Australian Government
Department of the Environment and Energy

Research/Estimates Officer
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600
Australia

Environment and Communications Committee, Environment and Energy Portfolio

I am writing to you in relation to a request of 26 February 2018 at the Senate Estimates hearing of the Environment and Communications Legislation Committee by Senator Rachel Siewert, for a copy of the information provided by Cameco Australia to the Department during a site visit to the proposed Yeelirrie Uranium Mine. Further to the responses given at the time of Senator Siewert's request, and later in the response to question on notice 95, the additional information received by the Department is enclosed.

The additional information contains material about the Yeelirrie uranium project, the plant species *Atriplex yeelirrie* and subterranean fauna species. The information is representative of the view of the proponent in relation to these matters. The Department will consider the information as part of its assessment of the proposed action.

The additional information also references a "proposed Federal condition". As the assessment of the proposed action has not yet been completed, the Australian Government has not yet formed a view on whether the project should be approved or – if it is to be approved – any conditions that may be attached to the approval.

Other information and updates on the progress of the assessment can be viewed on the Department's website at: http://epbcnotices.environment.gov.au/referralslist/

Yours sincerely

Gregory Manning
Assistant Secretary
Assessments (WA, SA, NT) and Post Approvals Branch
9 November 2018

7th November 2017

Yeelirrie Uranium Project DoEE Site Visit

Yeelirrie Homestead

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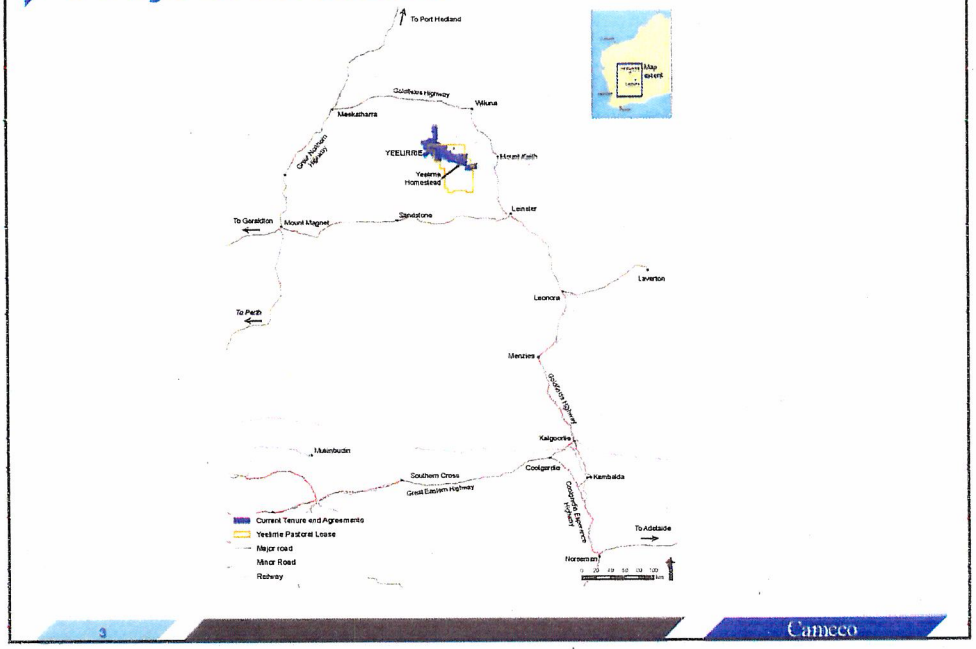
Yeelirrie Project

Development operating life	22 years, including 3 years of pre-production dewatering , mining and construction, 12 years of mining , 15 years of processing and 4 years of decommissioning and closure
Open Pit	Shallow depth alluvial deposit with mineralisation from surface to about 10 metres deep. 9 kms long x 1 km wide (average)
Clearing	Project footprint of approximately 2421.8 ha
Mining Rate	Average mining rate of 8Mtpa of ore and waste
Tailings	All tailings deposited in open pit at rate of approx. 3Mtpa
Production	3850 tonnes UOC (average) per annum

