelling are less than or close to the average and median background levels in groundwater for the metals of concern (Table 5 above). Transport of these contaminants is limited due to sorption on

to solid media of geologic origin (soils). Chloride is 'non-sorbing', and hence is modelled to travel further, as set out above.

The ANZECC Guidelines for Fresh and Marine Water Quality (ANZECC 2000) set standards for the contaminants of concern as displayed in Table 6 below.

Table 6: Recommended water quality trigger values considered low risk for some metals in livestock drinking water (All values are mg/L)

Species	Trigger value (low risk)	Modelled plume threshold in addition to baseline
Arsenic	0.5 – up to 5	0.01
Molybdenum	0.15	0.01
Uranium	0.2	0.2
Vanadium	Not determined	0.01

Source. Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).

Threshold levels in addition to baseline are used by the proponent to define the front of plumes of contaminants of concern that may leach from the TSF. The concentration threshold used for uranium (0.2 mg/L), when added to the median baseline value (0.16 mg/L - see Table 5) is about twice the low risk trigger value for uranium for stock water in Table 6. It is, however, well within the range of background values of 0.001-2.36 mg/L for uranium in groundwater reported in Table 4 above. The thresholds do not exceed low risk trigger values for the other species in Table 6 above. They are thus consistent with the requirements of the ANZECC Guidelines (ANZECC 2000). The proponent's modelling predicts that plumes of the contaminants of concern all remain well within the boundaries of Yeelirrie Station over the 15,000 year modelling period.

Noting that background uranium concentrations in groundwater in the region of the orebody are naturally elevated, and given the potential for uranium levels in groundwater to remain elevated above those set as low risk for stock water at up to six kilometres down-flow from the TSF as a result of seepage, the EPA recommends that groundwater from this area down flow of the TSF is not used for stock in the future. The EPA notes that the PER document does not show any stock water bores in this part of Yeelirrie Station at present. The EPA notes also that the plume from the TSF with elevated uranium concentrations is predicted to remain well within the boundaries of Yeelirrie Station over the 15,000-year modelling period at least, and hence under the control of the proponent while it owns the station.

The EPA is aware of the matters raised by submitters regarding water quality impacts to bores, in particular No-Ibla and Dempsey Bores, which are located upstream of the mine site. The EPA notes that the modelling demonstrates that changes to water quality are restricted to the boundaries of Yeelirrie Station and therefore expects no changes to the water quality currently available at the No-Ibla and Dempsey bores.

The DotE asked a number of questions about tailings management and how leaching would be minimised if groundwater flows back into the tailings. The proponent responded that the primary geochemical gradient introduced during this process is a decrease from the tailings pH of ~9.5 to the groundwater pH of ~7 and that the decrease in pH is a very effective method of controlling the mobility of a number of constituents of concern. Geochemical models predict a decrease in soluble uranium, vanadium, arsenic, molybdenum, selenium, chromium and copper due to the formation of secondary minerals in the tailings pile. A large factor in the expected formation of some of these secondary minerals after groundwater recovery was the availability of calcium and magnesium that have higher concentrations in the groundwater. The DotE advised that care needs to be exercised when extrapolating test work to the long term. The DotE also advised that the overall impact of the project is likely to be minor in the regional context and that the proposed development represents a relatively small disruption, mostly rectified by the proposed closure and rehabilitation activities.

The DER has provided advice in regard to modelling the fate and transport of uranium in hypersaline groundwater. That advice indicated that the test work carried out by the proponent is sound but may not be adequate. The DER advised that the proponent of another calcrete-hosted uranium proposal has made a commitment to undertake work recommended by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) during the mining phase of the Proposal to better inform the management of wastes and that a similar program would greatly reduce the level of uncertainty about uranium transport in groundwater at Yeelirrie. The EPA considers that a condition to the same effect should be applied to the proposal were it approved.

The proponent has committed to constructing a bund and channel that would divert external surface flows from a 1,000-year ARI rainfall event around the mine and processing site during operations. The bund would also prevent potentially contaminated rainfall runoff from leaving the site. The proponent has committed to constructing basins down flow of the site to capture sediment carried in the channel, prior to discharge. These actions would serve to avoid impacts on surface water quality.

The proponent has committed to backfilling the mine pits with tailings such that the pits become below-ground TSF. During operations, the TSF would incorporate under-drainage to capture and return seepage to the metallurgical plant, serving to avoid impacts on groundwater quality.

The DMP advised that the potential movement of selected solutes in groundwater that are constituents of concern is not anticipated to result in significant local or regional impacts, as groundwater is naturally saline and displays existing radiation levels above stock water guidelines.

When operations cease, the proponent has committed to covering the TSF with a capillary break and a soil cover to limit rainfall infiltration and support revegetation. A commitment has also been made to create a channel around the backfilled and rehabilitated mine site and TSF with the capacity to carry

runoff from a 100-year ARI event around the site without overtopping the rehabilitated area. The cover and channel would mitigate (but may not entirely prevent, as set out above) the potential for transport of contaminants via groundwater down-flow from the TSF.

Summary

Having particular regard to the:

- (a) the ANZECC Guidelines (ANZECC 2000);
- (b) proponent's plan to construct a diversion bund up to three metres high to prevent overtopping by a 1,000-year ARI rainfall event;
- (c) modelled predictions that contaminants of concern at the front of any plume leaching from the TSF are predicted to be within the range of background concentrations, and contained well within the boundaries of Yeelirrie Pastoral Lease;
- (d) advice of the DER in regard to modelling the fate and transport of uranium in hypersaline groundwater indicating that the test work carried out by the proponent is sound but may not be adequate;
- (e) DER advice that a program of work recommended by the CSIRO on transport in groundwater of uranium from tailings would greatly reduce the level of uncertainty about uranium transport at Yeelirrie; and
- (f) advice of the DoW that hydrogeological studies provide sufficient rigor and accuracy to enable an adequate assessment of impacts on the environment, other users and the aquifer system and that it has no objections to the proposal,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objectives for Inland Waters Environmental Quality provided that a condition is imposed which requires:

- the development and implementation of a Surface Water Management and Monitoring Plan;
- the development and implementation of a Groundwater Management and Monitoring Plan including provisions to prevent the abstraction of groundwater down flow from the TSFs within the boundaries of Yeelirrie Station for stock use where uranium levels are above the low risk trigger value for stock listed in the ANZECC Guidelines for Fresh and Marine Water Quality; and
- the development and implementation of a program of work on uranium transport in groundwater from tailings, as recommended by the CSIRO and on the advice of the DER.

The EPA notes that, should the Minister determine that the proposal may be implemented, the DoW will also regulate the abstraction of groundwater through the Groundwater Operating Strategy required by licensing under the RIWI Act, and the DER may regulate discharges from the operation under Part V of the EP Act.

3.7 Heritage

EPA objective

The EPA's environmental objective for this factor is *to ensure that historical and cultural associations, and natural heritage, are not adversely affected.*

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Heritage for this assessment and the relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement 41: *Assessment of Aboriginal Heritage* (2004) (GS41).

EPA assessment

The heritage environment of the development consists of various unregistered artefact sites, two Aboriginal heritage sites registered under the *Aboriginal Heritage Act 1972* (AH Act), culturally modified Kopi Gum trees (*Eucalyptus gypsophila*), and various flora and fauna bush tucker species.

To the north-east of the Development Envelope there is a concentration of registered Aboriginal heritage sites surrounding the Yeelirrie Pool², which include water holes, engravings, paintings, artefacts, scatters and places associated with indigenous mythology. This area holds both ethnographic and archaeological importance to the indigenous people of the area and was previously flagged as the Yeelirrie town site for the proposal in the 1970s by the former proponent, Western Mining Corporation. This area is no longer proposed for development by the current proponent, Cameco.

From studies provided by the proponent the Development Envelope is currently uninhabited by indigenous people, however the surrounding area was previously occupied. The archaeological patterning identified in the heritage studies provided by the proponent indicates a settlement model of people regularly visiting and staying close to the long-lasting water sources found in the upland areas north of the Development Envelope (e.g. Yeelirrie Pool) and using the southern plains and valley floor, where the Development Envelope is situated, for hunting and gathering activities (Waru Heritage Report, 2015).

The Department of Aboriginal Affairs (DAA) reported that there are currently two registered Aboriginal heritage sites (*Yeelirrie 03* and *Yeelirrie 38*) located partially within the Development Envelope in close proximity to the quarry. Both sites contain artefacts and scatters and site *Yeelirrie 03* contains a rock shelter.

Numerous archaeological surveys of the proposed Development Envelope have been conducted over the past 40 years, consistent with GS41. Each of

² the nearest sensitive receptor to the proposal, located 10.2km NE of the ore body

the surveys catalogues the locations of artefacts, cultural material or cultural activities within and surrounding the Development Envelope. These studies vary in what constitutes a heritage site (largely how many individual artefacts and density of artefacts within a certain area) and range in number from four to 166 individual sites. It is postulated by the proponent that this large variation can be explained by the dispersion of artefacts caused by repeated flooding and inundation of the area.

The latest heritage study by Waru (2015) identifies that four of the reported 166 sites are likely to meet the requirements as an Aboriginal site under the AH Act. These sites include: “Yeelirrie_061” and “Yeelirrie_198” (located north of the east pit in the Development Envelope); and “Yeelirrie_139”, “Yeelirrie_179” (located near the overburden stockpile and drainage infrastructure in the southeast of the Development Envelope). These sites are all listed as artefact scatter sites.

There were twenty individual recordings of Kopi Gum trees referred to as culturally modified trees (CMT) within the Development Envelope (located near the west pit and the blending and stockpile areas of the conceptual layout) previously used as a source of wood for containers or shields by the indigenous people in the area. The Kopi Gum trees are reported to have a rapid rate of decomposition in the area from termite infestation, making it difficult to preserve in situ. Very few CMTs have been recorded in the region and the CMTs at Yeelirrie are reported to be the largest recorded collection (Waru 2015). It is unknown at this stage whether the CMTs at Yeelirrie are unique or widely distributed as there is an absence of regional surveys for CMTs. It is worth noting that the Kopi Gum trees are known to occur throughout the region.

The proponent conducted a bush tucker assessment (based on a survey during 2011), involving the indigenous people of the area. The predominant bush tucker identified in the survey included Mulga, Bowgada, Ruby Saltbush, Berrigan, Australian Boxthorn, Quandong, Bush Plum, and Kangaroo.

Guidance Statement 41 – Assessment of Aboriginal Heritage, provides advice to proponents about the minimum requirements for environmental management of the heritage impacts of a proposal that the EPA considers when undertaking an assessment. In addressing this Guidance Statement it is expected that a proponent undertakes a competent analysis and reports on the likelihood of the presence of matters of heritage significance to Aboriginal people. This involves: a comprehensive review of all existing information; anthropological and archaeological surveys; consultation and engagement with Aboriginal people; and clear demonstration that Aboriginal concerns relating to the heritage factor have been addressed. In considering these requirements, the EPA notes the following:

- Various surveys have been conducted on the proposed Development Envelope I area over the past 40 years. The proponent commissioned a review of the various surveys in 2015 conducted by Waru Consulting.

- The Aboriginal people identified by the proponent for the Development Envelope are the Tjiwarl Native Title claimant group, who are represented by the Central Desert Native Title Services (CDNTS).
- The proponent has attended meetings with the CDNTS and members of the Tjiwarl Native Title claimant group since 2013. The meetings included explanation of the Proposal and the proposed environmental impacts, including, on fauna and flora, dust and radiation, transport etc.
- The proponent has not explicitly outlined the Aboriginal people's concerns about the proposal or the associated management to address these concerns as required in GS41. The proponent has, however, outlined the likely impacts and management of the following heritage considerations: archaeological heritage; flora and fauna bush tucker; CMTs; and the heritage sites surrounding the Development Envelope.

There are two registered Aboriginal sites which are located partially within the Development Envelope, but outside the proposed Indicative Footprint. The EPA is of the view that the implementation of the proposal will not have an impact on any currently registered Aboriginal sites.

The EPA considers that impact to Yeelirrie_61 and Yeelirrie_198 (unregistered heritage sites) may be avoidable as they are both located outside the Indicative Footprint. However, Yeelirrie_139 and Yeelirrie_179 (unregistered heritage sites) are located near the overburden stockpile and drainage infrastructure, and therefore impact to these sites is likely.

The EPA understands that the heritage surveys identified the largest reported occurrence of CMTs. It is considered that this is likely to be a reflection of focused local surveys and the absence of regional surveys for CMTs. The EPA also notes the reported decomposition from termite infestation, making it difficult to preserve in situ. As a result the EPA considers that the potential impact to these CMTs is not expected to be significant. However, the EPA expects the proponent to minimise impacts to the CMTs and has recommends a condition be imposed to achieve this.

The EPA notes that submitters have raised concerns about the destruction of Aboriginal Heritage sites across the Development Envelope and for plants which would have medicinal value and food value, and fauna such as the kangaroo.

The proponent has committed to implement ground disturbing activities to avoid as many of the recorded places as possible; undertake consultation regarding the disturbance of these sites with the DAA; and will comply with the requirements of the AH Act in relation to approvals to remove any sites as required. To ensure that impacts to Aboriginal Heritage are minimised, the EPA recommends a condition be imposed.

As each of the bush tucker species identified is widely spread throughout the arid zone the EPA does not consider the impact to the bush tucker species to be a significant consideration for the heritage factor for this proposal.

The Yeelirrie Pool is located 10.2 km north-east of the development envelope. However, considering it is the closest known sensitive receptor and holds heritage significance to the local Aboriginal people, impact analysis was conducted by the proponent. In summary, dust and radiation modelling was carried out for this location and consideration was given to the impact of surface water diversions and groundwater abstraction to Yeelirrie Pool. The studies conducted indicate no significant impact to Yeelirrie Pool.

Summary

Having particular regard to:

- (a) relevant EPA policy and guidance pertaining to Heritage;
- (b) the extensive archaeological studies conducted over the development envelope;
- (c) the proponent's ability to largely avoid the heritage sites (both registered and unregistered);
- (d) the geographical extent of Kopi Gum trees and likely occurrence of similar CMTs in the region; and
- (e) the geographical extent of the bush tucker hunted and gathered within the Development Envelope,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objective for Heritage provided that a condition is imposed. This would require the preparation and implementation of an Aboriginal Heritage Management Plan to minimise impacts as far as practicable to Aboriginal Heritage.

3.8 Rehabilitation and Decommissioning

EPA objective

The EPA's environmental objective for this factor is *to ensure that premises are decommissioned and rehabilitated in an ecologically sustainable manner.*

Relevant EPA policy and guidance

The EPA policy and guidance applicable to Rehabilitation and Decommissioning for this assessment and relevant matters discussed in the policy and guidance are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the proposal in relation to this factor:

- *Guidelines for preparing mine closure plans* (DMP & EPA 2015);
- Environmental Protection Bulletin No. 19 – *EPA involvement in mine closure* (EPA 2015e); and

- Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003).

The ESD referred to the EPA/DMP *Guidelines for Preparing Mine Closure Plans* (EPA 2011), which was revised in 2015. The EPA required the proponent to prepare the PER document having regard to current policy and guidance.

EPA assessment

The EPA notes that the proponent has addressed the current policy and guidance considered to be relevant for this factor in the PER document. The EPA has assessed Rehabilitation and Decommissioning for this proposal in accordance with the *Guidelines for Preparing Mine Closure Plans* (DMP & EPA 2015) and Environmental Protection Bulletin No. 19.

The proposal is located in station country where the natural vegetation has been grazed by stock for much of the past 80 to 90 years. Although Yeelirrie Station is now de-stocked, pastoralism remains a dominant land use in the region. Groundwater is used to water livestock and for mineral processing. The demand for water to meet these requirements can be expected to continue. Re-established landforms similar to their surroundings and natural vegetation that can be managed in the same way as the existing landscape are most likely to be ecologically sustainable in the long term. The EPA considers that activities that depend on natural soil, water, flora and fauna resources should not be significantly compromised by the condition of the rehabilitated landscape if they are to be sustainable in the long term.

At the end of the project, Cameco proposes that all plant, structures, pipes, power lines and concrete footings would be demolished and removed to at least one metre below ground level. Contaminated pipes, tanks, soil and other materials would be buried in the mine pit and materials below contamination limits would be recycled or placed in landfill.

Cameco proposes that mined pits would be backfilled with tailings and stockpiled overburden. At least one metre of clean calcrete would be placed over the backfilled tailings to act as a capillary break. At least two metres of stockpiled surficial loamy overburden would then be placed over the capillary break to support vegetation and act as an absorbent layer for the majority of rainwater. Progressive rehabilitation is proposed, with revegetation commencing on the first TSF cell by the end of mining year two of the project. All remaining open pit areas not used as TSF cells would be backfilled with mine waste in years 19 to 22 of the operation.

Cameco has prepared a Conceptual Mine Closure Plan (MCP) based on the requirements of the *Guidelines for preparing mine closure plans* (DMP & EPA 2015). The proponent's documentation indicates that the proponent considered key objectives covered by EPA Environmental Protection Bulletin 19 with respect to mine closure planning for incorporation into the MCP. In particular the proponent is aware that the EPA, rather than the DMP, would regulate

rehabilitation of the site since it is subject to a State Agreement Act, as set out in Environmental Protection Bulletin 19.

The conceptual MCP covers the backfilled mine pit and in-pit TSFs only. Closure of processing and supporting infrastructure areas would be dealt with in subsequent versions of the MCP. Cameco says that it intends the MCP to be a 'living document' that is updated regularly and that it would conduct further studies and incorporate them into the MCP. The MCP would be submitted to the EPA for review and approval every three years. High-level rehabilitation objectives and completion criteria are listed in Table 6.1 of the MCP.

The proponent has undertaken a number of studies and modelling exercises relevant to closure of the mine site. Models have been created and interrogated on landform evolution (over 10,000 years in response to prevailing climatic conditions), TSF cover infiltration and seepage (over 15,000 years), post-closure surface and groundwater flows and to predict radiation impacts on non-human biota.

