



Jack Hills Expansion Project Public Environmental Review Response to Public Submissions

EPA Assessment Number: 1789

DOCUMENT NO:	JHS-0000-EN-RPT-001_0
RADIX FILE NO:	
DOCUMENT CUSTODIAN:	Lara Jefferson

8 Dec 2010	Draft – Internal	M. Toner	L. Jefferson		Draft 1
17 Dec 10	Final	M. Toner	L. Jefferson	L. Jefferson	Final
DATE	REASON FOR ISSUE	BY	CHECKED	APPROVED	REV NO./ISSUE NO.

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1. INTRODUCTION

1.1 PURPOSE OF DOCUMENT

This document is a Response to Submissions that has been compiled in reply to comments received during the formal public consultation period for the Public Environmental Review (PER) for the Jack Hills Expansion Project (JHEP) (EPA Assessment Number: 1789). This response has been prepared in accordance with Section 9.2 of the EPA's Environmental Impact Assessment (Part IV Division 1) Administrative Procedures 2002. The purpose of this document is to provide a summary of key environmental issues raised in the public and government agency submissions made on the PER and to provide written responses to these issues.

The formal public consultation period occurred between 13 September and 22 October 2010 (a six week period). Twelve formal submissions were received by the Office of the Environmental Protection Authority (OEPA) and forwarded to Crosslands Resources Ltd (CRL). This document provides CRL's response to all items raised in the submissions.

2. PROJECT PROGRESS

The Jack Hills Expansion Project (JHEP) is currently in a Bankable Feasibility Study (BFS) phase (completion Q2 2011), with the project undergoing detailed design that will further optimise engineering, financial, constructability, indigenous heritage and environmental factors. CRL has undergone a process of identifying areas that may be required for design options and included these in the potential disturbance area. The final mine layout was presented within this disturbance footprint. The alternative footprint presented in Section 6 of the PER has not been presented in this document, as the original footprint will, at this stage, continue to be the footprint under consideration for the formal Environmental Impact Assessment. The footprint is provided at Figure 1, Appendix A.

CRL has continued to define and assess the two proposed borefields, Murchison (1A, 1B and 1C) and Byro. Estimates on the net area to be impacted within the broader borefield area presented in the PER are provided in Table 1.

Table 1 Borefield Extents

Description	Gross Area (ha)	% Area Used	Net Area (ha)
Murchison Borefield 1A	38497	0.31	120
Murchison Borefield 1B	50861	0.24	120
Murchison Borefield 1C	31315	0.27	85
Byro Borefield	778426	0.08	600

Changes that have occurred since lodgement of the PER include:

- Summary Table 1.2 and Surface Water Section: Proposed Management Measure:
 - Overflows from the Integrated Waste Landform (IWL) as a result of extreme weather events will be collected in bunded drains at the toe of the stockpile for detention and controlled release. This has been changed to: runoff from waste and tailings storage will be designed to contain the 1 in 100 year – 72 hour rainfall event.

- Hydrocarbon Storage (Section 5.12.2, Pg 45): In site fuel storage will have a total capacity of 4,500 KL rather than 3,000 KL.
- CRL have continued to undertake indigenous heritage surveys along the gas pipeline. These surveys have identified indigenous heritage sites (unregistered sites) that are of importance to the traditional owners. As a result, the alignment of the gas pipeline near Jack Hills has been relocated to ensure there is no impact to permanent water pools on the Murchison River. The revised location of the gas pipeline is provided in Figure 2 (Appendix A) and will be an open cut pipeline crossing. No permanent water pools exist at this crossing nor is there any groundwater dependent vegetation in the vicinity.