Project Location



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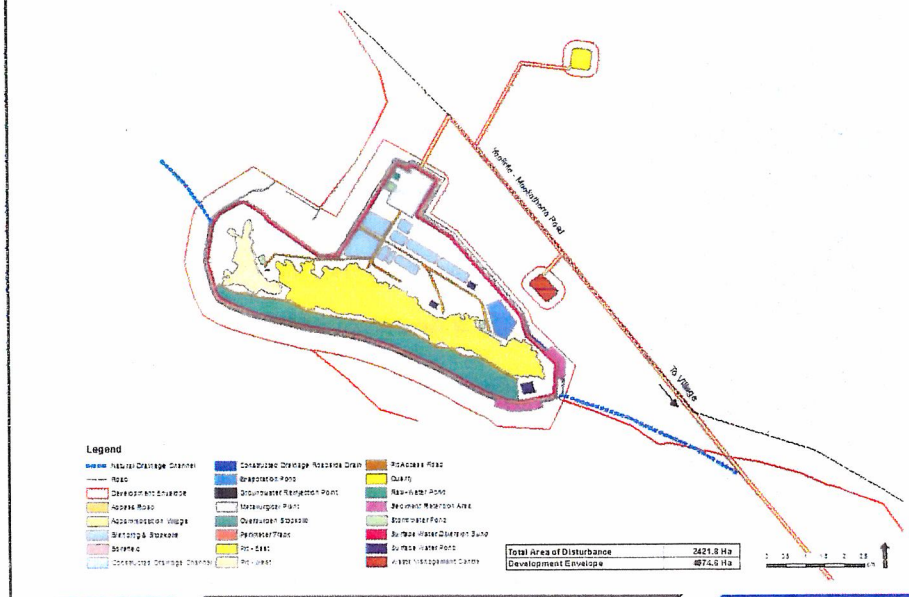
Development Envelope



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Project Timeline

YEAR	DEWATERING SCHEDULE	MINING SCHEDULE	MILLING SCHEDULE	TAILINGS DEPOSITION SCHEDULE	COVER
1					
2	Construction camp and plant	Mine Block1 MB1 dewatered and mined			
3		Mine Block 2 MB2 dewatered and mined			
4		Mine Block 3 MB3 dewatered and mined	Start of milling		
5		Mine Block 4 MB4 dewatered and mined			
6		Mine Block 5 MB5 dewatered and mined			
7		Mine Block 6 MB6 dewatered and mined			
8		Mine Block 7 MB7 dewatered and mined			
9		Mine Block 8 MB8 dewatered and mined			
10		Mine Block 9 MB9 dewatered and mined			
11		Mine Block 10 MB10 dewatered and mined			
12		Mine Block 11 MB11 dewatered and mined			
13		Mine Block 12 MB12 dewatered and mined			
14		Mine Block 13 MB13 dewatered and mined			
15		Mine Block 14&15 MB14&15 dewatered and mined			
16	End of mining	Mine Block 14&15 MB14&15 dewatered and mined			
17					
18	End of milling		End of milling		
19				Decommissioning. Placing of wastes in mining blocks 9 - 15	
20					
21					
22	Cover completed				

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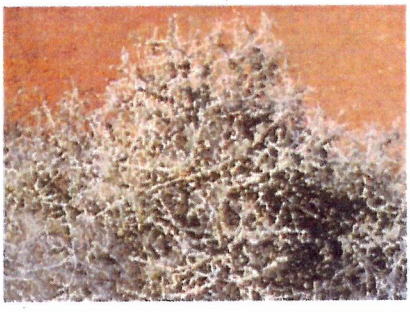
Atriplex yeelirrie



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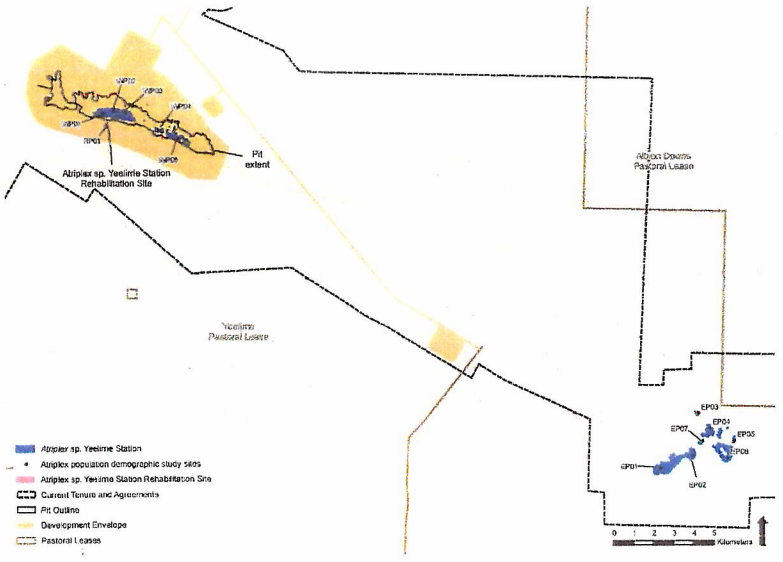
History

- Plant discovered during 2010 surveys and classed as "Priority 1" species; upgraded to "Threatened" species in February 2012
- Three populations:
  - Western Population on orebody consisting of 84,510 plants (2011)
  - Eastern Population consisting of 190,656 plants (30km SE of the orebody)
  - Rehabilitation population consisting of 109 plants (2014)
- 2012 study identified genetic diversity between the two populations
- 2014 Taxonomic review concluded:
  - "genetic divergence" between the populations, but
  - "no consistent morphological differentiation" between populations
- The review concluded that the new taxon should be described as a single species and managed to preserve the genetic diversity
- This species is also listed as Endangered under the Commonwealth EPBC Act