The landscape evolution model (SWC 2015) examined a 'worst-case' scenario with no vegetation re-establishment and a case where vegetation establishes after 100 years and reduces erodability to 1/10th of the un-vegetated case. Landform modelling predicted that the rehabilitated and revegetated landforms should not be subject to significant erosion that would expose the tailings. Since the planned cover on the TSF comprises one metre of coarse material overlain by at least two metres of soil, some gullies 1.5 m deep and soil loss up to 0.5 m over 10,000 years should not significantly reduce the effectiveness of the cover to contain the tailings and limit infiltration of rainwater into the underlying TSF cells over that timeframe.

The TSF cover is designed to control seepage into the underlying tailings and to provide a medium for vegetation establishment on the new landform. The proponent modelled the capacity of this cover design to limit infiltration, using historical rainfall and evaporation averages and storm events, including a 100-year ARI event. This modelling predicted an average seepage rate of 1.2 mm/yr through the TSF cells. This rate was then used to model contaminant transport from the cells, as discussed in Section 3.6 Inland Waters Environmental Quality. The results of modelling over a 15,000 year timeframe predicted that seepage through the tailings would not result in groundwater concentrations of contaminants of concern that were significantly above background levels.

The Commonwealth DotE provided advice that the overall impact of the proposal is likely to be minor in the regional context and that the proposed development of the Yeelirrie deposit represents a relatively small disruption, mostly rectified by the proposed closure and rehabilitation activities. The DotE also advised that additional detail around Landform Evolution Modelling would be required as the MCP is developed, but considered that this could be achieved using conditions if approval was given that the proposal may proceed.

The DotE flagged that such conditions should require:

- updating of the Landform Evolution Modelling using digital elevation modelling data suited to the extent of the modelled area and consistent with best practice;
- suitable on-ground data collection to calibrate erosion models;
- demonstration of the validity of assumptions used in the MCP and consideration of the effects of breakdown of those assumptions; and
- prediction of the timeframe for and situation that would result once;
 - the cover material is eroded away; and
 - sorption processes come into equilibrium.

The DMP has also advised that the proponent has indicated that the surficial profile would be able to meet the growth requirements of the selected revegetation candidate species and that selection of appropriate candidate species minimises the potential for disruption of the capillary break. Given the likely time until mining commences and the anticipated total mine life, the DMP advises there remains sufficient time for closure objectives and financial provisioning, as required in the *Guidelines for preparing mine closure plans* (DMP/EPA 2015), to be further refined, developed and updated.

Given that the tailings are deposited entirely below ground, the risk of erosion is limited, even if the cover layers were breached. The proponent tested the erosion potential of soil cover types suitable for mine closure in the laboratory and used those results to conduct landform evolution modelling over a 10,000-year timeframe (SWC 2015). Results from that modelling predicted that the rehabilitated and revegetated landforms should not be subject to significant erosion that would expose the tailings. The proponent also undertook modelling over a 15,000 year timeframe predicting that seepage through the tailings would not result in groundwater concentrations of contaminants of concern that were significantly above background levels (Cameco 2015a).

Deposition below ground can be considered best practice in that it avoids the risk of wall failures that can occur with above-ground tailings storage facilities. The use of best practice in this way is consistent with a matter in EPA Guidance Statement 55 *Implementing Best Practice in Proposals Submitted to the EIA Process*. The planned low-angled landform and use of a native vegetation cover are generally consistent with the surroundings and can be considered acceptable provided erosion does not exceed the predicted limits and vegetation re-establishes successfully. To this end, the EPA notes that the proponent intends to prepare a MCP, to undertake additional rehabilitation studies, to incorporate those findings into updates of the plan, and to submit those updates to the EPA every three years.

The EPA considers that effective decommissioning and rehabilitation are important to the acceptability of Cameco's uranium mining proposal. It is important that rehabilitation and revegetation are successful to avoid exposure of the tailings or excessive infiltration of rainwater.

The EPA notes that decommissioning and rehabilitation can be achieved, provided that best practice planning and implementation practices are diligently applied. The EPA notes the proponent's plan to meet the requirements of the *Guidelines for preparing mine closure plans* (DMP & EPA 2015) and considers that successful closure is possible if the provisions in these guidelines and subsequent updates are met. To that end, the EPA recommends that a condition requiring a MCP to be prepared, regularly updated, implemented and publicly reported on should be imposed on the proposal were it approved.

The EPA also considers that the proponent's further research should include studies on the realistic rate at which revegetation cover can be established, the effect of that vegetation cover on the erosion rate (particularly on the avoidance of gully) and the need for alternative surface treatments such as tillage, ripping, rock armoring and runoff management works to prevent erosion. These studies should be augmented by studies of measured infiltration rates into realistic analogues of the planned TSF cover system. These additional studies would be consistent with Cameco's stated intention to conduct further studies and incorporate them into regular updates of the MCP.

Noting that this is a State Agreement project, the EPA would need to regulate compliance with the MCP process, rather than the DMP as would normally be the case. Three-yearly review of the MCP by the EPA would allow it to examine the performance and efficacy of additional studies by Cameco. The EPA would also be able to require improvements in the design of the TSF cover and its planned rehabilitation via this mechanism. The EPA could also use this process to monitor the implementation and success of rehabilitation, and to require Cameco to rectify any deficiencies and produce public reports on its rehabilitation activities.

Summary

Having particular regard to the:

- a) preparation by Cameco of a Conceptual MCP based on the requirements of the *Guidelines for preparing mine closure plans* (DMP & EPA 2015);
- b) commitment by the proponent to update the MCP and submit it to the EPA for approval every three years;
- c) commitment by the proponent to incorporate the findings of additional studies into future versions of the MCP;
- d) results of modelling over a 10,000-year timeframe predicting that the rehabilitated and revegetated landforms should not be subject to significant erosion that would expose the tailings; and
- e) results of modelling over a 15,000-year timeframe predicting that seepage through the tailings would not result in groundwater concentrations of contaminants of concern that were significantly above background levels,

the EPA considers that, in the event the Minister determines that the proposal may be implemented, it could be managed to meet the EPA's objective for

Rehabilitation and Decommissioning provided a condition is imposed which requires:

- the preparation of a MCP that is regularly updated, effectively implemented, and made publicly available;
- further research on the rate at which revegetation cover can be established, the effect of vegetation cover on the erosion rate and the need for alternative surface treatments to prevent erosion. These studies should be augmented by studies of measured infiltration rates into realistic analogues of the planned TSF cover system;
- updating the Landform Evolution Model using digital elevation modelling data suited to the extent of the modelled area and consistent with best practice; and
- on-ground data collection to calibrate erosion models.

3.9 Offsets

EPA objective

The EPA's environmental objective for this factor is *to counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.*

Relevant EPA policy and guidance

The EPA and State Government policy and guidance applicable to Offsets (Integrating Factor) for this assessment and relevant matters discussed in each policy and guidance document are outlined in Appendix 4. The EPA considers that the following policy and guidance is relevant to its assessment of the proposal in relation to this factor:

- *WA Environmental Offsets Policy* (Western Australian Government 2011); and
- *WA Environmental Offsets Guidelines* (Western Australian Government 2014).
- Environmental Protection Bulletin No. 1 – *Environmental Offsets*. (EPA 2014a).

EPA assessment

Principle 1 of the WA Government's Offsets Policy states "environmental offsets will only be considered after avoidance and mitigation options have been pursued".

Flora and Vegetation

Consistent with Principle 1 of the WA Government's Offsets Policy, the proponent has applied the mitigation hierarchy by identifying measures to

avoid, minimise and rehabilitate environmental impacts through actions that include:

- enhancing the health of the Eastern population of *A. yeelirrie* by fencing;
- investigating tenure options including establishment of a Conservation Area over the Eastern *A. yeelirrie* population;
- developing an Interim and full Recovery Plan for *A. yeelirrie* in consultation with Parks and Wildlife;
- avoiding loss of genetic material from the Western population of *A. yeelirrie* by collecting and preserving seed, researching plant establishment, eco-physiology, translocation to other sites with similar soils and early rehabilitation on the mine site; and
- preparing a draft MCP to rehabilitate the mine pit and wider project area.

Following the implementation of all mitigation measures, it is considered that the proposal would have a significant residual impact from the direct clearing of all 84,510 plants over 76 ha of the Western population of the threatened (Declared Rare Flora) *A. yeelirrie*. This loss would represent 30.7% of the total known population and 36.7% of the overall area occupied by this species.

While noting this significant residual impact, the EPA does not consider that the proposal will significantly affect the viability of the species, as discussed in Section 3.2. Therefore, the EPA is of the view that offsets are appropriate for this proposal to counterbalance this significant residual impact.

This is consistent with Principle 2 of the Environmental Offsets Policy and the Residual Impact Significance Model in the Environmental Offsets Guidelines. The proponent has proposed the following offsets:

1. Implement a comprehensive research program to investigate the ecology, ecophysiology, habitat requirements and determinants, to inform the habitat reconstruction and translocation option and to answer current uncertainties;
2. Undertake investigations to report of the potential suitability of each site. Investigations would include, soil investigations, drainage, land tenure and potential for long-term protection of the site;
3. Undertake a trial translocation program, testing surface and sub-surface soils through relocation and potential seeding techniques;
4. Implement translocation at tested and approved sites;
5. Implement site re-creation at two sites within the Yeelirrie mine area;
6. Translocation to be conducted at several sites away from the mining area prior to the commencement of mining;
7. Recreation of sites within the mining area included in the mine schedule; and
8. Collection of seed and store at the Parks and Wildlife seed bank.

Consistent with Principles 2 and 3 of the Environmental Offsets Policy, the EPA considers that the offset proposed for this proposal is adequate, based on the information provided by the proponent in the PER document, such as the evidence provided that *A. yeelirrie* has been known to regenerate following rehabilitation in 2004 (Cameco 2015) and the Response to Submissions document (Cameco 2016).

Consistent with principles 4 and 5 of the WA Environmental Offsets policy, the outcomes and knowledge gained from the translocation offset will be useful in furthering the understanding of the requirements of this species.

In the event the Minister determines that the proposal may be implemented, the EPA recommends a condition be imposed requiring the development of an Offset Plan to ensure that at least the same number of *A. yeelirrie* individuals impacted by the proposal are successfully translocated. The Offset Plan would also define completion criteria to ensure the required outcome is achieved. Consistent with Principles 5 and 6 of the Environmental Offsets Policy, the Plan would also allow for an adaptive management framework and a flexible approach to ensure that the anticipated outcomes are realised.

Subterranean Fauna

Consistent with Principle 1 of the WA Government's Offsets Policy, the proponent has applied the mitigation hierarchy by identifying measures to avoid, minimise and rehabilitate environmental impacts through actions that include:

- avoiding loss of four troglafauna species by preserving 10.5 ha of the orebody to retain subterranean fauna habitat;
- avoiding impacts to subterranean fauna habitat within the northwest palaeo-channel, outside the Impact Area;
- minimising impacts to stygofauna by developing a Subterranean Fauna Management Plan (integrated closely with a Groundwater Management Plan), in accordance with EAG 17;
- minimising impact to stygofauna species and suitable habitat through pumping optimisation and the strategic location of abstraction wells; and
- minimising impacts to stygofauna by ensuring groundwater drawdown of 0.5 m does not extend beyond the 0.5 m drawdown contour as presented in Figure 9-17 of the PER document.

Noting the discussion provided in Section 3.1 Subterranean Fauna, the EPA is of the view that there is too great a chance of a loss of species that are restricted to the Impact Area and therefore considers that the proposal should not be implemented. However, it should be noted that Section 5 Other Advice discusses potential offsets for Subterranean Fauna should the Minister determine that the proposal may be implemented.

Summary

Having particular regard to the:

- (a) relevant WA Government and EPA policy and guidance pertaining to Offsets; and
- (b) EPA's assessment that there remains a significant residual impact on the threatened species *A. yeelirrie*, which is acceptable and capable of being offset; and
- (c) unacceptable impact to subterranean fauna species,

the EPA considers that:

- in the event the Minister determines that the Proposal may be implemented the impacts to Flora and Vegetation would be acceptable and the proposal could be managed to meet the EPA's objective for Flora and Vegetation, provided an offset condition is imposed to counterbalance the significant residual impact on the Rare Flora species; and
- there is too great a chance of a loss of subterranean fauna species restricted to the Impact Area. As a result, and having regard the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity*, and the Principle of intergenerational equity the EPA is of the view that the proposal cannot be managed to meet the EPA's objective for Subterranean Fauna.

4. Matters of National Environmental Significance

The Commonwealth Minister for the Environment determined that the proposal is a controlled action under the EPBC Act as it is likely to have a significant impact on one or more Matters of National Environmental Significance (MNES). It was determined that the proposed action is likely to have a significant impact on the following matters protected by the EPBC Act:

- Listed threatened species and communities (sections 18 & 18A);
- Listed migratory species (sections 20 & 20A); and
- Nuclear actions (sections 21 & 22A).

This proposal is being assessed as an accredited assessment under section 87 of the EPBC Act. This allows the State of Western Australia to use the PER process to assess the action under the EPBC Act on behalf of the Commonwealth Minister for the Environment.

The EPA has generally considered the intent of Commonwealth policy, guidance and plans considered to be relevant for this factor.

The assessment report on the proposed action prepared by the EPA and provided to the Western Australia Minister for Environment is forwarded to the Commonwealth Minister for Environment who would then make a decision as

to whether or not the Proposal should be approved under the EPBC Act. This is separate from any Western Australia approval that may be required.

Commonwealth policy and guidance

As the proposal is being assessed as an accredited assessment under Section 87 of the EPBC Act, Commonwealth policy and guidance also applies to this assessment including *Environmental Protection and Biodiversity Conservation Act 1999 – Environmental Offsets Policy* (Department of Sustainability, Environment, Water, Population and Communities 2012). Consistent with the requirements of the ESD for the proposal, the Department of the Environment (DotE) has advised that the following conservation advice, species-specific recovery plans, and threat abatement plans for relevant species listed under the EPBC Act are relevant for this assessment.

- *Survey guidelines for Australia's threatened birds*, (Australian Government 2010a);
- *Survey guidelines for Australia's threatened bats*, (Australian Government 2010b);
- *Survey guidelines for Australia's threatened mammals*, (Australian Government 2010c);
- *Commonwealth Conservation Advice on Polytelis alexandrae (Princess Parrot)* (Threatened Species Scientific Committee 2008);
- *National Recovery Plan for Malleefowl (Leipoa ocellata)* (Benshemesh, J., 2007);
- *National Recovery Plan for the Greater Bilby (Macrotis lagotis)* (Pavey, C. 2006);
- *A Recovery Plan for the Great Desert Skink (Egernia kintorei) 2001-2011* (McAlpin, S., 2001);
- *Recovery plan for five species of rock wallabies: Black-footed rock wallaby (Petrogale lateralis), Rothschild rock wallaby (P. rotherschildi), Short-eared rock wallaby (P. brachyotis), Monjon (P. burbridgei) and Nabarlek (P. concinna) 2012-2022* (Pearson, D.J., 2013);
- *Commonwealth Conservation Advice on Idiosoma nigrum (shield-back trapdoor spider)* (Threatened Species Scientific Committee (TSSC), 2013);
- *Threat Abatement Plan for Predation by the European Red Fox* (Department of the Environment, Water, Heritage and the Arts 2008c);
- *Threat Abatement Plan for Reduction in Impacts of Tramp Ants on Biodiversity in Australia and its Territories* (Department of the Environment and Heritage 2006);
- *Threat Abatement Plan for Predation by Feral Cats* (Department of the Environment 2015);
- *Threat Abatement Plan for Competition and Land Degradation by Rabbits* (Department of the Environment, Water, Heritage and the Arts 2008a);

- *Threat Abatement Plan for Competition and Land Degradation by Unmanaged Goats* (Department of the Environment, Water, Heritage and the Arts 2008b); and
- *Threat Abatement Plan for the Biological Effects, including Lethal Toxic Ingestion, caused by Cane Toads* (Commonwealth of Australia 2011).

The DotE has advised that the Mulgara (*Dasycercus cristicauda*) and the Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*) have both been de-listed under the EPBC Act since the controlled action decision for this proposal. Thus, the DotE advised that section 139 of the EPBC Act no longer requires that the Commonwealth Minister for Environment act consistently with the recovery plans. However, these recovery plans are still likely to contain relevant information that may be considered in carrying out the assessment.

Atriplex yeelirrie has been listed since the controlled action decision.

EPA assessment

The EPA notes that the proponent has addressed the intent of EPA and Commonwealth policy, guidance and plans considered to be relevant for this factor in the PER document.

As noted in Table 2, the proposal would result in the clearing of up to 2,422 ha of potential habitat, some of which may support species that are MNES.

Listed threatened species and communities

Table 9-32 in Section 9.3 (Terrestrial Fauna) of the PER document provides a summary of the Vegetation and Substrate Associations (VSAs) within the project area and the area of each that would be cleared. The four threatened species noted in the Commonwealth conservation advice and recovery plans listed above, Malleefowl, Greater Bilby, Princess Parrot, Great Desert Skink, Black-flanked Rock-wallaby, and Shield-backed Trapdoor Spider may occur within this suite of VSAs.

The proponent conducted targeted searches for significant fauna within the Study Area and suitable adjacent habitat. The proponent reported that three listed threatened species, Malleefowl, Black-flanked Rock-wallaby and Shield-backed Trapdoor Spider, were confirmed as present during field surveys. The locations of these records are shown in Figure 10-1 of the PER document. Majority of those records fall outside the Development Envelope, with the nearest about two kilometres from the boundary. Two Malleefowl mounds were located within the Development Envelope and would be disturbed as a result of the proposal. However, the EPA notes that each of these species occupies habitat that occurs outside the calcrete environment that hosts the ore body. The types of habitats affected by clearing for project infrastructure are widespread in the Study Area, as shown by Figure 10-1 in the PER document. The proponent also states that no Threatened Ecological Communities were found in the area.