Atriplex yeelirrie - locations

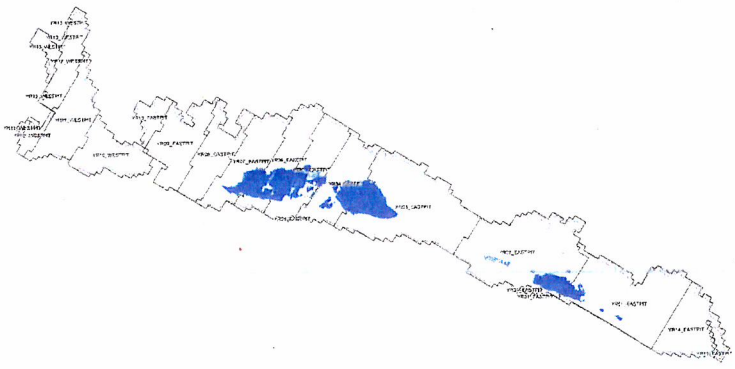


Work Completed to Date

- Ecophysiological studies
- Review of potential translocation sites
- Seed viability testing
- Population dynamics studies
- Study of the rehabilitation population

Impacts

- **Development of the Project will result in**
  - removal of 30% of the known population of the species
  - removal of 100% of the Western population genotype



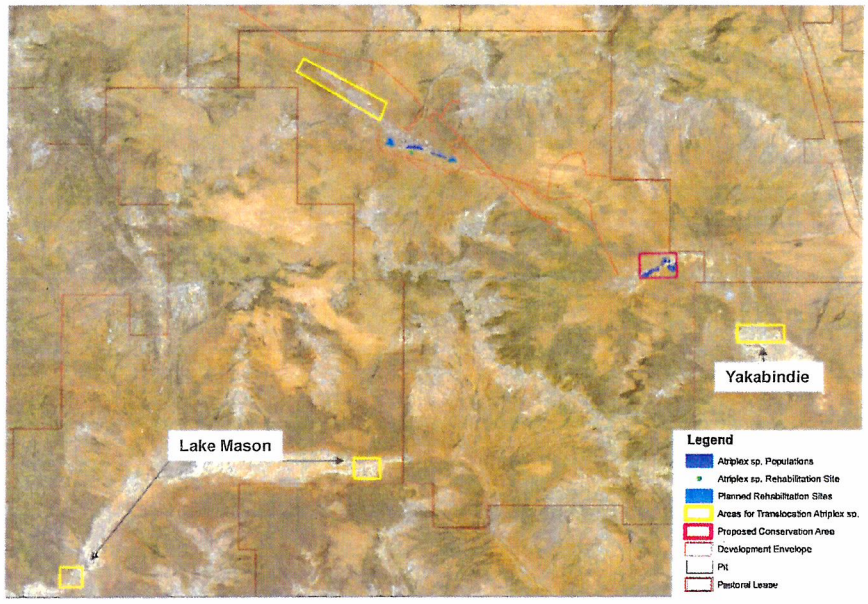
Management of Western Genotype

- To address the impact on the Western Genotype, Cameco has proposed to re-establish populations at natural locations and in re-constructed locations (Translocation) with two objectives:
  - To establish new populations of the Western genotype
  - To establish the populations over a number of sites to minimise risk
- Current proposals include:
  - Translocation at 4 natural locations
  - Re-construction of 2 sites within the open pit using surface and subsoil taken from adjacent habitat

Proposals to Translocate

- Implement a comprehensive research program
- Undertake a trial translocation program
- Undertake a report on the potential suitability of each natural translocation site.
- Implement translocation
- Implement site re-construction
- Collect seed and store

Potential Translocation Sites



Management of Eastern Genotype

- **Improve the protection of the population by fencing the area**
- **Investigate and implement options for the long term protection of the area** including through changes in land tenure and/or land ownership
- **Collect seed and store with the DPaW seed bank**
- **Undertake bi-annual population dynamics survey** to identify population condition and trend and analyse the status of the population through PVA statistical analysis

State Position

In their Report and Recommendations the EPA concluded that the Environmental Objective for Flora (Atriplex) could be met.

- Position reached after considerable involvement and after numerous presentations and site visits by technical specialists and senior people from OEPA, EPA and Dept of BCA (DPaW).
- EPA recommended the suite of conditions that appear in the Ministerial Statement.
- The Conditions
  - sets out a research plan,
  - requirements for translocation, and
  - recognises the time potentially required to demonstrate success – 20 years.

Current status

Plan for Trial Translocation submitted to DBCA for final review.

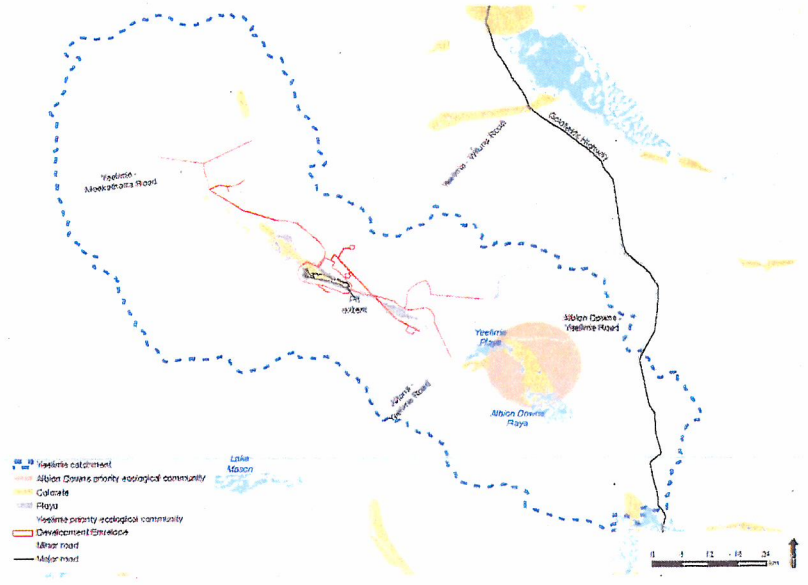
Money in 2018 budget to implement Trial.

Materials to fence Eastern population purchased. Fence to be erected in 2018.

Subterranean Fauna - History

- **Study and Project area are within the uppermost reaches of the Carey palaeochannel (Lake Miranda catchment)**
  - Yeelirrie PEC
  - Albion Downs PEC (not impacted by the proposal)
- **Total number of species within the study area:**
  - 73 stygofauna
  - 45 troglofauna
- **No listed species**
- **Large sampling effort**

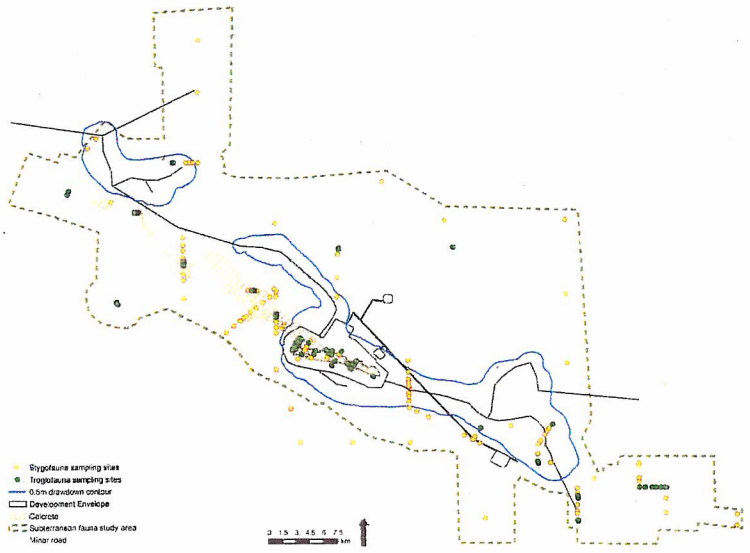
Project area



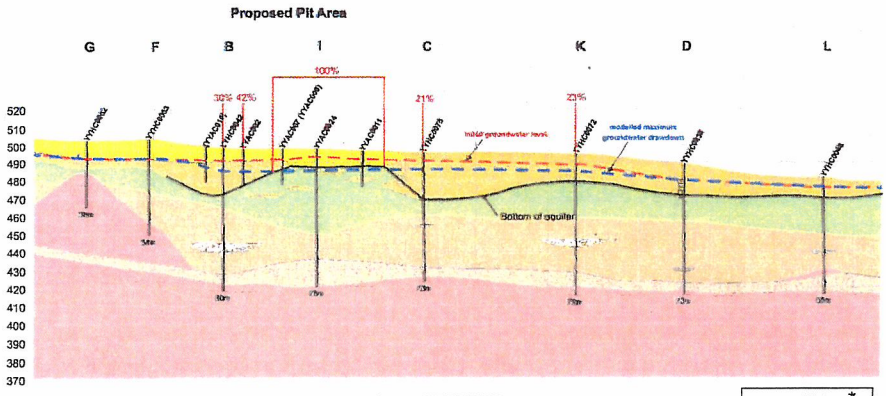
Work Completed to Date

- **Nearly 800 deliberately collected subterranean fauna samples collected from Yeelirrie by Subterranean Ecology (2011):**
  - 448 troglofauna samples
  - 347 stygofauna samples
  - collected over six rounds of sampling between 2009 and 2010.
- **Cameco undertook additional sampling and drilling in 2015:**
  - February 2015 – first round of reference sampling around the western and southern boundary of drawdown (20 bores)
  - June/July 2015 – second round of reference sampling around the western and southern boundary of drawdown (46 bores)
- **Review and reassessment in 2015**