While listed threatened species may occur in the area of impact of the Proposal, 70 per cent or more of each VSA habitat type in the Study Area occurs outside the area of direct impact and potential indirect impact, as set out in Table 9-32 of the PER document. No unacceptable or unsustainable impacts are expected as a result of the proposal on the listed threatened species discussed above.

An assessment of the likely impact of the proposal on *Atriplex yeelirrie* is set out in Section 3.2 of this report. *A. yeelirrie* comprises Western and Eastern populations. Cameco has proposed management measures to preserve the Eastern population. The Western population lies wholly within the orebody and the proposal would result in the loss of the genetically distinct Western population. Hence, the proposal would have a significant residual impact from the direct clearing of all 84,510 plants over 76 ha of the Western population of *A. yeelirrie*.

Listed migratory species

Listed migratory species that may occur in the Study Area are listed in Table 10-3 of the PER document. Of these, the Rainbow Bee-eater and Fork Tailed Swift were recorded during surveys conducted for the proponent. Rainbow Bee-eaters are common and widespread in Australia. Fork Tailed Swifts are regular summer migrants found throughout Australia. Neither species is considered likely to be critically dependent on habitat in the project envelope.

No migratory waterbirds were recorded during surveys for the project, although waterbirds may be attracted to the 50 ha evaporation pond. The proponent plans to use deterrent techniques, including flashing beacons and noise-generating gas guns that have been effective in other inland environments, and plans to provide details in a Fauna Management Plan. No unacceptable or unsustainable impacts are expected as a result of the proposal on the listed migratory species discussed above.

Nuclear actions

The EPA has assessed the potential impacts of radiation on people in Section 3.4 of this report (Human Health), on fauna in Section 3.3 (Terrestrial Fauna) and on flora in Section 3.2 (Flora and Vegetation).

In addition to listed threatened species and communities and migratory species, the EPA has also given consideration throughout the various stages of its assessment process to the other important aspects of the environment that may be affected by the proposal. The EPA's assessment of the likely impacts of the proposal are provided in Section 3 of this report. In addition, the EPA's consideration of other aspects not discussed in Section 3 are provided in Appendix 3.

Management

The proponent would implement a number of procedures to mitigate impacts on native biota, including the management of surface water and groundwater levels as outlined in Section 3.5, the staged clearing of vegetation, progressive rehabilitation, and restriction of vehicle movements. These management measures would be set out in a series of management plans including plans for Fauna, Flora and Vegetation, Conservation Significant Flora (*A. yeelirrie*) and Subterranean Fauna. These plans for the management of biota would be augmented by plans to manage surface water, groundwater and other aspects of the proposal that may affect the biota. A list of these plans is presented on page 430 of the PER document.

The proponent has also proposed a range of research and translocation actions for *A. yeelirrie*, and additional survey and study actions on subterranean fauna to counterbalance the significant residual impact on these key factors of the EPA's assessment of this proposal. The EPA assessment of these proposals can be found under Section 3.9 Offsets.

The need for management of pests such as feral cats, rabbits, foxes, goats, cane toads and tramp ants should be subject to a risk-based assessment during the formulation of the Fauna Management Plan and any management needs included in that Plan. There does not appear to be any component of this proposal that would lead the EPA to suspect that these animals would represent an unmanageable additional threat to listed MNES species if this proposal was implemented.

Summary and recommendations

The EPA considers that the impacts from the proposal on the listed threatened species, communities and migratory species are not expected to result in an unacceptable or unsustainable impact on the conservation status of these listed species. The EPA has also concluded that for all key environmental factors, except Subterranean Fauna, the EPA's objectives could be met. Therefore the EPA's view is that impacts from the proposal associated with the nuclear actions are not expected to result in an unacceptable or unsustainable impact, except in relation to Subterranean Fauna.

In addition, in the event the Minister determines that the proposal may be implemented, the EPA has provided a number of draft conditions (Appendix 6) to minimise the impacts on MNES determined for this proposal, including, but not limited to:

- limiting the location and authorised extent of the clearing of vegetation to 2,422 ha, as set out in Table 2 of Schedule 1;
- requiring the protection of the Eastern population of *A. yeelirrie*;
- requiring the implementation of an Offset Plan for *the A. yeelirrie* to counterbalance the significant residual impact on the Threatened species; and

- requiring a Fauna Management Plan to minimise impacts to listed threatened fauna species.

The EPA notes that, if the Proposal is approved, the Commonwealth Government is likely to impose additional conditions relating to potential impacts from radiation, as it has done for other uranium mines in Australia.

5. Other advice

The EPA is of the view that the proposal meets the objectives for all of the key environmental factors apart from Subterranean Fauna, having regard for the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity*, and the *Principle of intergenerational equity*.

Section 44(2a) of the EP Act provides that the EPA may include other information, advice or recommendations in its assessment report.

In this context, if the Minister determines that the proposal may be implemented, the EPA advises that the Ministerial approval should be subject to those conditions set out in Appendix 6 of this report for the following key environmental factors:

- Flora and Vegetation;
- Terrestrial Fauna;
- Hydrological Processes;
- Inland Waters Environmental Quality;
- Heritage;
- Rehabilitation and Decommissioning; and
- Offsets.

The Ministerial approval should also include appropriate conditions regarding the impacts on subterranean fauna.

In the specific case of subterranean fauna, the EPA considers that uncertainty surrounding the potential for serious or irreversible damage may be mitigated by further scientific investigation, research and study to determine if the restricted species either extend beyond the Impact Area of the proposal, or a compelling case is made that their habitat is continuous and extensive well beyond the impact area.

It is the EPA's opinion that should the Minister determine that the proposal may be implemented, such investigations and research would be of value in understanding, and potentially mitigating further impacts on, these species. An environmental management plan should be included in any statement of implementation should focus on, but not be limited to:

- Sampling and identification of subterranean fauna taxa and/or suitable habitat of restricted species outside the impact area as per the requirements of Environmental Assessment Guideline No. 12 *Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013) or another appropriate methodology.
- Ensuring information is scientifically rigorous and statistically valid.
- Restricting the groundwater drawdown to that modelled in the PER document.
- Monitoring which includes thresholds, triggers, contingency actions, and reporting.
- Establishing a Troglofauna Protection Area.

The EPA considers that an industry-funded research program with the long-term aim of reducing the uncertainty surrounding the conservation of subterranean fauna species in the presence of mining may assist with improving the currently limited scientific understanding of subterranean fauna across the State and inefficient sampling methods. A commitment by the proponent to support such a program could potentially, and indirectly, offset the local impacts it might have on subterranean fauna at Yeelirrie to the broader benefit of subterranean fauna conservation state wide.

An offsets plan to improve the scientific knowledge and understanding of subterranean fauna taxa should be included in any statement of implementation and address, but not be limited to:

- Improving the knowledge of their taxonomy, distribution and habitat requirements.
- Developing a better understanding of the impact on subterranean fauna from mining operations.
- Identifying the key variables to support the ecological function of subterranean fauna.

Lastly, in addition to the proposed offset for the threatened flora species, *Atriplex yeelirrie*, the EPA also advises that the proponent has committed to investigating tenure options to ensure long-term protection of the Eastern population, including the establishment of a Conservation Area. The EPA is of the view that long-term protection of the Eastern population is important in ensuring to ensure the long-term viability of the species.

6. Recommendations

That the Minister for Environment notes:

1. the report on the key environmental factors of Subterranean Fauna, Flora and Vegetation, Terrestrial Fauna, Human Health, Hydrological

Processes, Inland Waters Environmental Quality, Heritage, Rehabilitation and Decommissioning, and Offsets, set out in Section 3;

2. that the EPA has concluded that the proposal cannot meet the EPA's environmental objectives for Subterranean Fauna, having regard to the *Precautionary Principle*, the *Principle of the conservation of biological diversity and ecological integrity*, and the *Principle of intergenerational equity* and therefore should not be implemented;
3. the EPA's other advice presented in Section 5 and Appendix 6 about conditions, should the Minister determine that the Proposal may be implemented.

Appendix 1

List of Submitters

Organisations:

1. Commonwealth Department of the Environment
2. Department of Aboriginal Affairs
3. Department of Environment Regulation
4. Department of Mines and Petroleum
5. Department of Parks and Wildlife
6. Department of State Development
7. Department of Water
8. Main Roads WA
9. Radiological Council WA
10. Western Australian Museum
11. Conservation Council of Western Australia, Australian Conservation Foundation, Friends of the Earth Australia, The Wilderness Society, Anti Nuclear Alliance of WA, the West Australia Nuclear Free Alliance, Australia Nuclear Free Alliance
12. Denmark Environment Centre Inc.
13. Kalgoorlie-Boulder Chamber of Commerce and Industry
14. People for Nuclear Disarmament
15. Uniting Church in Australia
16. Wildflower Society of Western Australia

Individuals:

Senator Scott Ludlam – Australian Greens

The Hon Robin Chapple MLC – member for the Mining and Pastoral Region

151 individual submissions

2,964 pro forma submissions

Appendix 2

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Appendix 3

Summary of Identification of Key Environmental Factors and Principles

Summary of identification of key environmental factors

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
LAND			
Subterranean fauna	<p>The proposal would result in mining of up to 726 ha of subterranean fauna habitat, potential changes in groundwater quality due to process spills and lowering of the water table by 0.5 m or more over an additional 1,056 ha over the life of the mine. Groundwater levels could take 50+ years to recover. These changes would adversely affect stygofauna that depend on groundwater and troglifauna that inhabit voids in material that would be removed by mining.</p>	<p>Parks and Wildlife</p> <p>The proponent has not provided any detail about the percentage of the habitat that supports the species that could be lost. There is no evidence of a strategy to protect or relocate those species. There is no indication that the habitat of those species will be restored at any time.</p> <p>The basis for the 0.5 m threshold is somewhat unclear and may be arbitrary or a proposed experimental level, rather than being based on a thorough understanding of the impacts of various drawdown levels on salinity gradients in the affected aquifer/s, or ecological impacts.</p> <p>The groundwater model used does not appear to have been developed based on full consideration of the complexity of the hydrological environment at Yeelirrie or to model the potential influence that changes to particular hydrological parameters could have on the habitat and survival of subterranean fauna.</p>	<p>Having regard to the potential impacts from the removal of subterranean fauna habitat, potential for process spills and lowering of the water table the EPA identified Subterranean Fauna as a key environmental factor. Subterranean Fauna is discussed in section 3.1.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>The PER has assessed the potential impact on troglofauna as the direct loss of habitat from excavation and drying of habitat at the edges of the active mine pit.</p> <p>Department of the Environment The practicability of the proposed mitigation measures for subterranean fauna should be demonstrated, including how groundwater contamination will be addressed or managed.</p> <p>WA Museum The subterranean fauna of the Yeelirrie site is one of the most diverse local subterranean fauna known to exist. The development of a shallow and thus extensive open pit mine in the core of this distribution will disrupt this community and might lead to species extinction.</p> <p>CCWA The Yeelirrie Subterranean community Priority 1 PEC comprises a series of highly endemic, diverse stygofauna and troglofauna species within multiple calcrete habitats. The impact of the mine and</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>groundwater dewatering pose an unacceptable risk that could see a number of subterranean species become extinct.</p> <p>There is strong evidence that the Yeelirrie Subterranean Community should be listed as a TEC, given the highest diversity of any subterranean ecosystem in the region, the highest rates of endemism and the threat of mining, which threatens to destroy the community and habitat.</p> <p>There is sufficient evidence in the Bennelongia and Subterranean Ecology work to show that a significant number of species only exist in the direct Impact Area of the mine. If the mine is approved these species could become extinct. The remaining 100 species that rely on the Yeelirrie subterranean ecosystem for their sole habitat could also be indirectly impacted.</p> <p>In past assessments where a singleton has not been able to be identified beyond the Impact Area a 500m exclusion zone has been placed around the location where a troglodfauna species was found and restricted.</p> <p>As the pits are proposed to be tailings storage facilities and toxic/radioactive chemicals have a deleterious impact on fauna within the nearby</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>subterranean habitat, it is expected that a continuous calcrete habitat would be required to be preserved between the location of each of five troglodfauna species and the remaining unaffected habitat beyond the mine pit and various tailings plumes.</p> <p>The drawdown of water provides the greatest risk to Subterranean fauna. This is expected to have a residual impact of 500 years post mining.</p> <p>The prime subterranean habitat is to become a series of tailings cells and dumps for processed material, waste rock and contaminated materials. No attempt has been made to reinstate any kind of suitable habitat for subterranean fauna in the mine area.</p> <p>It is not expected that the pit, during or after mining, will ever become suitable habitat for subterranean fauna.</p> <p>R Chapple</p> <p>Cameco has not identified the impact of their proposed operation on subterranean fauna, such as habitat loss and degradation, ongoing mortality, species interactions, changes in hydrology, disturbance and bioaccumulation.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>S Ludlam</p> <p>Yeelirrie has extremely high diversity and short-range endemism of the subterranean fauna making it highly likely that many restricted species of stygofauna and troglofauna are going to suffer high or critical impacts as a result of mining. The Yeelirrie uranium mine Proposal is also likely to make a number of subterranean fauna extinct.</p> <p>Enough information has been provided to place the 15 species on the Threatened species lists under the <i>Wildlife Conservation Act 1950</i> and/or the <i>Environment Protection and Biodiversity Conservation Act 1999</i>.</p> <p>Public Submitters</p> <p>Impacts to subterranean fauna that are only known from the pit area.</p> <p>Further targeted surveys should be carried out outside of the pit areas prior to ground disturbing activities in order to find the 15 species.</p> <p>Cameco has only provided general management measures to minimise the potential impacts to these species.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
Flora and vegetation	<p>The Proposal would result in the clearing of up to 2,422 ha of native vegetation, removal of one of two populations of the threatened species <i>Atriplex yeelirrie</i> and potential threats to flora and vegetation from radiation, lowering of the water table, fragmentation, weeds and fire.</p>	<p>Parks and Wildlife</p> <p>The complete removal of the western genotype represents an extreme and unacceptably high level of risk to the conservation of the western genotype in the wild.</p> <p>There are concerns regarding the translocation of the Western population as a mitigation strategy.</p> <p>The complete loss of the western genotype coupled with continued decline of the eastern genotype, including with respect to area, extent and/or quality of habitat, and potentially number of individuals or area of occupancy, could lead the taxon meeting the IUCN criteria for listing as critically endangered. Arresting the decline of the eastern genotype could reduce the potential for the threat category to change to this extent.</p> <p>Without a comprehensive understanding of habitat requirements for the taxon, predictions of whether adequate potential habitat exists within Lake Mason (or outside the taxon's current range) are considered unreliable. Without scientific investigation of the ecophysiology of the taxon in relation to inundation, tolerable ranges for salinity, and other physical and chemical soil characteristics, statements of inferred</p>	<p>Having regard to the potential impacts from clearing of native vegetation, impacts on threatened flora, potential effects of radiation, lowering of the water table, fragmentation, weeds and fire the EPA identified Flora and Vegetation as a key environmental factor. Flora and Vegetation is discussed in section 3.2.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>limitations or determinants of the taxon's distribution have limited reliability.</p> <p>Given the specific properties of the soil profile of <i>Atriplex</i> sp. Yeelirrie Station and the uncertainty as to what inundation periods <i>Atriplex</i> sp. Yeelirrie Station requires, it is unclear whether mounding of the soil could replicate the conditions in which this taxon naturally grows. An assessment of the potential impacts on Lake Mason and the associated vegetation and flora would also need to be undertaken prior to commencement of habitat modifications.</p> <p>The elevated salt levels at Lake Mason and their implications for establishment and long term survival of <i>Atriplex</i> sp. Yeelirrie Station could also be an issue in understanding habitat and potential suitability for a translocation site.</p> <p>There is an apparent deficiency in the area / amount of inferred habitat that has been identified by the proponent as suitable for translocating <i>Atriplex</i> sp. Yeelirrie Station compared to the amount that is proposed to be impacted.</p> <p>The number of individuals established in a translocated population would need to be at least</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>double that required for a monoecious species that was being translocated. In addition, the ratio of male to female plants would need to be similar to the natural population.</p> <p>High levels of seedling mortality have been observed in the natural populations and recruitment appears to be highly variable across the natural populations, possibly due to highly site specific hydrological factors and soil properties affecting the germination, establishment and survival of young plants.</p> <p>In highly variable environments such as Yeelirrie or Lake Mason, establishing populations that are able to cope with this variability, with enough individuals of the correct male to female ratio and effective recruitment would be a challenge.</p> <p>In view of the apparent difficulties in identifying a suitable natural translocation site for <i>Atriplex</i> sp. Yeelirrie Station with similar soil profiles and materials to the natural populations, there would appear to be value in further consideration of utilising soil from the pit areas to construct a suitable 'translocation soil profile' near the mine.</p> <p>The proponent should clarify whether the increasing salinity at the eastern population may pose a threat to</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>the conservation of the eastern population, what the potential causes of increasing salinity are and what possible mitigation measures could be employed to address the threat.</p> <p>The local population of Priority 3 <i>Eremophila arachnoides</i> subsp. <i>arachnoides</i> at Yeelirrie is the largest recorded population of this species. The potential for 26.5 per cent combined direct and indirect impact (risk largely from flooding) may potentially be significant at the local and regional scale.</p> <p>The Proposal presents a scenario of directly impacting more than 30 percent of six vegetation units.</p> <p>Department of the Environment</p> <p>It is unclear whether the percentage loss of <i>Atriplex</i> sp. Yeelirrie Station has been calculated using the rehabilitation population.</p> <p>It is not clear whether studies have been undertaken to determine the origin of the sub-populations of <i>Atriplex</i> sp. Yeelirrie Station, and the relative importance of each genotype.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>The Flora and Vegetation Management Plan should incorporate ongoing monitoring and mitigation measures that reflect the water requirements of any identified Groundwater Dependent Ecosystems.</p> <p>The groundwater monitoring program needs to complement the GDV condition monitoring program. The GDV program needs to have reference to modelling and conceptualisations.</p> <p>CCWA</p> <p>The overall risk to flora and vegetation includes water drawdown, reinjection of water, increased salinity, erosion, dust deposition, disruption to surface water flow and land clearing, and that Cameco has relied on uncertainty to make optimistic predictions about species existing elsewhere while downplaying the risks.</p> <p>Concern about the extensive clearing of Mulga <i>Grevillea berryana</i> Shrubland. Cameco also say that 99% of this vegetation community occurs in the 1m drawdown contour. <i>Grevillea berryana</i> is known to be a groundwater dependent plant species so it is expected that drawdown will impact this species. This species and vegetation community will suffer heavy</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>impacts from clearing and water drawdown. This species and vegetation community will suffer heavy impacts from clearing and water drawdown. Without looking for evidence about the component species existing elsewhere Cameco just make the proposition that it is and make no further mention of it here or in any of the Appendices on vegetation and fauna. While it is quite possible that this species is widespread the proponent should provide that evidence.</p> <p><i>Rhagodia</i> is a high-risk species. Given that it has only been identified in the Project area the public submitter views the possible impacts as high impact. Cameco have not done an in depth study into the potential impacts of water drawdown or dust deposition, increased salinity or any other potential impact that may have dire consequences for this species.</p> <p>There is concern about the ability for the survival of the Western population of the <i>Atriplex</i> sp. Yeelirrie Station taxon and concern over Cameco's ability to re-vegetate the pit area and re-establish the Western population.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Wildflower Society</p> <p>Transplanting individuals from one ecosystem into another is compromising the integrity of the recipient ecosystem. This effectively increases the overall impact of the Project rather than lessening it. Efforts would be better spent protecting the remaining in-situ populations by exclusion, maintaining water regimes, seed banking and weed control.</p> <p>No regional assessment of vegetation types present in the study area was demonstrated in the PER document. The only regional representation assessment was of Land Systems, which is too broad for EIA. Using Land Systems only is the equivalent of doing a conservation significance assessment of flora by identifying species to genus only.</p> <p>There was only a local conservation significance assessment done of 'vegetation communities' within the footprint.</p> <p>Because of the extra pressures placed on a significant part of the landscape as a result of this Project, and the likely conservation significance of some of the flora species and vegetation types in the local area, it is recommended that if possible, the</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Yeelirrie pastoral station remain destocked for the life of the Project.</p> <p>Public Submitters</p> <p>The contaminated dust from the mine will impact the vegetation.</p> <p>The PER lists the protection of the eastern <i>Atriplex</i> sp. Yeelirrie Station population as management for reducing the projects impact on the species, however if they are separate species protection of the eastern <i>Atriplex</i> sp. Yeelirrie Station is not a sufficient approach.</p>	
Terrestrial fauna	<p>The Proposal would result in direct loss of 2,422 ha of potential fauna habitat by clearing.</p> <p>There is potential for indirect impacts on Terrestrial Fauna as a result of increased dust emissions, vehicle strikes, feral predation, habitat fragmentation,</p>	<p>Department of Parks and Wildlife</p> <p>Further investigation is required to determine whether a resident population of the threatened black-flanked rock-wallaby is likely to occur at Yeelirrie.</p> <p>The Department of Parks and Wildlife should be consulted during the development and review of the proponent's fauna management plan and strategies.</p> <p>The impacts on the known and potential SRE's are difficult to assess. Further surveys should be completed. It may be appropriate to require the development of a management plan for SREs.</p>	<p>Having regard to the potential impacts from the clearing of native habitat, ongoing mine operations (vehicle strikes, dust) and altered ecological processes (feral predation, habitat fragmentation, weeds, hydrology, fire) the EPA identified Terrestrial Fauna as a key environmental</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	weed infestation, altered fire regimes and changes to groundwater hydrology.	<p>Department of the Environment</p> <p>It should be noted that Malleefowl is no longer listed as a migratory species, and the Northern Marsupial Mole has been delisted under the EPBC Act.</p> <p>Further information needs to be provided to quantify the impacts potentially resulting from ground disturbing activities.</p> <p>Conservation Council of WA</p> <p>The proponent has offered only broad-brushed solutions to potential problems and not specifically identified areas that would be protected or offsets that would be applied.</p> <p>The proponent should have identified the locations of the significant fauna species and have detailed management actions in place.</p> <p>There needs to be more detailed explanation to support the assertion that the impacts would be minor or negligible.</p> <p>The submitter remains critical over the use of the ERICA model to determine the potential level of radiation exposure. Ground testing and assessments</p>	<p>factor. Terrestrial Fauna is discussed in section 3.3.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>on individual species and pathways should be conducted.</p> <p>The submitter contends that any Fauna Management Plan that is developed should be made open to public comment prior to any Departmental or Ministerial Approval.</p> <p>Public submitters</p> <p>Concerns were raised around the impacts of radiation and contaminated dust on terrestrial fauna.</p>	
Terrestrial environmental quality	<p>The Proposal has the potential to impact on Terrestrial Environmental Quality as a result erosion and sedimentation; flooding of water storage facilities; spills; seepage from the TSF and Waste storage and Dust deposition.</p> <p>There is also the potential for mineralised material</p>	<p>Department of the Environment</p> <p>Clarification sought on the additional waste management facility to provide separation of disposal for non-radioactive material separate from radioactive material.</p> <p>PND(WA)</p> <p>Major rainfall events could lead to the mines overburden and tailings storage facility being flooded.</p> <p>Public Submitters</p> <p>The proponent has stated that they are unsure if the site has been contaminated by previous activities.</p>	<p>Terrestrial environmental quality was identified as a preliminary key environmental factor in the Environmental Scoping Document for the Proposal.</p> <p>Having regard to Environmental Assessment Guideline 9 - <i>Application of a Significance Framework in</i></p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	being deposited outside the project area during the hauling process.		<p><i>the Environmental Impact Assessment Process</i> (EPA, 2015b) and given:</p> <ul style="list-style-type: none"> • Results of calculations undertaken to determine the depth of water in the TSF following a 72-hr PMP event, determined that the design of the TSF would be adequate to contain the resulting volume following such an event; • The proponent's confirmation through the response to submissions, that sewage would not be sent to the TSF and would be treated prior to use as irrigation; • The clarification provided in response to

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			<p>submissions regarding the use of the additional waste management facility and radioactive and non-radioactive waste streams;</p> <ul style="list-style-type: none"> • The proponent's management commitments to develop; surface water, radiation and dust management plans; and • The proponent's commitments around rehabilitation and vehicle and equipment hygiene, <p>the EPA consider that it is unlikely the proposal would have a significant impact on Terrestrial Environmental Quality and</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			the proposal can meet the objective for this factor. Accordingly, the EPA did not identify terrestrial environmental quality as a key environmental factor at the conclusion of its assessment
WATER			
Hydrological processes	<p>Hydrological processes may be impacted by the diversion of surface water flows from mine construction, groundwater dewatering and abstraction, and groundwater reinjection.</p> <p>A surface water diversion bund would be constructed around the mine area to prevent surface water runoff</p>	<p>Department of Water</p> <p>The predicted water level drawdown in the palaeo-channel shows that there is no notable interference between the proposed abstraction at Yeelirrie and the Albion Downs palaeo-channel well-field.</p> <p>No discernible change in groundwater flow is expected at the catchment scale.</p> <p>The DoW has not comprehensively assessed the dewatering model and the modelled drawdowns. This would be undertaken as part of the licensing process required under the RIWI Act. However, the modelling appears sufficient and accurate to determine groundwater drawdown and impacts.</p>	<p>Having regard to the potential to impact surface and groundwater hydrological regimes and affect the availability of groundwater for dependent ecosystems and other groundwater users, the EPA identified Hydrological Processes as a key environmental factor. Hydrological Processes are discussed in section 3.5.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	<p>being discharged into the natural environment. This could alter the baseline hydrology during a significant flood event.</p> <p>The Proposal would require approximately 8.7 megalitres of water per day to meet project demands for ore processing and site management. This water would be supplied from pit dewatering until year 4 of operations. After that time the water supply would be supplemented by the proposed wellfields. Drawdown from these wells could lower the water table, affecting other users, including pastoralists who depend on groundwater</p>	<p>The hydrogeological studies provide sufficient rigour and accuracy to enable an adequate assessment of impacts on the environment, other users and the aquifer system.</p> <p>Further liaison with the DER is recommended as the DoW understands that the reinjection may require discharge licensing from the DER.</p> <p>Department of the Environment</p> <p>The site water balance and the Goldsim model do not account for potential changes in rainfall resulting from forecast climate change.</p> <p>It is unclear how the modelled water balance compares to the conservative scenario utilised in groundwater flow modelling.</p> <p>Public</p> <p>Concerns raised about the quantity of water required for processing, and the long-term effects on surface water and groundwater.</p> <p>Concerns raised about potential impacts on neighbouring bores.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	<p>for stock and industrial users supplied from the existing Albion Downs borefield.</p> <p>Prior to processing activities commencing in year 4, surplus water would be reinjected into the calcrete aquifer via a Managed Aquifer System. Reinjection could cause the water table to rise, with the potential to adversely affect biota dependent on the unsaturated zone above the existing water table.</p>		
Inland Waters Environmental Quality	Diversion of surface flows may affect surface water quality by increasing flow velocities and hence increasing the potential	<p>Department of Water</p> <p>The Department of Water has advised that Cameco's hydrogeological studies for this proposal provide sufficient rigor and accuracy to enable an adequate assessment of impacts on the environment, other</p>	Having regard to the potential for the Proposal to have impacts on surface and groundwater quality and to affect the

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	<p>for erosion and sediment loading.</p> <p>Stored tailings may provide a source for elevated metals and salt in groundwater, with the potential to affect the quality of future supplies for stock or other uses down flow.</p>	<p>users and the aquifer system and that it has no objections to the Proposal.</p> <p>Department of the Environment The Department of the Environment asked a number of questions about tailings management and how leaching would be minimised if groundwater flows back into the tailings. The Department advised that the proponent's responses were largely satisfactory but suggested that care needs to be exercised when extrapolating test work to the long term. The Department also advised that the overall impact of the project is likely to be minor in the regional context and that the proposed development represents a relatively small disruption, mostly rectified by the proposed closure and rehabilitation activities.</p> <p>Department of Environment Regulation The Department of Environment Regulation has provided advice in regard to modelling the fate and transport of uranium in hypersaline groundwater. That advice indicated that the test work carried out by the proponent is sound but may not be adequate. DER advised that another proponent of another calcrete-</p>	<p>quality of groundwater for dependent ecosystems and other groundwater users, the EPA identified Inland Waters Environmental Quality as a key environmental factor. Inland Waters Environmental Quality is discussed in section 3.6.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>hosted uranium proposal has made a commitment to undertake work recommended by the CSIRO during the mining phase of the Proposal to better inform the management of wastes and that a similar program would greatly reduce the level of uncertainty about uranium transport in groundwater at Yeelirrie.</p> <p>Department of Mines and Petroleum</p> <p>The Department of Mines and Petroleum asked about the modelling of solute transport from tailings and the relationship of the 'worst case' to the 'base case' with respect to potential impacts on regional groundwater quality. The DMP subsequently acknowledged that information on solute transport modelling for the TSF is detailed within Section 7.6.12 of the Conceptual Mine Closure Plan and that the potential movements of selected constituents of concern (COCs) are not anticipated to result in significant local or regional impacts, as groundwater is naturally saline and displays existing radiation levels above stock water guidelines.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Public</p> <p>Intense rainfall may pose a significant erosion risk to ore stockpiles and to drainage quality of runoff.</p> <p>The frequency and intensity of rainfall events, dust storms, cyclones could exceed expectations and have a detrimental impact on:</p> <ul style="list-style-type: none"> • Drainage systems capacity; • Tailings; • Inundation of backfilled areas; and • Metalliferous drainage from ore stockpiles. <p>Uranium tailings would pollute and impact on rivers.</p>	
AIR			
Air quality and atmospheric gases	The generation of radionuclide-containing dust from mining, stockpiling, processing, crushing and milling, and	<p>Department of Environment Regulation</p> <p>The modelling of fugitive particulate emissions is complex. However in this case the modelling is appropriate to show that the dust contribution is not significant at larger distances.</p>	Air quality and atmospheric gases was identified as a preliminary key environmental factor in the Environmental

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	<p>SO₂, NO₂, CO and dust emissions from power generation and haulage has the potential to impact on the environment and human health. Greenhouse gas emissions from diesel-fired power generation also have the potential to impact on the environment.</p>	<p>The air dispersion model, CALPUFF, used for airshed modelling of NO₂ emissions from the Project, is an appropriate model in this case. The configuration of the air dispersion modelling appears reasonable.</p> <p>The air quality assessment of power generators was conducted based on using rich-burn engines with no emission control in place. It was unclear from the report whether after-treatment systems are proposed to be used to reduce NO₂ exhaust emissions.</p> <p>An assessment of incremental deposited dust against the standard of 2g/m²/month was undertaken and it is noted that predicted incremental dust levels at sensitive receptors (Table 9.6.8) are expected to be very low, at a maximum of 0.013g/m²/month. However, an assessment of total deposited dust against the standard of 4g/m²/month has not been carried out. The proponent has advised that this was due to lack of background data.</p> <p>CCWA</p> <p>The proponent has not described the risks or potential impacts from dust from stockpiling of the various ore types and inversions.</p>	<p>Scoping Document for the Proposal.</p> <p>Having regard to Environmental Assessment Guideline 9 - <i>Application of a Significance Framework in the Environmental Impact Assessment Process</i> (EPA, 2015b) and given:</p> <ul style="list-style-type: none"> • use of meteorological data for all seasons of the year, which includes high wind speed conditions and inversions, in the air quality dispersion modelling; • results obtained from air quality modelling which indicate that ground-level concentrations of the

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>PS151</p> <p>In 2004, there was a horrific dust storm that caused dust to pile up 3-8 inches deep on the Yeelirrie-Meekatharra Road and the topsoil was gone making the roots of the spinifex visible. Have these storms been considered?</p> <p>Cameco should be made to monitor at its neighbours to ensure people outside the mine are not being impacted. The monitoring needs to be robust (PM2.5) and the samples should be independently tested. The submitters believe that there should be guarantees that people outside the mine are safe and that at no stage they would come in contact with the contaminated dust.</p> <p>The submitters consider they have contaminated air to the north (lead mine) and to the east is where the uranium mine would be. In cyclone seasons we get the north westerlies and the weather comes from the north west. During summer time and leading up to summer we get strong winds from the east. The easterlies are the prevailing winds. We are going to get hammered from those two boundaries with contaminated dust.</p>	<p>key mining-related pollutants, including dust, SO₂, CO, Total Suspended Particulates (TSP), dust deposition rate and PM_{2.5} at sensitive receptors would comply with relevant air quality standards, is consistent with EPA Guidance Statement 55 – <i>Implementing Best practice in Proposals submitted to the Environmental Impact Assessment process</i>;</p> <ul style="list-style-type: none"> • calculated direct greenhouse gas emissions of 193,5330 tpa during operations, do not significantly increase the State's total greenhouse gas emissions, which in

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>PS3, PS50, PS151 It is unsatisfactory that a Dust Management Plan is not included.</p> <p>Denmark Environment Centre The Project would release significant CO₂ emissions (126,000 tonnes per year) at a time when we need to be looking at reductions in emissions.</p>	<p>2011-12 was 70.5 million tonnes (Mt) and, consistent with EPB 24 – <i>Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process</i>, does not require further assessment;</p> <ul style="list-style-type: none"> operational measures the proponent would implement to maximise energy efficiency and minimise greenhouse gas emissions are consistent with EPB 24; the EPA's evaluation of radionuclides in dust under the key factor Human Health in this report;

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			<ul style="list-style-type: none"> • advice from the Department of Environment Regulation that the CALPUFF model and its configuration is appropriate; • ability of Part V of the EP Act to adequately regulate air quality impacts, including NO₂; • advice from the proponent that the predicted emission rates of NO_x have been based on rich-burn engines with no emission controls, <p>the EPA considers that it is unlikely that the Proposal would have a significant impact on air quality and atmospheric gases and the Proposal</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			can meet the objectives for this factor. Accordingly, the EPA did not identify air quality and atmospheric gases as a key environmental factor at the conclusion of its assessment.
PEOPLE			
Human Health	<p>Potential impacts from increased exposure to radiation due to mining, haulage and stockpiling of ore and overburden, crushing, processing, product storage, radioactive waste storage and transport of uranium oxide.</p> <p>Potential impacts from noise from mining operations and transport.</p>	<p>Radiological Council The proponent has identified the key factors which need to be included with respect to radiation. The risks associated with radiation are expected to be addressed in the Radiation Management Plan and can be adequately monitored and managed under this plan. This would be regulated by the Radiological Council under the <i>Radiation Safety Act 1975</i>, and the Department of Mines and Petroleum under the <i>Mines Safety and Inspection Act 1994</i>.</p> <p>Department of the Environment The overall approach towards the management of radiation exposure is consistent with</p>	<p>Having regard to the potential impacts from the increase in exposure to radiation on human health of workers, residents at nearby sensitive receptors and along the transport route, the EPA identified Human Health as a key environmental factor. Human Health is discussed in section 3.4.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>recommendations of best international practice (International Commission on Radiological Protection), in particular the proposed application of the principle of optimisation.</p> <p>Please provide a discussion on how radiation doses or the effects of possible erosion of the cover material by surface flooding (after rehabilitation of the mine) can affect the predicted radiological impact on humans, and the environment.</p> <p>Monitoring and checking is always required to verify that the assumptions incorporated in design remain valid. The proponent needs to develop appropriate Plans to implement these checks.</p> <p>CCWA</p> <p>There is no assessment of the health risk of radon gas coming from stockpiles. This gas also gets trapped between layers of hot and cold air.</p> <p>CCWA, Denmark Env. Centre; PND(WA), PS151, OEPA</p> <p>Please confirm whether the maximum wind speeds (e.g. those associated with dust storms) in the region</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>have been included in the dust modelling to determine worst case potential impacts on sensitive receptors.</p> <p>PS1, PS3, PS10, PS49 Uranium mining poses a significant risk to workers and other persons exposed to uranium mining activities. Many studies provided which show the relationships between radiation and cancer.</p> <p>CCWA, Denmark Env. Centre There is no Transport Management Plan provided, so there is scant detail on how Cameco would seek to identify and manage the risks. Transport of yellow cake (to port) always carries the risk of accidents.</p> <p>Kalgoorlie-Boulder Chamber of Commerce and Industry Seeks assurance that regional communities on the transport route are taken into consideration.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
Heritage	<p>Potential impacts on Aboriginal sites partially within and surrounding the development envelope and heritage sites (unregistered) within the development envelope.</p> <p>Potential dust impacts at Yeelirrie Pool.</p> <p>Potential accumulation of radiation in bush tucker</p>	<p>DAA</p> <p>There are currently two registered Aboriginal heritage places known to DAA as being located either wholly or partially within the proposed development envelope. It is understood more contemporary heritage surveys have been undertaken and these Aboriginal heritage places have been identified.</p> <p>It is understood that a number of archaeological places, mainly stone tool artefact scatters and culturally modifies trees, have been identified within the development envelope.</p> <p>It is understood the Proponent considers that the Proposal will not have an impact on any currently registered Aboriginal sites, however, archaeological places identified that have not yet been reported to the DAA may not be avoided.</p> <p>It is also understood that the Proponent has committed to:</p> <ul style="list-style-type: none"> • Consultation with DAA regarding the status and management of Aboriginal sites across the Proposal area; • Consultation with members of the Tjiwari Native Title claimants and with other Aboriginal groups 	<p>Heritage was identified as a preliminary environmental factor in the Environmental Scoping Document.</p> <p>Having regard to Guidance Statement No. 41 – <i>Assessment of aboriginal heritage</i> (EPA 2004) and EAG 9 - <i>Application of a Significance Framework in the Environmental Impact Assessment Process</i> (EPA 2015b) and given:</p> <ul style="list-style-type: none"> • the nature of the heritage and geographic extent of the Kopi Gum; and • the proposed Environmental Heritage Management plan,