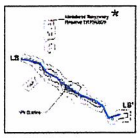
Sampling Locations



Longitudinal Cross Section



Hole name	top aquifer	bottom aquifer	initial water table	elevation drawdown	thickness aquifer	WL change	%
YYHC0042	492.29	473	492.29	486.56	19.29	5.73	30
YYHC002	491.5	477	491.42	485.39	14.5	6.03	42
YYHC0075	490.46	469	490.43	469	21.46	4.431	21
YYHC0072	486.35	479	486.35	484.65	7.354	1.704	23
YYHC0038	479.63	471	479.63	480.14	8.634	-0.506	0
YYHC0048	475.98	470	475.98	476.68	5.978	-0.682	0



Initial groundwater level
Modelled maximum groundwater drawdown

Quaternary/Recent
Calcrete (Including Pomaklanous & Earthy)
Sandy Alluvium, Silty Sand, Silty Sandstone
Clayey Alluvium,Silty Clay, Sandy Clay, Clayey Sand (Incl Clay Quartz)

Early-Tertiary
Palaeochannel Clay (Parkeith Shale)
Upper & Lower Section
Mid-Palaeochannel Sand (Lower Section)
Basal-Palaeochannel Sand (Wallaby Sandstone)

Archaean
Weathered Granite
Granite (Fresh)

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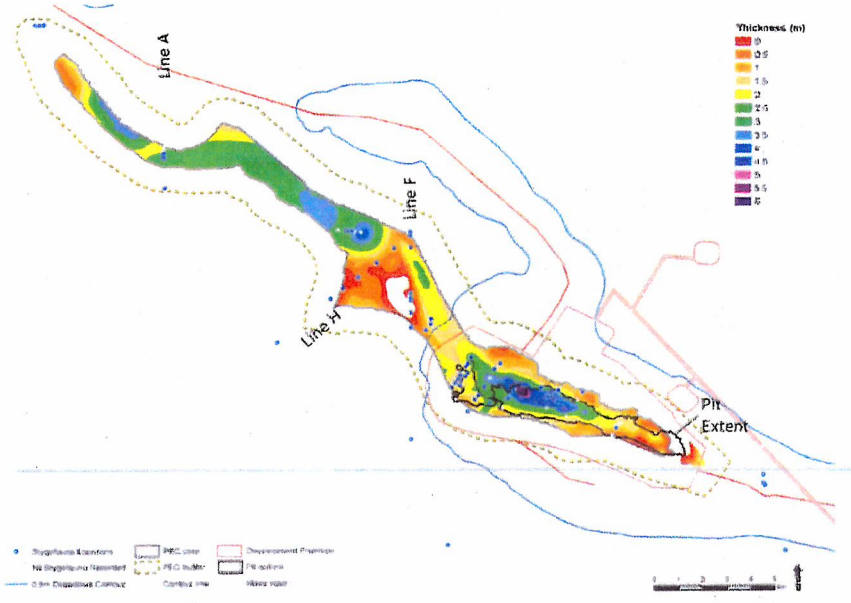
Yeelirrie PEC



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Physical Impacts

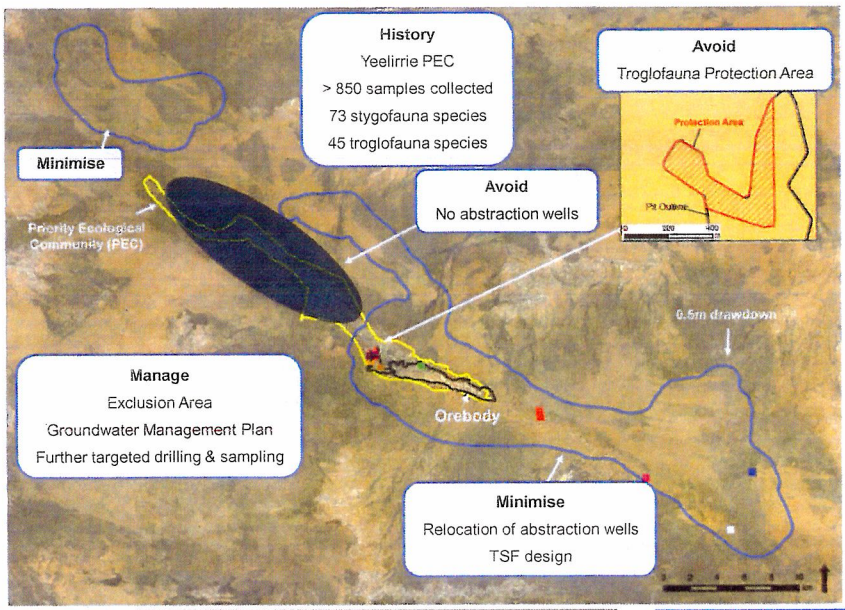
Stygofauna and PEC

- > 0.5 m drawdown
  - Long-term recession groundwater levels;
  - Saturated calcrete thickness; and
  - Ability to monitor and manage.
- Impacts to the PEC
  - 42% of area
  - 43% of volume
- Impacts of solute transport are expected to be minor to negligible