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>with an interest in the area about the archaeological material and sites;</p> <ul style="list-style-type: none"> • Consultation with Thiwarl elders and other Aboriginal community representatives about the Proposal for a Management Area to protect ethnographic sites north and south of the Proposal area; • Undertake surveys for archaeological sites on land not previously surveyed that may be impacted by the Proposal; and • The development of an Aboriginal Cultural Management Plan. <p>DAA advised that any potential impacts to Aboriginal heritage from the Proposal can be addressed through the mechanisms established in the provisions of the <i>Aboriginal Heritage Act 1972</i>.</p> <p>Department of the Environment</p> <p>Completion of cultural mapping of the development envelope and any other areas that may be indirectly impacted, including its relevance should be undertaken.</p>	<p>the EPA identified Heritage as a key environmental factor. Heritage is discussed in Section 3.7.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Assessment of impacts on any Aboriginal sites of significance, including a description on heritage sites and/or cultural associations should be undertaken. It is noted that a Cultural Heritage Management Plan will need to be developed prior to commencement.</p> <p>PND (WA) Indigenous ecological knowledge should be incorporated into any future land clearing at Yeelirrie</p> <p>R Chapple The original assessment carried out in 1978 identified 42 registered sites of which 35 contained evidence of Aboriginal habitation. These 35 sites should have been identified in the PER and they still fall within the classifications contained within the <i>Aboriginal Heritage Act 1972</i>. A full reassessment of the sites should be provided.</p> <p>CCWA These sites should not be destroyed and 'avoid where possible' is not sufficient. The submitter supports the following resolution passed at the Yule River annual</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>meeting ..."<i>procedural fairness is in the Aboriginal Heritage Act 1972 (WA) for decisions affecting the heritage of Traditional Owners, and that other legal challenges available to protect threatened heritage sites be investigated.</i>"</p> <p>Uniting Church</p> <p>In all matters relating to this proposal, nothing can proceed without the 'free, prior and informed consent' of the indigenous people affected. The full list of rights of the Indigenous people should be upheld for the Yeelirrie Traditional Owner in relation to this proposal.</p> <p>Public Submitters</p> <p>Total disregard for aboriginal heritage – Yeelirrie is a very significant site for Aboriginal Heritage with over 42 aboriginal sites in the Project area. The Proposal includes no reassessment of these sites.</p> <p>There is no mention in the PER of how aboriginal heritage sites will be protected and how concerns and opposition of traditional owners will be handled.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Cameco has not proposed to reduce access or block traditional owners from the mine and surrounds for fear of contamination.</p>	
Amenity	<p>The generation of dust and noise from land clearing, mining activities, stockpiling and transport may impact on sensitive receptors.</p>	<p>No submissions were noted specifically in relation to the factor of amenity. Submissions received about dust are noted under the factors of Human Health and Air Quality and Atmospheric Gases above.</p>	<p>Amenity was not identified as a preliminary key environmental factor in the Environmental Scoping Document for the Proposal.</p> <p>The potential impacts of dust and noise on sensitive receptors in the vicinity of the proposed mine were considered.</p> <p>Having regard to EAG 13 – <i>EPA consideration of environmental impacts from noise (2014)</i>, Guidance Statement (GS) No. 3 – <i>Separation distance between</i></p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			<p><i>industrial and sensitive land uses</i> (EPA 2005) and given:</p> <ul style="list-style-type: none"> • The separation distance between the nearest residence and the proposed mine site is consistent with GS 3; • the results of a modelling study confirming that noise emissions would comply with the Environmental Protection (Noise) Regulations 1997; • an expected increase of noise at residences located along the transport route of approximately 0.4dB(A), which is not significant;

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
			<ul style="list-style-type: none"> • results obtained from air quality modelling which indicate that the dust deposition rate at sensitive receptors will comply with relevant air quality standards; <p>the EPA considers that it is unlikely that the Proposal would have a significant impact on amenity and the Proposal can meet the objectives for this factor. Accordingly, the EPA did not identify amenity as a key environmental factor at the conclusion of its assessment.</p>
INTEGRATING FACTORS			
Rehabilitation and Decommissioning	If decommissioning and rehabilitation are unsuccessful, contaminated equipment	Department of the Environment Geoscience Australia anticipates that the overall impact of the project is likely to be minor in the regional context. The proposed development of the	Having regard to the potential impacts from exposure of contaminated plant and tailings if

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
	<p>or tailings may be exposed to the environment. Contaminants of concern could then be transported to the wider environment, as dust or water-borne sediment, in the long term.</p> <p>Unsuccessful closure and rehabilitation of the TSFs in the mine-out pits could lead to potential long-term impacts on aquifer water quality downstream, from TSF seepage containing elevated levels of contaminants.</p>	<p>Yeelirrie deposit represents a relatively small disruption, mostly rectified by the proposed closure and rehabilitation activities.</p> <p>The Mine Closure Plan will need to demonstrate the validity of the assumptions used and that the modelling considers the effects of break-down of these assumptions.</p> <p>The Mine Closure Plan will need to describe the situation that will result once the cover material is eroded away, and once the sorption processes come into equilibrium.</p> <p>Cameco has committed to completing a detailed LIDAR survey prior to commencement of Project design and construction. This LIDAR survey is considered essential prior to any significant disturbance. Uncertain if this LIDAR survey needs conditioning given Cameco's voluntary commitment. Cameco notes and agrees that regular updates of the landform evolution model will be required and refer to a generic approach involving the continual improvement (Plan Do Act Check) of management plans.</p> <p>On ground data collection is important to calibrate erosion models. This should be considered either</p>	<p>decommissioning and rehabilitation are not successful, and the potential for long-term impacts to aquifer water quality from seepage from the tailings storage facility, the EPA identified Rehabilitation and Decommissioning as a key integrating environmental factor. Rehabilitation and Decommissioning is discussed in section 3.8.</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>through conditioning (although Cameco have agreed with the requirement to calibrate the model) or through Cameco describing what on ground activities will be undertaken to calibrate the landform models.</p> <p>Given the limited relief and the requirement for landforms such as the TSF impoundments to contain tailings material for significant time periods potentially extending 10,000 years it is recommended that further work on landform evolutions is required to inform the final post rehabilitation landform design. This modelling should utilise DEM data which is suited to the extent of the modelled area and be consistent with best practice landform modelling. Recommended as a conditioning requirement or further information request regarding Cameco's statement on the limited value of higher resolution modelling.</p> <p>Department of Mines and Petroleum</p> <p>DMP is satisfied that the proponent has clearly shown an understanding of DMP's regulatory role for the Project, including Mine Closure Plans.</p> <p>The proponent has indicated that the surficial profile will be able to meet the growth requirements of the selected revegetation candidate species and that</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>selection of appropriate candidate species minimises the potential for disruption of the capillary break.</p> <p>Given the likely time until mining commences and the anticipated total mine life, there remains sufficient time for closure objectives and financial provisioning to be further refined, developed and updated.</p> <p>Radiological Council</p> <p>The proponent has identified the key factors which need to be included with respect to radiation. The risks associated with radiation are expected to be addressed in the Radiation Management Plan and can be adequately monitored and managed under this plan. This will be regulated by the Radiological Council under the <i>Radiation Safety Act 1975</i>, and the Department of Mines and Petroleum under the <i>Mines Safety and Inspection Act 1994</i>.</p> <p>Conservation Council of WA</p> <p>The public submitter would like to know how water from the backfilled pit area will behave if the pits are inundated after closure.</p> <p>The public submitter expects a detailed outline of the obligations for management to come in the future</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>Mine Closure Management Plan and urges the EPA and the Minister to require that the proponent have a public consultation period before approval of any future Mine Closure Management Plan.</p> <p>Will fencing be maintained post closure?</p> <p>What mechanisms are in place to stop contaminated materials leaching from the pit during rainfall events post closure?</p> <p>The public submitter recommends that conditions be applied to ensure corporate responsibility over the site is not relinquished until tailings can be robustly demonstrated to present no risk.</p> <p>The public submitter urges the EPA to recommend a 100% bond, annually reviewed and adjusted, be applied to any approval for uranium mining at Yeelirrie.</p> <p>Public</p> <p>Concerns that rehabilitation is unlikely to adequately re-establish flora and fauna in the region into the future.</p> <p>Cameco has not presented a detailed Mine Rehabilitation Plan in the PER.</p>	

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		In the event that the Yeelirrie mine is approved, the Minister for Mines and Petroleum should require unconditional performance bonds from Cameco.	
Offsets	<p>If significant residual impacts remain after the proponent's application of measures to avoid, minimise and rehabilitate impacts to any key factor then offsets are required.</p> <p>Significant residual impacts remain for Subterranean Fauna and on the Threatened Flora species <i>A. yeelirrie</i></p>	<p>Parks and Wildlife</p> <p>There is uncertainty as to:</p> <ul style="list-style-type: none"> • The nature of the proposed offsets for this proposal. • What outcomes the proposed offsets would likely deliver. • Whether the outcomes are adequate to address residual impacts (if these impacts are found to be acceptable). <p>Due to the significance of the impacts and the uncertainty identified above, Parks and Wildlife is not currently in a position to indicate support or otherwise for the proposed offsets.</p> <p>Although the proposed conservation measures with regard to the eastern population of <i>A. yeelirrie</i> are supported on face value, these measures may not directly offset or compensate for the total loss of the only natural population of the western genotype.</p>	<p>Having regard to the proponent's application of measures to avoid, minimise and rehabilitate impacts on Subterranean Fauna and on the Threatened Flora species <i>A. yeelirrie</i>, significant residual impacts remain for these factors.</p> <p>Consistent with the <i>WA Environmental Offsets Policy</i> (Government of Western Australia, 2011), and the <i>WA Environmental Offsets Guidelines</i> (Government of Western Australia, 2014) residual threats to these factors would require an offset and</p>

Preliminary environmental factors	Description of the Proposal's likely impacts on the environmental factor	Government agency and public comments	Evaluation of whether a factor is a key environmental factor
		<p>CCWA While Cameco have an overarching principle to avoid and minimise ground disturbance and clearing, they have not identified or specified any habitat areas that will be protected or any offsets for those areas. Significant flora and fauna species are likely to become collateral damage without any clear commitments to protect, preserve, offset, relocate or any other possible management options.</p> <p>Uniting Church The estimated volume of greenhouse gas emissions over the life of this Project is a significant environmental impact that must be accompanied by effective and equivalent offsets.</p> <p>Public Submitters A significant offset should be developed in relation to subterranean fauna.</p>	<p>hence the EPA identified Offsets as a key integrating factor. Offsets are discussed in section 3.9</p>

Summary of identification of principles

PRINCIPLES	
Principle	Consideration
<p>1. The precautionary principle</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by –</i></p> <p><i>a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i></p> <p><i>b) an assessment of the risk-weighted consequences of various options.</i></p>	<p>The EPA has had regard to the precautionary principle in its assessment of the proposal in assessing whether the proposal is likely to meet its environmental objectives for the environmental factors. The EPA has assessed whether the proposal:</p> <ul style="list-style-type: none"> • poses a threat of serious or irreversible damage to the environment; and • the degree of scientific uncertainty associated with any threat of serious or irreversible environmental damage. <p>The EPA has had particular regard to the precautionary principle with respect to the environmental factor 'Subterranean fauna' and the EPA's environmental objective for that factor.</p> <p>The EPA considers that implementation of the proposal may pose a threat of serious or irreversible damage to the environment, in that there is a chance that a number of subterranean fauna species may be lost.</p> <p>Further, the EPA considers that there is scientific uncertainty about the extent of the serious or irreversible damage to the environment.</p> <p>In reaching this conclusion, the EPA has considered:</p> <ul style="list-style-type: none"> • the extent to which the threat of loss of subterranean fauna species could be avoided; and

	<ul style="list-style-type: none"> the risk-weighted consequences associated with implementing the proposal, having considered the degree of scientific uncertainty, and the extent of threat after applying avoidance actions. <p>Given that there is a chance that implementation of the proposal may pose a threat of serious or irreversible damage to the environment - the possible loss of a number of subterranean species - and the degree of scientific uncertainty about the extent of that threat, the EPA has recommended that the proposal not be implemented.</p>
<p>2. The principle of intergenerational equity</p> <p><i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</i></p>	<p>The EPA has had regard to the principle of intergenerational equity in its assessment of the proposal in assessing whether the proposal is likely to meet its environmental objectives for the environmental factors.</p> <p>The EPA has had particular regard to the principle in assessing the environmental factor 'Subterranean fauna'.</p> <p>In its assessment of this factor, given the degree of scientific uncertainty regarding the restricted distribution of certain subterranean fauna species that may be impacted by the proposal, the EPA determined that there is too great a chance that there would be a loss of one or more species, and therefore that the proposal should not be implemented.</p>
<p>3. The principle of the conservation of biological diversity and ecological integrity</p> <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>The EPA has had regard to the principle of the conservation of biological diversity and ecological integrity in its assessment of the proposal in assessing whether the proposal is likely to meet its environmental objectives for the environmental factors.</p> <p>The EPA has had particular regard to the principle in assessing the environmental factor 'Subterranean fauna'.</p>

	<p>In its assessment of this factor, given the degree of scientific uncertainty regarding the restricted distribution of certain subterranean fauna species that may be impacted by the proposal, the EPA determined that there is too great a chance that there would be a loss of one or more species, and therefore that the proposal should not be implemented.</p>
<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p> <p>(1) <i>Environmental factors should be included in the valuation of assets and services.</i></p> <p>(2) <i>The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i></p> <p>(3) <i>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.</i></p> <p>(4) <i>Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.</i></p>	<p>In considering this principle, the EPA notes that the proponent would bear the cost relating to waste and pollution, including avoidance, containment, decommissioning, rehabilitation and closure.</p> <p>The EPA had regard to this principle during the assessment of this proposal.</p>

<p>5. The principle of waste minimisation</p> <p><i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i></p>	<p>Having regard for this principle, the EPA notes that the proposal would generate atmospheric pollutants and liquid and solid wastes. The proponent would be expected to address the waste hierarchy and minimise the generation of unavoidable wastes. Liquid and solid waste created as a result of implementation of the Proposal would be disposed of according to relevant regulations and legislation. The EPA notes that the discharge of atmospheric pollutants and liquid and solid wastes can be adequately regulated by the DER via appropriate Works Approval and Licence conditions under Part V of the Environmental Protection Act 1986.</p> <p>The EPA had regard to this principle during the assessment of this proposal.</p>
<p>Environmental principles of the EPA</p>	
<p>1. Best practice</p> <p><i>When designing proposals and implementing environmental mitigation and management actions, the contemporary best practice measures available at the time of implementation should be applied.</i></p>	<p>Having regard for this principle, the EPA notes that, the proponent is proposing to use best practice for storage of tailings. The proponent will also be implementing the principle of ‘as low as reasonably achievable’ for management of radiation.</p> <p>The EPA had regard to this principle during the assessment of this proposal.</p>
<p>2. Continuous Improvement</p> <p><i>The implementation of environmental practices should aim for continuous improvement in environmental performance.</i></p>	<p>The proponent would be required to improve mitigation practices in accordance with state, national and international guidelines. The proponent will also be implementing the principle of ‘as low as reasonably achievable’ for management of radiation.</p> <p>In considering this principle, the EPA notes that the proponent operates under a management system which sets out a framework of adaptive management.</p> <p>The EPA has recommended conditions requiring the development of environmental management plans. As outlined in EAG 17 - <i>Preparation of</i></p>

	<p><i>management plans under Part IV of the Environmental Protection Act 1986</i> (EPA, 2015d), the EPA encourages adaptive management and continual improvement through environmental management plans.</p> <p>The EPA had regard to this principle during the assessment of this proposal.</p>
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Appendix 4

Relevant EPA Policies and Guidance and identified matters

The EPA reviewed its policies and guidance documents for each environmental factor to determine their relevance to the assessment of the Proposal. The EPA has outlined the relevant matters discussed in each policy and guidance document for the key environmental factors below.

1. Flora and Vegetation

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 51 – *Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia* (EPA 2004a);
- Position Statement No. 2 – *Environmental protection of native vegetation in Western Australia*, (EPA 2000); and
- Position Statement No. 3 – *Terrestrial biological surveys as an Element of Biodiversity Protection* (EPA 2002).
- Technical Guide – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA and DPaW, 2015).

Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment.

Relevant matters discussed in the Technical Guide for include:

- The level of survey, survey effort and methods used should be appropriate to the bioregion, the local and regional context and the size of the Proposal; and
- The analysis, interpretation and reporting undertaken is of a suitable quality and of consistent methodology to enable the EPA to determine the impacts of proposals on flora and vegetation.

The EPA notes that the *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* was released in December 2015. This was after flora and vegetation surveys were undertaken for the Proposal, however the EPA considered that the flora and vegetation surveys were of an adequate standard to address the requirements of the Technical Guide (2015).

Guidance Statement No. 51 – Terrestrial flora and vegetation surveys for environmental impact assessment in WA

Relevant matters discussed in Guidance Statement No. 51 for this assessment include the following objectives:

1. Surveys are planned and designed appropriately.
2. The analysis, interpretation and reporting is of a suitable quality and consistent methodology to enable the EPA to judge the impacts of proposals on flora and vegetation.
3. The environment, in particular significant flora and vegetation biodiversity is identified and protected.

Position Statement No. 2 – Environmental protection of native vegetation in Western Australia

Relevant matters discussed in Position Statement No. 2 for this assessment include the following, in relation to the EPA's consideration of biological diversity in assessing a proposal:

1. No known species of plant or animal is caused to become extinct as a consequence of the development and the risks to threatened species are considered to be acceptable.
2. No association or community of indigenous plants or animals ceases to exist as a result of the project.
3. There would be an expectation that a proposal would demonstrate that the vegetation removal would not compromise any vegetation type by taking it below the "threshold level" of 30% of the pre-clearing extent of the vegetation type.
4. Where a proposal would result in a reduction below the 30% level, the EPA would expect alternative mechanisms to be put forward to address the protection of biodiversity.
5. There is a comprehensive, adequate and secure representation of scarce endangered habitats within the project area and/or in areas which are biologically comparable to the project area, protected in secure reserves.
6. The on-site and off-site impacts of the project are identified and the proponent demonstrates that these impacts can be managed.

Position Statement No. 3 – Terrestrial biological surveys as an element of biodiversity protection

Relevant matters discussed in Position Statement No. 3 for this assessment include the following:

1. The EPA expects proponents to demonstrate in their proposals that all reasonable measures have been undertaken to avoid impacts on biodiversity. Where some impact on biodiversity cannot be avoided, it is for the proponent to demonstrate that the impact will not result in unacceptable loss.
2. The EPA expects proponents to ensure that terrestrial biological surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered and the relevant EPA objectives for protection of the environment.
3. In the absence of information that could provide the EPA with assurance that biodiversity will be protected, the EPA will adopt the precautionary principle.

Position Statement No. 3 refers to definitions, principles and objectives in the first national biodiversity strategy *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996). The EPA notes that the most recent version of the strategy, *Australia's Biodiversity Conservation Strategy 2010–2030* (Commonwealth of Australia, 2010), refers

to a shortened definition of biological diversity and contains different principles. The 2010 Strategy also notes that a review of the 1996 Strategy found it difficult to objectively measure performance against the qualitative objectives in the 1996 Strategy and that there have been shifts in environmental management approaches regarding biodiversity conservation. Therefore, the EPA has not considered the matters relating to the 1996 Strategy to be relevant for this assessment.

EPA Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems

This guidance statement was listed in the EPA's Environmental Scoping Document (EPA 2015) as a relevant guideline, however, it is considered not to be relevant for this factor.

EPA notes that Guidance Statement No. 6 – *Rehabilitation of Terrestrial Ecosystems* was prepared in 2006 to guide the preparation of documentation for the environmental impact assessment process of EPA and to help produce management plans to rehabilitate vegetation. The more recent *Guidelines for preparing mine closure plans* (2011 and revised 2015) also guides the preparation of Environmental Impact Assessment documentation and mine closure plans (which include the rehabilitation of vegetation) for mining proposals. The EPA considers that the more recent *Guidelines for preparing mine closure plans* is more relevant to its assessment than Guidance Statement No. 6.

2. Terrestrial Fauna

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Position Statement No. 3 – *Terrestrial biological surveys as an Element of Biodiversity Protection*, (EPA 2002);
- Guidance Statement No. 56 – *Terrestrial Fauna Surveys for Environmental Impact Assessment in WA* (EPA 2004b);
- Guidance Statement No. 20 – *Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA* (EPA 2009); and
- Technical Guide - *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

Position Statement No. 3 – Terrestrial biological surveys as an Element of Biodiversity Protection

Relevant matters discussed in Position Statement No. 3 include the following:

1. The EPA expects proponents to demonstrate in their proposals that all reasonable measures have been undertaken to avoid impacts on biodiversity. Where some impact on biodiversity cannot be avoided, it is for the proponent to demonstrate that the impact will not result in unacceptable loss.

2. The EPA requires that the quality of information and scope of field surveys meets the standards, requirements and protocols as determined and published by the EPA.
3. The EPA expects proponents to ensure that terrestrial biological surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered and the relevant EPA objectives for protection of the environment.
4. In the absence of information that could provide the EPA with assurance that biodiversity will be protected, the EPA will adopt the precautionary principle.

Position Statement No. 3 refers to definitions, principles and objectives in the first national biodiversity strategy *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia, 1996). The EPA notes that the most recent version of the strategy, *Australia's Biodiversity Conservation Strategy 2010–2030* (Commonwealth of Australia, 2010), refers to a shortened definition of biological diversity and contains different principles. The 2010 Strategy also notes that a review of the 1996 Strategy found it difficult to objectively measure performance against the qualitative objectives in the 1996 Strategy and that there have been shifts in environmental management approaches regarding biodiversity conservation. Therefore, the EPA has not considered the matters relating to the 1996 Strategy to be relevant for this assessment.

Guidance Statement No. 56 – Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia

Relevant matters discussed in Guidance Statement No. 56 include the following:

1. The scale and methods of fauna and faunal assemblage survey is planned and designed appropriately for the region;
2. The survey, analysis, interpretation and reporting undertaken for EIA is of a suitable quality and of consistent methodology to enable the EPA to judge the impacts of proposals on fauna and faunal assemblages;
3. The environment, in particular conservation significant fauna and significant faunal assemblages are identified and protected through best practice; and
4. Survey data is capable of underpinning long-term observation and measurement of later compliance and audit purposes.

Guidance Statement No. 20 – Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in WA

Relevant matters discussed in Guidance Statement No. 20 include the following:

1. ensure the protection of key habitats for short range endemic invertebrate fauna species;

2. maintain the distribution, abundance and productivity of populations of short range endemic invertebrate taxa;
3. ensure that the conservation status of short range endemic invertebrate taxa is not adversely changed as a result of development proposals; and
4. ensure that proposals do not potentially threaten the viability of, or lead to the extinction of, any short range endemic invertebrate species.

Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment

Relevant matters discussed in the Technical Guide include the following:

1. The level of survey, survey effort, survey design and methods used should be appropriate to the province, faunal group and size of the proposal; and
2. The analysis, interpretation and reporting undertaken is of a suitable quality and of consistent methodology to enable the EPA to judge the impacts of proposals on fauna and faunal assemblages.

EPA Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems

This guidance statement was listed in the EPA's Environmental Scoping Document (EPA 2015) as a relevant guideline, however, it is considered not to be relevant for this factor.

EPA notes that Guidance Statement No. 6 – Rehabilitation of Terrestrial Ecosystems was prepared in 2006 to guide the preparation of documentation for the environmental impact assessment process of EPA and to help produce management plans to rehabilitate vegetation. The more recent Guidelines for preparing mine closure plans (2011 and revised 2015) also guides the preparation of Environmental Impact Assessment documentation and mine closure plans (which include the rehabilitation of vegetation) for mining proposals. The EPA considers that the more recent Guidelines for preparing mine closure plans is more relevant to its assessment than Guidance Statement No. 6.

Commonwealth Policy & Guidance

As the Proposal is being assessed as an accredited assessment under Section 87 of the EPBC Act, Commonwealth policy and guidance also applies to this assessment. Consistent with the requirements of the ESD for the proposal, the Department of the Environment has advised that the following conservation advice, species-specific recovery plans, and threat abatement plans for relevant species listed under the EPBC Act are relevant for this assessment.

- *Survey guidelines for Australia's threatened birds*, (Australian Government 2010);
- *Survey guidelines for Australia's threatened bats*, (Australian Government 2010);

- *Survey guidelines for Australia's threatened mammals*, (Australian Government 2010);
- *Commonwealth Conservation Advice on Polytelis alexandrae (Princess Parrot)* (Threatened Species Scientific Committee 2008);
- *National Recovery Plan for Malleefowl (Leipoa ocellata)* (Benshemesh, J., 2007);
- *National Recovery Plan for the Greater Bilby (Macrotis lagotis)* (Pavey, C. 2006);
- *A Recovery Plan for the Great Desert Skink (Egernia kintorei) 2001-2011* (McAlpin, S., 2001);
- *Recovery plan for five species of rock wallabies: Black-footed rock wallaby (Petrogale lateralis), Rothschild rock wallaby (P. rothschildi), Short-eared rock wallaby (P. brachyotis), Monjon (P. burbidgei) and Nabarlek (P. concinna) 2012-2022* (Pearson, D.J., 2013);
- *Commonwealth Conservation Advice on Idiosoma nigrum (shield-back trapdoor spider)* (Threatened Species Scientific Committee (TSSC), 2013);
- *Threat Abatement Plan for Predation by the European Red Fox* (Department of the Environment, Water, Heritage and the Arts 2008);
- *Threat Abatement Plan for Reduction in Impacts of Tramp Ants on Biodiversity in Australia and its Territories* (Department of the Environment and Heritage 2006);
- *Threat Abatement Plan for Predation by Feral Cats* (Department of the Environment 2015);
- *Threat Abatement Plan for Competition and Land Degradation by Rabbits* (Department of the Environment, Water, Heritage and the Arts 2008);
- *Threat Abatement Plan for Competition and Land Degradation by Unmanaged Goats* (Department of the Environment, Water, Heritage and the Arts 2008); and
- *Threat Abatement Plan for the Biological Effects, including Lethal Toxic Ingestion, caused by Cane Toads* (Commonwealth of Australia 2011).

The Department of the Environment has further advised that the Mulgara (*Dasycercus cristicauda*) and the Slender-billed Thornbill (Western) (*Acanthiza iredalei iredalei*) have both been de-listed under the EPBC Act since the controlled action decision for this proposal. Therefore in both these situations the recovery plans, conservation advice or threat abatement plans are not a statutory requirement to be considered under the EPBC Act threatened species trigger, although their assessment remains a general consideration under the nuclear action 'whole of environment' trigger.

3. Subterranean Fauna

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 54a – *Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia*, (EPA 2007); and
- Environmental Assessment Guideline No. 12 – *Consideration of subterranean fauna in environmental impact assessment in Western Australia* (EPA 2013b).

Guidance Statement No. 54a - Sampling Methods and Survey Considerations for Subterranean Fauna in Western Australia

Relevant matters discussed in Guidance Statement No. 54a include the following:

1. The level of survey, survey timeframes, sampling planning and methods should be designed appropriately including preliminary investigations (desktop review and pilot study) for subterranean groups and habitat;
2. The use of appropriate sampling methods, effort and survey design, including both within and outside the area of impact, employing a reasonable sampling effort that will collect most species and provide sufficient information to demonstrate whether the project is likely to impact on species of conservation concern;
3. Use of appropriate methods, including genetics, to determine species identifications, resolve taxonomy and species ranges; and
4. Reporting should be clearly written and contain all relevant information presented at a sufficient quality to enable the EPA to judge the impacts of proposals.

Environmental Assessment Guideline No. 12 - Consideration of subterranean fauna in environmental impact assessment in Western Australia

Relevant matters discussed in EAG 12 include the following:

1. Appropriate level of survey required based on the likely presence of subterranean fauna and the potential impact on its habitat.
2. Survey design, including:
 - Sufficient survey using the most contemporary techniques and standards, to ensure that the subterranean fauna is adequately understood in the context of the project footprint and surrounding areas;
 - the amount of sampling required being based on the presence of habitat supporting subterranean fauna, likely significance of impacts, and existing sampling information;
 - the use of genetics to resolve uncertainty regarding species identification and distribution; and
 - the use of surrogates based on the biological features of species or species group and/or physical characteristics of a habitat, on a local scale to infer the likely distribution of another poorly sampled species.

3. Specimen vouchering and lodgment of data and DNA sequences with State collections to improve the knowledge of subterranean fauna.
4. Adequate interpretation and reporting of the results to allow an understanding of the subterranean fauna present in the project area, and analysis to consider the significance of the predicted impact on subterranean fauna.

4. Human Health

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 3 – *Separation distance between industrial and sensitive land uses* (EPA 2005);
- Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003); and
- Environmental Assessment Guideline No. 13 – *Consideration of environmental impacts from noise* (EPA 2014).

Guidance Statement No. 3 – Separation distance between industrial and sensitive land uses

Relevant matters discussed in Guidance Statement No. 3 include the following:

1. The EPA's approach to protecting the amenity of sensitive land uses from emissions from industrial land uses.
2. When and how to use the generic separation distances.
3. The approach if generic separation distances cannot be met.

Guidance Statement No. 55 – Implementing best practice in proposals submitted to the environment impact assessment process

The relevant considerations for Guidance Statement No. 55 include the following:

1. All relevant environmental quality standards must be met.
2. Common pollutants should be controlled by proponents adopting Best Practicable Measures to protect the environment.
3. Hazardous pollutants should be controlled to the Maximum Extent Achievable, which involves the most stringent measures available. For a small number of very hazardous and toxic pollutants, costs are not taken into account

Environmental Assessment Guideline No. 13 – Consideration of environmental impacts from noise

Relevant matters discussed in Environmental Assessment Guideline No. 13 include the following:

1. The EPA expects proponents to use best practice noise management, for all noise forms, to minimise impacts on human health and amenity.
2. The EPA expects proponents to achieve compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997*.
3. The proponent is expected to demonstrate that impacts from noise emissions have been avoided, minimised and mitigated using best practice and technology.
4. If the Proposal demonstrates it meets the assigned levels in the noise regulations or the criteria in SPP 5.4, then it can be managed to meet the EPA objectives for Amenity or Human Health factors and this will result in these factors not being considered a key environmental factor and the EPA will not assess them further.

5. Air Quality and Atmospheric Gases

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 3 – *Separation distance between industrial and sensitive land uses* (EPA 2005);
- Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003); and
- Environmental Protection Bulletin No. 24 – *Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process* (EPA 2015).

Guidance Statement No. 3 – Separation distance between industrial and sensitive land uses

Relevant matters discussed in Guidance Statement No. 3 include the following:

1. The EPA's approach to protecting the amenity of sensitive land uses from emissions from industrial land uses.
2. When and how to use the generic separation distances.
3. The approach if generic separation distances cannot be met.

Guidance Statement No. 55 – Implementing best practice in proposals submitted to the environment impact assessment process

Relevant matters discussed in Guidance Statement No. 55 include the following:

1. All relevant environmental quality standards must be met.
2. Common pollutants should be controlled by proponents adopting Best Practicable Measures to protect the environment.

Environmental Protection Bulletin No. 24 – Greenhouse gas emissions and consideration of projected climate change impacts in the EIA process

Relevant matters discussed in Environmental Protection Bulletin No. 24 include the following:

1. The EPA's definition of what constitutes a significant quantity of greenhouse gas emissions from a proposal. The EPA may decide to assess greenhouse gas emissions within the EIA process if a proposal's expected total greenhouse gas emissions are deemed to be significant.
2. The identification of all greenhouse gas emission sources from the proposal and the calculation of all expected Scope 1 (direct) and Scope 2 (energy indirect) greenhouse gas emissions in accordance with the National Greenhouse and Energy Reporting Act 2007 (NGER Act).
3. Demonstrating that the proposal is designed and will be operated in a manner which maximises energy efficiency and minimises greenhouse gas emissions as far as practicable.
4. Providing an analysis of greenhouse gas intensity (i.e. quantity of CO₂-e generated per tonne of product produced) and the consideration of published benchmarked best practice for equivalent plants and equipment.
5. Proponents may be requested to target continuous improvement in net greenhouse gas emissions and emission intensity through the periodic review, and where practicable, adopt advances in technology and process management.

Guidance Statement No. 12: Minimising GHG Emissions (2002)

This guidance statement was listed in the EPA's Environmental Scoping Document (EPA 2015) and the proponent's PER document as a relevant guideline, however, it was withdrawn in September 2015 and replaced by Environmental Protection Bulletin No. 24.

6. Terrestrial Environmental Quality

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 6 – *Rehabilitation of Terrestrial Ecosystems* (EPA 2006).

Guidance Statement No. 6 - Rehabilitation of Terrestrial Ecosystems

Relevant matters discussed in Guidance Statement No. 6 include the following:

1. Information about the diversity of plants and their capacity to recruit from seeds.
2. Setting of rehabilitation objectives that take into account the complexity of constraints to effective rehabilitation.

3. Setting of completion criteria that are attainable in realistic timeframes and ensure rehabilitation objectives have been met.
4. The use of similar rehabilitation objectives and completion criteria within particular industries and within geographical regions when appropriate.
5. Life-of-mine approaches are required where financial and logistical planning required for effective rehabilitation occurs early in the life of projects (ANZMEC 2000).

7. Hydrological Processes

The EPA listed two policies as relevant in its ESD, which the proponent had regard for in its PER:

- EPA Position Statement No. 4 Environmental Protection of Wetlands; and
- EPA Position Statement No. 2 Environmental Protection of Native Vegetation.

However, as there were no wetlands within the Proposal area PS 4 was considered not to be relevant for this assessment. Position Statement 2 was more appropriately considered under the Flora and Vegetation factor. Therefore, the EPA determined that there is no specific EPA policy or guidance statement that is relevant for Hydrological Processes for this assessment.