Troglofauna

- Loss of habitat through excavation of the mine pit

Impact Mitigation



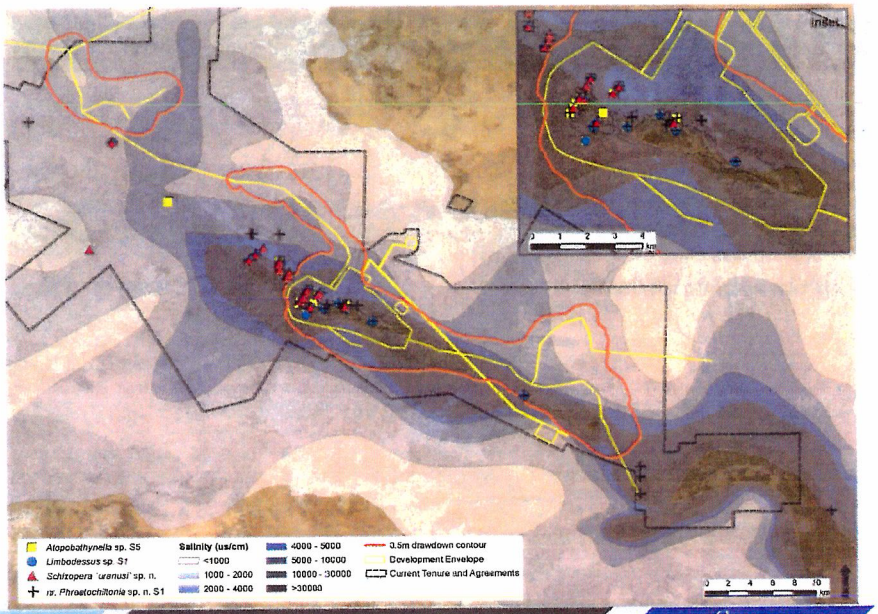
Impact Mitigation

	Area (Ha)	Volume (m3)
Total size of the PEC	4184	81,963,327
Affected by 0.5m drawdown	1,777 (42%)	35,517,742 (43%)
Area excavated for mining	727 (17%)	16,382,466 (20%)
Total habitat remaining after mining	3,457 (83%)	65,580,861 (80%)

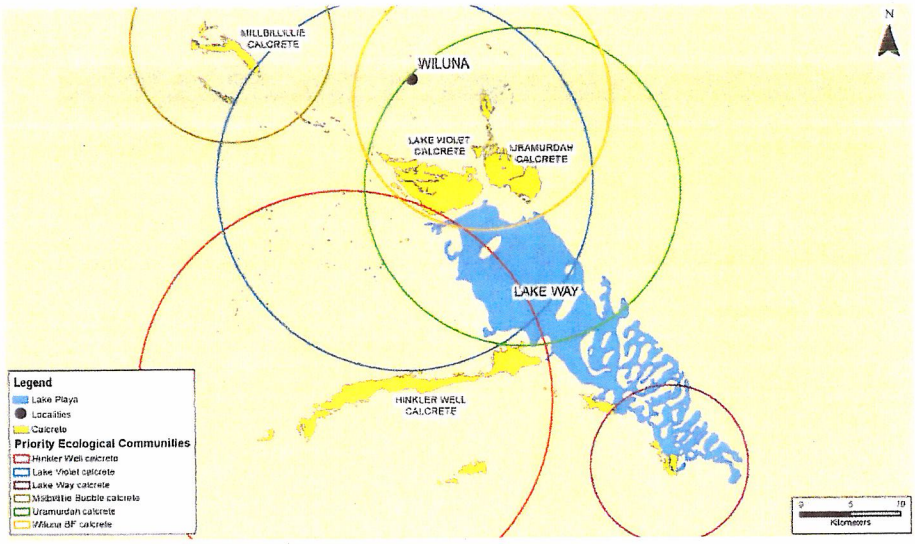
Impact Mitigation

	Stygofauna	Troglofauna	Total
If abstraction wells within the palaeochannel NW of mine pit	~50 (60%)	5 (11%)	~55 (47%)
PER	11 (15%)	5 (11%)	15 (13%)
Troglofauna Protection Area	11 (15%)	1 (2%)	12 (10%)
Further Optimisation	8 (11%)	1 (2%)	9 (8%)