Other Department of Water policies listed in the ESD that the EPA do not consider to be relevant for the assessment of this factor include:

- Operational Policy No. 1.01 – Managed aquifer recharge in Western Australia;
- Operational Policy No. 1.02 Policy on water conservation/efficiency plans (DoW 2009); and
- Water Resource Allocation and Planning Series Report No.45 – *Groundwater risk-based allocation of planning process* (DoW 2011).

Operational Policy No. 1.01 was considered not relevant for the assessment of this factor as the proposed reinjection did not meet the definition for managed aquifer recharge within the policy.

Operational Policy 1.02 is applied when preparing a water conservation/efficiency plan as part of an operating strategy therefore it is considered that this policy was not relevant for the assessment of this factor.

Water Resource Allocation and Planning Series Report No.45 is not considered relevant for the assessment of this factor as the report outlines the procedure undertaken by the Department of Water to develop allocation limits and licensing rules in areas where there is limited knowledge of groundwater.

Other policies relevant to this factor are:

- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand – *Australian and New Zealand guidelines for fresh and marine water quality. Volume 1.* (ANZECC/ ARMCANZ 2000); and
- Operational Policy No. 5.12 – *Hydrogeological reporting associated with a groundwater well licence* (DoW 2009); and
- Water Resource Allocation and Planning Series Report No.45 – *Groundwater risk-based allocation of planning process*

EPA Position Statement No 5 Environmental Protection and Ecological Sustainability of the Rangelands in WA

This guidance statement was listed in the proponent's PER document as a relevant guideline, however, it was determined that this policy is not relevant for the EPA's assessment of this factor.

8. Inland Waters Environmental Quality

The EPA has determined that there is no specific EPA policy or guidance statement that is relevant for Inland Waters Environmental Quality for this assessment. Other policy relevant to this factor is:

- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand – *Australian and New Zealand guidelines for fresh and marine water quality. Volume 1.* (ANZECC/ ARMCANZ 2000).

Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 1

Relevant matters discussed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality include the following:

1. Recommended water quality trigger values considered low risk for some metals in livestock drinking water.
2. Tolerances of livestock to total dissolved solids (salinity) in drinking water.

9. Heritage

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 41 – *Assessment of Aboriginal heritage* (EPA 2004)

Guidance Statement No. 41 – Assessment of Aboriginal heritage

Relevant matters discussed in Guidance Statement No. 41 include the following:

1. Consult with staff of the DIA and review any site records (desk-top review) in accordance with the AH Act.
2. Undertake an Aboriginal heritage survey (if it is noted from a desk-top review that an adequate survey has not been undertaken for an area to be developed) which should include both consultation with appropriate Aboriginal people, which may include an anthropological survey, and, if necessary, an archaeological survey.
3. Inform the relevant Aboriginal people about details of the proposed development, including potential environmental impacts.
4. Consult with relevant Aboriginal people to enable them to make known to the proponent their concerns in regard to environmental impacts as they affect heritage matters.
5. Demonstrate that any concerns raised by Aboriginal people have been adequately considered by the proponent in its management of environmental impacts, and any changes as a result of this process are made known to the relevant Aboriginal people.

10. Rehabilitation and Decommissioning

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this factor:

- Guidance Statement No. 6 – *Rehabilitation of Terrestrial Ecosystems* (EPA 2006);
- Environmental Protection Bulletin No. 19 – *EPA Involvement in Mine Closure* (EPA 2015);
- *Guidelines for Preparing Mine Closure Plans* (DMP & EPA 2015); and
- Guidance Statement No. 55 – *Implementing best practice in proposals submitted to the environment impact assessment process* (EPA 2003).

Guidance Statement No. 6 - Rehabilitation of Terrestrial Ecosystems

The EPA notes this guidance was prepared in 2006 to guide the preparation of documentation for the environmental impact assessment process of EPA and to help produce management plans to rehabilitate vegetation. The more recent *Guidelines for preparing mine closure plans* (2011 and revised 2015) also guides the preparation of Environmental Impact Assessment documentation and mine closure plans (which include the rehabilitation of vegetation) for mining proposals. The EPA considers that the more recent *Guidelines for preparing mine closure plans* is more relevant to its assessment than Guidance Statement No. 6.

Environmental Protection Bulletin No. 19 – EPA Involvement in Mine Closure

Relevant matters discussed in Environmental Protection Bulletin No. 19 include the following:

1. The EPA will assess all mining projects that are not subject to the *Mining Act 1978*. Examples include pre-1899 title or minerals-to-owner tenure, Hampton locations or State Agreement Act projects.
2. This Proposal is a State Agreement Act project, and not subject to the *Mining Act 1978*.
3. For all mining projects not subject to the *Mining Act 1978*, mine closure will be assessed and regulated by the EPA only.

Guidelines for Preparing Mine Closure Plans

Relevant matters discussed in the Guidelines for Preparing Mine Closure Plans include the following:

1. From the project approval stage throughout mine life, the Mine Closure Plan should demonstrate that ecologically sustainable mine closure can be achieved consistent with agreed post-mining outcomes and land uses, and without unacceptable liability to the State.
2. Planning for mine closure should be fully integrated in the life of mine planning. For new projects, closure planning should start in the project feasibility stage (before project approvals).
3. Mine Closure Plans must be site-specific.
4. Closure planning should be risk-based.
5. Consultation should take place between proponents and stakeholders.
6. Post-mining land uses should be identified and agreed upon through consultation before approval of new projects.
7. Materials characterisation needs to be carried out prior to project approval to a sufficient level of detail to develop a workable closure plan.
8. Closure planning should be based on adaptive management. Closure plans should identify relevant experience from other mine sites and research, and how lessons learned from these are to be applied.
9. management plans are in place.

Guidance Statement No. 55 – Implementing best practice in proposals submitted to the environment impact assessment process

Relevant matters discussed in Guidance Statement No. 55 include the following:

1. All relevant environmental quality standards must be met.
2. Common pollutants should be controlled by proponents adopting Best Practicable Measures to protect the environment.

11. Offsets

The EPA considers that the following policy and guidance is relevant to its assessment of the Proposal in relation to this:

- WA Environmental Offsets Policy (Western Australian Government 2011);
- WA Environmental Offsets Guidelines (Western Australian Government 2014); and
- Environmental Protection Bulletin No. 1 – *Environmental Offsets*. (EPA 2014).

WA Environmental Offsets Policy

Relevant matters discussed in the WA Environmental Offsets Policy include the six principles identified within the Policy:

1. Environmental offsets will only be considered after avoidance and mitigation options have been pursued.
2. Environmental offsets are not appropriate for all projects (circumstances).
3. Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted.
4. Environmental offsets will be based on sound environmental information and knowledge.
5. Environmental offsets will be applied within a framework of adaptive management.
6. Environmental offsets will be focussed on longer term strategic outcomes.

WA Environmental Offsets Guidelines

In addition to guidance on the application of the principles contained within the offsets policy, the relevant matters discussed in the offsets guidelines for this assessment include the following:

1. Environmental offsets will only be applied where the residual impacts of a project are determined to be significant, after avoidance, minimisation and rehabilitation have been pursued.
2. Proponents must apply the mitigation hierarchy (avoid, minimise, rehabilitate and offset) to reduce the potential impacts of a proposal on the environment.
3. The residual impact significance model outlines how significance is determined and when an offset is likely to be required, or may be required, in relation to relevant EPA environmental factors.

Environmental Protection Bulletin No. 1 – Environmental Offsets

Relevant matters discussed in Environmental Protection Bulletin No. 1 for this assessment include the following:

1. The EPA adopts the WA Environmental Offset Policy and WA Environmental Offset Guidelines for application through the environmental impact assessment process.
2. Where the EPA is of the view that a significant residual impact remains after avoidance, minimisation and rehabilitation efforts, the EPA will ensure that any offsets are recommended as conditions of approval in the EPA's report to the Minister for Environment, as well as including details on the rationale for the offset.
3. As part of an Environmental Review document, proponents must include a section discussing how it has applied the mitigation hierarchy to its proposal. Offsets should be addressed in a separate section of the document, after the assessment of environmental factors.
4. If it is likely that a proposal will have a significant residual impact, the proponent should provide further details on the proposed offset, as outlined in the bulletin. The final decision on the need for and appropriateness of any offsets will be determined by the EPA at the end of the assessment process.

Relevant Commonwealth policy and guidance

As the Proposal is being assessed as an accredited assessment under Section 87 of the EPBC Act, Commonwealth policy, guidelines and plans also apply to this assessment. The following Commonwealth policy is relevant for this factor, consistent with the requirements of the ESD for the Proposal.

- Environmental Protection and Biodiversity Conservation Act 1999 – Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities 2012).

12. Non EPA Radiological Technical Guidance

The proponent considered the following technical guidance during the radiological assessments and design of the mine site:

1. ICRP 107 - Nuclear Decay Data for Dosimetric Calculations, Ann. ICRP 38 (3);
2. ICRP 103 - The 2007 Recommendations of the International Commission on Radiological Protection, Ann. ICRP 37 (2-4);
3. ICRP 101 - The Optimisation of Radiological Protection: Broadening the Process, Ann. ICRP 36 (3);
4. ICRP 100 - Human Alimentary Tract Model for Radiological Protection;
5. ICRP 99 - Low Dose Extrapolation of Radiation Related Cancer Risk;
6. ICRP 91 - A Framework for Assessing the Impact of Ionising Radiation on Non-Human Species;
7. ICRP 89 - Basic Anatomical and Physiological Data for Use in Radiological Protection: Reference Values; ICRP 83 - Risk Estimation for Multifactorial Diseases;

8. ICRP 82 - Protection of the Public in Situations of Prolonged Radiation Exposure;
9. ICRP 78 - Individual Monitoring for Internal Exposure of Workers;
10. ICRP 77 - Radiological Protection Policy for the Disposal of Radioactive Waste;
11. ICRP 76 - Protection from Exposures: Application to Selected Radiation Sources;
12. ICRP 75 - General Principles for Radiation Protection of Workers;
13. ICRP 74 - Conversion of Coefficients for Use in Radiological Protection against External Radiation;
14. ICRP 72 - Age-dependent Doses to the Members of the Public from Intake of Radionuclides: Part 5 - Compilation of Ingestion and Inhalation Coefficients;
15. ICRP 71 - Age-dependent Doses to Members of the Public from Intake of Radionuclides;
16. Part 4 - Inhalation Dose Coefficients;
17. ICRP 70 - Basic Anatomical & Physiological Data for use in Radiological Protection;
18. ICRP 69 - Age-dependent Doses to Members of the Public from Intake of Radionuclides;
19. ICRP 68 - Dose coefficients for Intakes of Radionuclides by Workers;
20. ICRP 67 - Age-dependent doses to Members of the Public from the Intake of Radionuclides: Part 2 - Ingestion Dose Coefficients;
21. ICRP 66 - Human Respiratory Tract Model for Radiological Protection;
22. ICRP 65 - Protection Against Radon-222 at Home and at Work;
23. ICRP 64 - Protection from Potential Exposure: A Conceptual Framework; and ICRP 60 - 1990 Recommendations of the ICRP.
24. Tailings Storage Facilities in Western Australia - Code of Practice;
25. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Radiation Protection Series (RPS) 1-16 - Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005), specifically including RPS 1 (Recommendations for limiting exposure to ionizing radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation); RPS 2 (Safe Transport of Radioactive Material);
26. RPS 9 (Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing);
27. Code of Practice for the Safe Transport of Radioactive Material (ARPANSA 2008);

28. ARPANSA Safety Guide - Methods for Monitoring, Assessing and Recording Occupational Radiation Doses in Mining and Mineral Processing (Draft 2010);
29. Handbook of parameter values for the prediction of radionuclide transfer in terrestrial and freshwater environments, Technical Report Series 472: (International Atomic Energy Agency, 2010);
30. Classification of radioactive waste, general safety guide No CSG-1: (International Atomic Energy Agency, 2009);
31. Security in the transport of radioactive material, IAEA nuclear security series No. 9: (International Atomic Energy Agency, 2008);
32. Predisposal management of radioactive waste, general safety requirement (GSR) part 5: (International Atomic Energy Agency, 2009);
33. Management system for the safe transport of radioactive materials, safety standard series number TS-G-1.4: (International Atomic Energy Agency, 2009);
34. Regulations for the safe transport of radioactive materials, TS-R-1: (International Atomic Energy Agency, 2009);
35. International Atomic Energy Agency Safety Series: 26 - Radiation Protection of Workers in the Mining and Milling of Radioactive Ores;
36. 90 - The Application of the Principles for Limiting Releases of Radioactive Effluents in the case of the Mining and Milling of Radioactive Ores;
37. 95- Radiation Monitoring in the Mining and Milling of Radioactive Ores (jointly sponsored with the International Labor Organisation and the World Health Organisation);
38. 100 - Evaluating the reliability of predictions made using environmental transfer models;
39. 111 - Principles of Radioactive Waste Management Safety Fundamentals;
40. 112 - Compliance Assurance for the Safe Transport of Radioactive Material;
41. 115 - International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources;
42. International Commission on Radiological Protection (ICRP) 108 - Environmental Protection: the Concept and Use of Reference Animals and Plants, Ann, ICRP 38 (4-6);
43. Department of Mines and Petroleum, 2010. Managing Naturally-Occurring Radioactive Material (NORM) in Mining and Mineral Processing - Guidelines: NORM-1 Applying the system of radiation protection to mining operations;
44. NORM-2.1 Preparation of a radiation management plan - exploration;
45. NORM-2.2 Preparation of a radiation management plan - mining and processing;
46. NORM-3,1 Monitoring - pre-operational monitoring requirements;

47. NORM-3.2 Monitoring - operational monitoring requirements;
48. NORM- 3.3 Monitoring - air monitoring strategies;
49. NORM-3.4 Monitoring - airborne radioactivity sampling;
50. NORM-3.5 Monitoring - measurement of particle size;
51. NORM-4.1 Controlling - dust control strategies;
52. NORM-4.2 Controlling - management of radioactive waste;
53. NORM-4.3 Controlling - transport;
54. NORM-5 Dose assessment;
55. NORM-6 Reporting requirements; and
56. NORM-7 Boswell - assessment and reporting database. Department of Mines and Petroleum, 2013.

Appendix 5

Identified Decision-making Authorities

Identified Decision-making Authorities

Section 44(2) of EP Act specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA's recommended conditions and procedures.

Section 45(1) requires the Minister for Environment to consult with decision-making authorities, and if possible, agree on whether or not the Proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified for this consultation:

Decision-making Authority	Approval
1. Minister for State Development	<i>Uranium (Yeelirrie) Agreement Act 1978</i> Development proposal
2. Minister for Mines and Petroleum	<i>Mining Act 1978</i> Mining proposal
3. Minister for Water	<i>Rights in Water and Irrigation Act 1914</i> Water extraction licence
4. Minister for Environment	<i>Wildlife Conservation Act 1950</i> Taking of flora and fauna
5. Minister for Aboriginal Affairs	<i>Aboriginal Heritage Act 1972</i> Section 18 clearances
6. Director General, Department of Environment Regulation	<i>Environmental Protection Act 1986</i> • Works approval and licence
7. Department of Mines and Petroleum	Mining Proposal • <i>Mining Act 1978</i> Director Environment Division Dangerous Goods • <i>Dangerous Goods Safety Act 2004</i> Chief Dangerous Goods Officer Mine Safety • <i>Mines Safety and Inspection Act 1994</i> State Mining Engineer
8. Radiological Council	<i>Radiation Safety Act 1975</i> • Permit to mine radioactive materials • Permit to transport radioactive materials
9. Shire of Wiluna	<i>Building Act 2011</i> • Building permit for worker accommodation <i>Planning and Development Act 2005</i> • Planning approval for worker accommodation

10. Department of Health	<i>Health Act 1911 and Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974</i> <ul style="list-style-type: none"> • Sewage treatment permit
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Note: In this instance, consultation and agreement is only required with DMAs No.1 to No. 5 as they are Ministers.

Appendix 6

Other advice – Potential Environmental Conditions

If the Minister forms the view that the proposal may be implemented, the EPA's advice is that the Ministerial approval should be subject to the conditions set out below and the development of appropriate conditions regarding the mitigation of impacts on Subterranean Fauna.

The first five conditions would relate to the following standard requirements: Proposal Implementation, Contact Details, Time Limit for Proposal Implementation, Compliance Reporting, and Public Availability of Plans and Reports. The remaining conditions would relate to the relevant key environmental factors:

Flora and Vegetation

6 Threatened flora (*Atriplex yeelirrie*) – Management-based Plan

6-1 The proponent shall manage the implementation of the proposal, including proposed mitigation measures, to meet the following **environmental objective**:

- (1) protect the Eastern population of the threatened flora species *Atriplex yeelirrie*.

6-2 The proponent shall consult with Parks and Wildlife in the preparation of an *Atriplex Yeelirrie* Conservation Management Plan required by condition X¹--1 that satisfies the requirements of condition X-2, to meet the outcomes required by condition 6-1.

6-3 The *Atriplex Yeelirrie* Conservation Management Plan required by condition X-1 shall include provisions required by condition X-2 to address impacts on *Atriplex yeelirrie* including from, but not limited to: direct clearing; changes to groundwater levels and groundwater quality; changes to surface flows; dust; cattle and weeds.

6-4 The proponent shall continue to implement the version of the *Atriplex Yeelirrie* Conservation Management Plan most recently approved by the CEO, on advice of Parks and Wildlife, until the CEO has confirmed by notice in writing that the *Atriplex Yeelirrie* Conservation Management Plan required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 6-1.

7 Flora and Vegetation – Management-based Plan

¹ Wherever X- is referenced this refers to a standard condition that includes the requirements required for a Management-based Condition Environmental Management Plan in the EPA's *Environmental Assessment Guideline 17 for Preparation of management plans under Part IV of the Environmental Protection Act 1986*.