Salinity



Review of Lake Way Calcretes



Review of Lake Way Calcretes

70 species of stygofauna identified

Hinkler Well Calcrete

- 33 species
- 21 (64%) species recorded from other calcretes

Lake Violet Calcrete

- 38 species
- 25 (66%) species recorded from other calcretes

Uramurdah Calcrete

- 36 species
- 23 (64%) species recorded from other calcretes

Review of Lake Way Calcretes

Displayed Salinity Tolerances

- **Some syncarid and copepod species recorded in hypersaline groundwater > 70ppt**
- **Numerous species found to be tolerant of relatively wide ranges of salinity**
  - *Dussartcyclops uniarticulatus* 1ppt to 25 ppt
  - *Chiltoniidae* and *Limbodessus* spp 1 ppt to 38 ppt
  - *Schizopera austindownsi* from 19 ppt to 78 ppt
  - *Brevisomabathynella* sp. SAM2 38 ppt to 72 ppt
  - *Atopobathynella wattsi* 5ppt to 65 ppt

Surrogacy Stuart Halse (Bennelongia)

EAG12

- Biological surrogates
- Physical surrogates

Stygofauna

- Likely to extend outside impact area: 6
- May extend outside impact area: 5* (1 singleton)

Troglofauna

- May extend outside impact area: 1 (specie is a singleton)

Surrogacy

Stygofauna

- **Enchytraeidae sp. Y4 –** located on south eastern end of 0.5m drawdown in low salinity groundwater. Pumping strategy amended to push location outside of impact zone. Enchytraeidae sp. Y6 - This species was collected at a single bore, YYD22, at the western end of the proposed mine pit and near to the limit of >0.5 m groundwater drawdown. Identification was genetic and based on a single animal; the other three enchytaeid worms in the same sample were assumed to be Enchytraeidae sp. Y6. Depth to watertable was about 6 m and groundwater salinity was approximately 10 g/L TDS.
- **Enchytraeidae sp. Y6** - it is inferred that Enchytraeidae sp. Y6 is likely to be more widespread at Yeelirrie, based on surrogate biological and habitat evidence. The related species, Enchytraeidae sp. Y5, has been collected in the north-west sector at depths to groundwater of about 6 m and salinities of 6-25 g/L TDS and in the south-east sector at about 10 g/L TDS. These parameters straddle those of Enchytraeidae sp. Y6, with both species appearing to occupy the same habitat. It appears likely that Enchytraeidae sp. Y6 has a similar distribution. In fact, it is possible that Enchytraeidae sp. Y6 has been collected more widely in existing samples but not identified because of the small numbers of specimens analysed genetically.
- Two species on Enchytraeidae recorded in the Pilbara have a range of 220km.

Surrogacy

Stygofauna

Novanitocrella "araia" sp. n – known from a single animal. The only other described species of the genus has a known linear range of 20km, therefore it is reasonable to assume that the range of this species could extend a short distance to the west of the mine pit in groundwater of similar salinity.

Novanitocrella "araia linec" ssp.n. – collected in three samples from two bores about 400 m apart (YYHC0036C and 37C) in the area of groundwater drawdown south-east of the mine pit. Groundwater salinity was about 11-14 g/L TDS.

The distance between records of *Novanitocrella* 'araia' sp. n. and *Novanitocrella* 'araia linec' ssp. n. is about 12 km and it is considered that they represent related species separated by a recent isolation event, so that it is unlikely their ranges overlap. The species appear to have similar salinity preference and the factors controlling their ranges are unknown.

Surrogacy

Stygofauna

- **Philosciidae sp. N. Y2** - this isopod species was collected as five specimens in four samples from two bore holes (YYD22 and YYAC36) about 400 m apart at the western end of the proposed mine pit and area of groundwater drawdown.

Terrestrial isopods often have restricted ranges (Judd *et al.* 2003) and subterranean philosciids have sometimes been shown to be restricted to single calcretes or to have mine-scale distributions (Cooper *et al.* 2008; Taiti and Humphreys 2001). Bore YYD22 contained two other species known only from the drawdown area (Enchytraeidae sp. Y6 and *Schizopera emphysema*), which suggests an unusual habitat may have been sampled (nine species of stygofauna were recorded in it altogether) and Philosciidae sp. n. Y2 may have a patchy distribution because of its occurrence in this unusual habitat. Based on modelled salinity, the range of Philosciidae sp. n. Y2 would be expected to extend west into the north-west sector but other factors may also be involved in determining the distribution of the species.

Surrogacy

Stygofauna

Shizopera akolos, Shizopera emphysema, Shizopera sp. 7439

- 14 species or subspecies of Shizopera have been collected from Yeelirrie.
- Shizopera uranusi sp. n shown to be widespread across a range of salinity at Yeelirrie as was *Schizopera austindownsi in Lake Way*.
- Three species or subspecies are known only from impact zone within the north western end of the mine pit
- Species described as a surface invading species that might be expected to be widespread
- Reasonable expectation that their range could extend to the north west beyond the impact zone where groundwater of similar water quality exists.

Surrogacy

Stygofauna

- **Kinnecaris "lined"** – located on the fringe of the borefield. Tolerance of salinity. Located where groundwater is estimated to be 10m deep and drawdown modelled to be approx 1 m.
- **Atopobathynella sp. "line K"** – also located on fringe of drawdown impact zone. Atopobathynella at Yeelirrie and at Lake Way are relatively widespread, and have a tolerance to a salinity range from fresh to about 15g/l TDS. Reasonable to assume that this species could be more widespread. The pumping strategy can be amended to push location outside of impact zone.
- **Halicyclops cf. eberhardi sp.B –** collected from a single bore on the periphery of the proposed pit and near the western boundary of the area of groundwater drawdown. Two other species or subspecies of Halicyclops have been collected. H. sp B occurs in the middle of the range of one of the other species. The variety of ranges of similar species suggests there are no fixed barriers that determine distribution. Modelled salinity suggests H. sp. B may occur within a narrow band west of the area of groundwater drawdown as well as further east.

Surrogacy

Troglofauna

- **Trichorhina sp.n.F –** three of the four species of the isopod *Trichorhina* collected in the study area are known from single bores, with *Trichorhina* sp. n. F being represented by a single animal within the proposed mine pit.

The fourth species, *Trichorhina* sp. n. G occurs in multiple bores in the northwest part of the Yeelirrie calcrete with a linear range of about 14 km.

Trichorhina sp. n. F may have a small range but further sampling may show it occurs outside the mine pit due to the fact that the related *Trichorhina* sp. n. G occurs in multiple bores in the northwest part of the Yeelirrie calcrete with a linear range of about 14 km.

Management and Mitigation: Commitments

- **Develop and implement an outcome-based Subterranean Fauna Management Plan**
- **Committing to and managing the 0.5m drawdown**
- **Not exceeding the groundwater quality or absolute groundwater level threshold** criteria beyond the mapped 0.5m contour
- **Establishing a Troglofauna Protection Area**
  - Prior to impacting the Troglofauna Protection Area, Cameco will undertake additional troglofauna sampling and habitat mapping in order to improve knowledge and confirm surrogacy predictions;
- **Undertaking further groundwater investigations of the wellfields during the DFS**

Why we think the impacts are over estimated

- Poor sampling design – not linked to geology, hydrology or salinity (driven by land access)
- No recognition of surrogacy positions
- No recognition of ability to manage/modify the groundwater abstraction (to reduce impact on three species)
- Assessment of impact at 0.5m drawdown

Review of proposed Federal Condition

Proposed condition – "*Demonstrate that no species would be made extinct by the implementation of the Project, prior to the commencement of the Project*".

For Subterranean fauna, the proposed Condition doesn't recognise the inherent difficulties associated with sampling for and describing species, including,

- Inadequate sampling technique
- Morphology vs genetic differentiation to determine what is a species
- Uncertainty around niche habitat and the difficulty in locating replicate habitat for sampling
- Goes against historical EPA decisions, eg Gorgon
- Is not realistic and unlikely to be achieved – ever!

EPA's decision

The EPA's Report and Recommendations provided a way forward for Government,

- ***considers that uncertainty surrounding the potential for serious or irreversible damage may be mitigated*** **(Section 5, pg 77).**
- ***recommended mitigation measures including...***
  - *Sampling and identification outside the impact area*
  - *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.*
  - *Development of an industry-funded research program with the long-term aim of reducing the uncertainty surrounding the conservation of subterranean fauna.*

EPA's decision

Typical approval conditions

Historically, conditions dealing with subterranean fauna (in the main), require preparation and implementation of a Subterranean Fauna Management Plan.

Some require ongoing surveys, eg. Gorgon, MS800, Cond 11.1(iv)

"in respect of any species that has only been found in the Gas Treatment Plant site as at the date of this Statement, the continuation of surveys for that species until it is found elsewhere"

Federal approval

The proposed Federal condition "demonstrate that no species would be made extinct by implementation of the project, prior to the commencement of the Project" is probably unachievable and unrealistic, given the uncertainty surrounding sampling and naming of subterranean fauna.

Cameco (and the State) considers the risks are manageable and that the approval of the Project provides an opportunity to address some of the uncertainties surrounding the factor for the net benefit of the environment.

The EPA considers the 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 extend beyond the Impact Area, or a compelling case is made that their habitat is continuous and extensive well beyond the impact area.

Questions

Thank you

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