- 7-1 The proponent shall manage the implementation of the proposal to meet the following **environmental objectives**:
- (1) avoid, where possible, and minimise direct and indirect impacts as far as practicable on the conservation significant Priority 1 flora species *Neurachne lanigera*, and *Rhagodia* sp. Yeelirrie Station;
 - (2) minimise direct and indirect impacts as far as practicable on conservation significant flora species, including, but not limited to, Priority 3 species *Bossiaea eremaea*, *Eremophila arachnoides* subsp. *arachnoides*, and *Euryomyrtus inflata*; and
 - (3) minimise direct and indirect impacts as far as practicable on the vegetation units including *Eucalyptus gypsophila* Woodland on Calcrete; *Casuarina pauper* Woodland on Calcrete; *Melaleuca xerophila* Shrubland on Calcrete; *Atriplex* sp. Yeelirrie Station Shrubland on Calcrete; *Rhagodia* sp. Yeelirrie Station Shrubland on Calcrete; Mulga *Grevillia berryana* Shrubland; *Lycium australe* Shrubland, *Eragrostis* sp. Grassland on Playa.
- 7-2 The proponent shall consult with Parks and Wildlife and prepare a Flora and Vegetation Management Plan required by condition X-1 that satisfies the requirements of condition X-2, to meet the objective required by condition 7-1.
- 7-3 The Flora and Vegetation Management Plan required by condition X-1 shall include provisions required by condition X-2 to address impacts on conservation significant flora and vegetation health including from, but not limited to: changes to groundwater levels and groundwater quality; changes to surface flows; dust; fire regimes and weeds.
- 7-4 The proponent shall continue to implement the version of the Flora and Vegetation Management Plan most recently approved by the CEO, on advice from Parks and Wildlife, until the CEO has confirmed by notice in writing that the Flora and Vegetation Management Plan required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 7-1.

Terrestrial Fauna

8 Conservation Significant Terrestrial Fauna – Management-based Plan

- 8-1 The proponent shall manage the implementation of the proposal to meet the following **environmental objectives**:
- (1) minimise direct and indirect impacts as far as practicable on conservation significant terrestrial fauna species and their habitat, including, but not limited to the Malleefowl, Black-flanked Rock-

wallaby, Peregrine Falcon, Brush-tailed Mulgara, and the Australian Bustard; and

- (2) minimise direct and indirect impacts as far as practicable to conservation significant short-range endemic invertebrate fauna, including but not limited to the Shield-backed trapdoor spider (*Idiosoma nigrum*).
- 8-2 The proponent shall consult with Parks and Wildlife and prepare a Terrestrial Fauna Management Plan required by condition X-1 that satisfies the requirements of condition X-2, to meet the objective of condition 8-1.
- 8-3 The Terrestrial Fauna Management Plan required by condition X-1 shall include provisions required by condition X-2 to manage impacts on conservation significant fauna listed in 8-1 including from, but not limited to, loss of habitat, changes to surface water regimes, changes to fire regimes and risk of vehicle strikes.
- 8-4 The proponent shall continue to implement the version of the Terrestrial Fauna Management Plan most recently approved by the CEO, on advice from Park and Wildlife, until the CEO has confirmed by notice in writing that the Terrestrial Fauna Management Plan required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 8-1.

Hydrological Processes

9 Hydrological processes - Survey

- 9-1 The proponent shall manage the implementation of the proposal to meet the following **environmental objectives**:
 - (1) minimise direct and indirect impacts as far as practicable to the hydrological regimes of surface waters and groundwater; and
 - (2) ensure groundwater dewatering and abstraction do not impact on surrounding water bores including No-Ibla and Dempsey bores, shown in Figure 2, having regard to climatic trends and seasonal variation.
- 9-2 Prior to the commencement of ground disturbing activities or as otherwise agreed in writing by the CEO the proponent shall prepare a Baseline Survey and Monitoring Plan which:
 - (1) details the proposed methodology for the baseline surveys and monitoring of hydrological processes;

- (2) identifies the sensitive receptors, with a particular focus on surrounding water bores including No-Ibla and Dempsey bores;
 - (3) identifies and spatially defines the proposed survey locations and monitoring/reference/control sites, and provide rationale for the location of the sites; and
 - (4) details the proposed frequency and timing of the surveys and monitoring.
- 9-3 The proponent shall commission a suitably qualified independent expert with relevant hydrogeology experience in excess of 10 years and agreed to in writing by the CEO to review to report on:
 - (1) the groundwater monitoring program described in the Baseline Survey and Monitoring Plan prior to its implementation.
- 9-4 The proponent shall amend the Baseline Survey and Monitoring Plan required by condition 9-2 in accordance with the recommendations of the independent expert review report required by 9-3.
- 9-5 The proponent shall submit the amended Baseline Survey and Monitoring Plan and the results and recommendations of the independent expert review required by condition 9-3 to the CEO within three (3) months of the proponent receiving the recommendations from the independent expert review.
- 9-6 After receiving notice in writing from the CEO that the Baseline Survey and Monitoring Plan satisfies the requirements of condition 9-2, the proponent shall undertake the baseline surveys and monitoring in accordance with the requirements of the Baseline Survey and Monitoring Plan to CEO to demonstrate that condition 9-1 will be met.
- 9-7 On completion of the baseline surveys and monitoring the proponent shall report to the CEO on the following:
 - (1) completion of the baseline surveys and monitoring in accordance with the Baseline Survey and Monitoring Plan;
 - (2) the results of the baseline surveys and monitoring; and
 - (3) a review of the results of the baseline surveys and monitoring from a suitably qualified independent expert with relevant hydrogeology experience in excess of 10 years and agreed to in writing by the CEO to review and report on, with particular focus on surrounding water bores, in particular No-Ibla and Dempsey bores.

- 9-8 The Baseline Survey and Monitoring Plan and the monitoring results required by condition 9-2, and the independent expert review report required by condition 9-3 shall be made publicly available and provided directly to surrounding properties within three (3) months of completion.

10 Hydrological Processes – Management Plan

- 10-1 The proponent shall consult with the Department of Water and prepare a Hydrological Processes Monitoring and Management Plan required by condition X-1 that satisfies the requirements of condition X-2, to meet the objectives required by condition 9-1.
- 10-2 The Hydrological Processes Monitoring and Management Plan required by condition X-1 shall have provisions to include:
- (1) the results of the baseline monitoring required by condition 9-7;
 - (2) monitoring of groundwater abstraction rates and groundwater levels;
 - (3) the results shall be reviewed every 3 years or as otherwise agreed to by the CEO; and
 - (4) an independent review of the Plan and monitoring results from a suitably qualified expert with relevant hydrogeology experience in excess of 10 years and agreed to in writing by the CEO.
- 10-3 The proponent shall continue to implement the version of the Hydrological Processes Monitoring and Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plan required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 9-1.
- 10-4 The Hydrological Processes Monitoring and Management Plan and the monitoring results required by condition 10-1, and the independent expert review report required by condition 10-2(3) shall be made publicly available and provided directly to surrounding properties within three (3) months of completion.

Inland Waters Environmental Quality

11 Inland waters environmental quality – Management-based Plan

- 11-1 The proponent shall manage the abstraction of groundwater for dewatering and the reinjection of surplus dewater to meet the following **environmental objectives**:

- (1) minimise water quality impacts as far as practicable to surface waters and groundwater; and
 - (2) prevent the abstraction of groundwater down flow from the TSFs within the boundaries of Yeelirrie Station for stock use.
- 11-2 The proponent shall prepare and submit a:
 - (1) Surface Water Management and Monitoring Plan; and
 - (2) Groundwater Management and Monitoring Plan,required by condition 6-1 that satisfies the requirements of condition X-2, to meet the objectives required by condition 11-1.
- 11-3 The Surface Water Management and Monitoring Plan required by condition 10-2(1) shall include, but not limited to, provisions to address the following:
 - (1) the construction of a surface water diversion bund and associated channel with the specifications to protect the mine site from a 1,000 year ARI rainfall event.
- 11-4 The Groundwater Management and Monitoring Plan required by condition 11-2(2) shall include, but not limited to, provisions to address the following:
 - (1) outline a program of work on uranium transport in groundwater from tailings to reduce the level of uncertainty about uranium transport at Yeelirrie, including the study of measured infiltration rates into realistic analogues of the planned TSF cover system.
- 11-5 The proponent shall continue to implement the version of the Surface Water Management and Monitoring Plan mostly recently approved by the CEO and the Groundwater Management and Monitoring Plan most recently approved by the CEO, on advice of the Department of Environment Regulation, until the CEO has confirmed by notice in writing that the plans required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 11-1.

Heritage

12 Heritage – Management-based Plan

- 12-1 The proponent shall manage the implementation of the proposal to meet the following **environmental objective**:

- (1) minimise impacts as far as practicable to registered sites Yeelirrie 03 and Yeelirrie 38, unregistered sites and culturally modified Kopi Gum trees (*Eucalyptus gypsophila*).
- 12-2 The proponent shall consult with the Department of Aboriginal Affairs and prepare an Aboriginal Heritage Management Plan required by condition X-1 that satisfies the requirements of condition X-2 to meet the objective of condition 12-1.
- 12-3 The proponent shall continue to implement the version of the Aboriginal Heritage Management Plan most recently approved by the CEO until the CEO has confirmed by notice in writing that the plans required by condition X-1 satisfies the requirements of condition X-2 to meet the outcomes required by condition 12-1.

Rehabilitation and Decommissioning

13 Rehabilitation and Decommissioning

- 13-1 The proponent shall manage the implementation of the proposal to meet the following **environmental objective**:
 - (1) ensure that the proposal is decommissioned and rehabilitated in an ecologically sustainable manner;
 - (2) ensure that seepage of 's from the TSF is minimised as far as practicable; and
 - (3) ensure that the erosion of the TSF cover is minimised as far as practicable.
- 13-2 Prior to the commencement of ground disturbing activities or as otherwise agreed in writing from the CEO, the proponent shall prepare and submit a Mine Closure Plan in accordance with the *Guidelines for Preparing Mine Closure Plans*, May 2015 (or any subsequent revisions of the guidelines), to the requirements of the CEO on advice of the Department of Mines and Petroleum.
- 13-3 The plan required by condition 13-2 shall include, but not be limited to provisions to address the following:
 - (1) specify the management actions that will be implemented to demonstrate compliance with the environmental objective specified in 13-1. Failure to implement one or more of the management actions represents non-compliance with these conditions;
 - (2) the provisions required by condition X-2;

- (3) conduct laboratory and field scale research on the rate at which revegetation cover can be established, the effect of vegetation cover on the erosion rate and the need for alternative surface treatments to prevent erosion on the cover system to inform condition 13-3(4);
- (4) update the Landform Evolution Modelling using digital elevation modelling data suited to the extent of the modelled area and consistent with best practice;
- (5) on-ground data collection to calibrate erosion models;
- (6) demonstrate the validity of assumptions used in the Mine Closure Plan and consideration of the effects of breakdown of those assumptions; and
- (7) predict the timeframe for and situation that would result if;
 - (a) the cover material is eroded away; and
 - (b) sorption processes come into equilibrium.

13-4 After receiving notice in writing from the CEO, on advice of the Department of Mines and Petroleum, that the Mine Closure Plan satisfies the requirements of condition 13-2, the proponent shall:

- (1) implement the provisions of the Mine Closure Plan; and
- (2) continue to implement the Mine Closure Plan until the CEO has confirmed by notice in writing that the proponent has demonstrated the objectives specified in condition 13-1 have been met.

13-5 In the event that monitoring, tests, surveys or investigations indicate exceedance of management targets specified in the Mine Closure Plan, the proponent shall:

- (1) report the exceedance in writing to the CEO within 21 days of the exceedance being identified;
- (2) investigate to determine the cause of the management targets being exceeded;
- (3) provide a report to the CEO within 90 days of the exceedance being reported as required by condition 13-5(1). The report shall include:
 - (a) cause of management targets being exceeded;

- (b) the findings of the investigation required by conditions 13-5(2);
- (c) details of revised and/or additional management actions to be implemented to prevent exceedance of the management target(s); and
- (d) proposed changes to proposal to prevent future exceedances of management targets.

13-6 In the event that one or more management actions specified in the Mine Closure Plan have not been implemented, the proponent shall:

- (1) report the failure to implement management action/s in writing to the CEO within 7 days of identification;
- (2) investigate to determine the cause of the management action(s) not being implemented;
- (3) investigate to provide information for the CEO to determine potential environmental harm or alteration of the environment that occurred due to the failure to implement management actions;
- (4) provide a report to the CEO within 21 days of the reporting required by condition 13-6(1). The report shall include:
 - (a) cause for failure to implement management actions;
 - (b) the findings of the investigation required by conditions 13-6(2) and 13-6(3);
 - (c) relevant changes made to proposal activities; and
 - (d) measures taken to prevent, control or abate the environmental harm which may have occurred.

13-7 The proponent may review and revise the Mine Closure Plan.

13-8 The proponent shall review and revise the Mine Closure Plan required by condition 13-2 at intervals not exceeding three (3) years, or as otherwise specified by the CEO, and submit the plan to the CEO at the agreed interval.

13-9 The proponent shall implement the latest revision of the Mine Closure Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 13-2, to meet the requirements of condition 13-1.

13-10 The proponent shall make the latest revision of the Mine Closure Plan publicly available.

Offsets

14 Offset – Threatened Flora (*Atriplex yeelirrie*)

14-1 The proponent shall undertake an offset with the objective to counterbalance the significant residual impact of clearing 84,510 plants of the western population of the *Atriplex yeelirrie*, as a result of the implementation of the proposal.

14-2 Prior to ground disturbing activities or otherwise agreed to by the CEO, the proponent shall prepare and submit an *Atriplex yeelirrie* Offset Plan to the CEO on advice of Parks and Wildlife.

The objective of the *Atriplex yeelirrie* Offset Plan is to ensure a self-sustaining population of mature individuals of the western population of the *Atriplex yeelirrie*.

The *Atriplex yeelirrie* Offset Plan shall:

- (1) identify the ecology, ecophysiology and habitat requirements and determinants of the western population;
- (2) identify the number of mature plants that each translocation site should support;
- (3) identify the appropriate sex ratio distribution;
- (4) describe the plant material to be used for translocation, to promote the viability of the species;
- (5) identify suitable translocation sites similar to those within the western population of the Yeelirrie palaeochannel through investigations such as but not limited to soil investigations, drainage, land tenure and potential for long-term protection of the site;
- (6) undertake a trial translocation program, testing surface and sub-surface soils through relocation and potential seeding techniques;
- (7) confirm that irrigation would be feasible for the first two (2) years at each translocation site;
- (8) describe the ongoing protection measures afforded to the translocated plants from threats including fire and future exploration and mining;

- (9) identify completion criteria to demonstrate that the translocated plants have established, are reproducing and have built-up a soil-stored seedbank;
- (10) identify timeframes and responsibilities for implementation;
- (11) identify reporting procedures, including the format, timing and frequency for the reporting of monitoring data against the completion criteria;
- (12) identify management and contingency measures, including trigger level actions and thresholds should completion criteria not be met;
- (13) implement translocation at tested and approved sites;
- (14) implement site re-creation at two sites within the Yeelirrie mine area; and
- (15) identify arrangements for the translocation sites post-completion of the plan.

14-3 After receiving notice in writing from the CEO, on advice from Parks and Wildlife, that the *Atriplex yeelirrie* Offset Plan satisfies the requirements of condition 14-2, the proponent shall:

- (1) implement the Plan in accordance with the requirements of the *Atriplex yeelirrie* Offset Plan; and
- (2) continue to implement the Plan in accordance with the requirements of the *Atriplex yeelirrie* Offset Plan until the CEO has confirmed by notice in writing that it has been demonstrated that the objective in condition 14-1 has been met.

14-4 Within fifteen (15) months of receiving the notice under condition 14-3, the proponent shall include in the Compliance Assessment Report required by condition X-6, a written report which outlines the success of implementation of the *Atriplex yeelirrie* Offset Plan, including monitoring data and the progress of this project until completion criteria have been met. This report should also be provided to Parks and Wildlife.

14-5 Should the objective of the *Atriplex yeelirrie* Offset Plan required by condition 14-2 not be achieved within twenty (20) years from implementation of the Plan, the proponent shall submit a revised *Atriplex yeelirrie* Offset Plan to the satisfaction of the CEO, outlining management strategies to achieve the outcome specified in condition 14-2. The revised plan must be submitted within three (3) months of the twenty (20) year period lapsing.

14-6 The proponent:

- (1) May review the *Atriplex yeelirrie* Offset Plan, or
- (2) Shall review and revise the *Atriplex yeelirrie* Offset plan as and when directed by the CEO.

14-7 The proponent shall implement the latest version of the *Atriplex yeelirrie* Offset Plan, which the CEO has confirmed by notice in writing, satisfies the requirements of condition 14-2.

Subterranean Fauna

If the Minister were to decide that the Proposal may be implemented, the EPA can provide advice on an appropriate condition to address impacts on Subterranean Fauna. The content of such a condition could include requirements as outlined in *Other advice* and may depend on further information or studies provided by the proponent.

Abbreviations and Definitions

Acronym or Abbreviation	Definition or Term
ARI	Annual Recurrence Interval
CEO	The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the <i>Environmental Protection Act 1986</i> , or his delegate.
Clearing	As defined in the <i>Environmental Protection Act 1986</i>
Chemicals of concern	chloride, uranium, vanadium, arsenic and molybdenum
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i>
Ground disturbing activities	Activities that are associated with the substantial implementation of a proposal including but not limited to, digging (with mechanised equipment), blasting, earthmoving, vegetation clearance, grading, gravel extraction, construction of new or widening of existing roads and tracks.
OEPA	Office of the Environmental Protection Authority
PEC	Priority Ecological Community
ha	Hectare
Mtpa	Million tonnes per annum
GL/a	Gigalitres per annum
TSF	Tailings storage facility

Appendix 7

Summary of Submissions and Proponent's Response to Submissions

Provided on CD in hardcopies of this report and on the EPA's website at
www.epa.wa.gov.au