2.1 FURTHER STUDIES

Since submission of the PER the following studies have been completed or were conducted as a component of current operations and address statements made in the public submissions:

- Vegetation Monitoring Strategy (Cardno, 2010; Appendix B).
- Draft Soil Quality Assessment of the Jack Hills Project (Landloch, 2010; Appendix B).
- Draft Rehabilitation Guidelines for Jack Hills Waste Landform (Landloch, 2010; Appendix B).
- Review of Waste Management Services (Bowman and Associates, 2010; Appendix B).
- Acid Mine Drainage (AMD) Progress Report (SGS, 2010; Appendix B).
- Eco-village Sustainability Report (Cardno, 2010; Appendix B).
- Memo on Pit Dewatering Assessment (SRK, 2010; Appendix B).
- Preliminary Murchison Borefield Assessment (Aquaterra, 2010; Appendix B).
- Stygofauna Progress Report (GHD, 2010; Appendix B).
- Annual Vegetation Monitoring Report (Cardno, 2010; Appendix B).
- Assessment of Rehabilitated Exploration areas at CRL, Jack Hills Operation and a Proposed Research Framework for Triodia Restoration (G&G Environmental, 2009; Appendix B).

CRL continues to investigate environmental aspects with studies that are currently underway including:

- Drainage - studies are underway to re-assess the flood modelling based on the mine layout and options for above-ground water pipelines (Golders).
- Stygofauna surveys – underway to assess Murchison Palaeochannel area 1B and planned for Byro Sub-basin (GHD).
- Flora and Fauna surveys - to assess areas not previously investigated as part of the previous surveys (GHD).
- AMD Kinetic testing (SGS).
- Waste Characterisation (MBS Environmental). Integrated Dust Management Plan (Coffey Environments) for inclusion in Project Management Plan.
- Closure Cost Estimates.
- Review of Potentially Fibrous Materials (Golders and Coffey Environments).
- Carbon Reduction Assessment Review: updated based on BFS design (Cardno).
- Indigenous Heritage – ongoing surveys of the disturbance footprint.
- Detailed design for bankable feasibility.
- Groundwater sampling, modelling and reporting in the Murchison Palaeochannel (Aquaterra) and Byro Sub-basin (Global Groundwater).

3. STAKEHOLDER CONSULTATION

CRL has and continues to engage with various stakeholders regarding the JHEP. Since submission of the PER, CRL has held meetings with the Department of Water (DoW), Department of Mines and Petroleum (DMP), the Department of Environment and Conservation (DEC) and the Australian Commonwealth Scientific and Research Organisation (CSIRO). These discussions focused on:

- The findings and adequacy of baseline surveys and further investigations scheduled, relating to groundwater, stygofauna and groundwater dependent ecosystems for the purposes of the Licence to Take Groundwater applications (5C);
- The proposed management measures and monitoring strategies;
- Future applications and additional information required (from that presented in the PER) – Licence to Take Groundwater and Mining Proposal;

- Potential Fibrous Material (PFM) Assessment: level of information for the Project Management Plan;
- Square Kilometre Array (SKA) and discussions around ensuring mining and SKA can coexist; and
- Briefing on the current operations and status of design.

Groundwater Abstraction

CRL held a workshop with the DoW, DEC, hydrology consultants (Aquaterra and Worley Parsons), GHD (biologists) and CRL to discuss the findings of the latest groundwater, stygofauna and groundwater dependent ecosystem surveys. The aim of the workshop was to provide an update on early aquifer modelling of the Murchison palaeochannel, stygofauna investigations and groundwater dependent vegetation surveys. These meetings will be ongoing to ensure regulators are updated on the status and key findings. A detailed Public Consultation Plan has been developed to address consultation activities associated with the water abstraction licenses.

General Consultation

A summary of consultation with key stakeholder groups is provided in Table 2.

Table 2 Stakeholder Consultation

Stakeholder Group	Details
Community Forums and local shires	3 August - Shire of Mullewa – CRL CEO meeting with President, Geraldton 3 August – Community Sundowner with CRL CEO, Geraldton 31 August – 1 September – Mid west Resource Forum presentation of project update, Geraldton 5 November – Project update at Cue Parliament (Western Australian Local Government Authority (WALGA) Murchison Zone Meeting), Cue
Landholders/Pastoralists	Beringarra, Judal and Mileura Stations– Meeting 29 June re road impacts, dust management, water drainage and concerns over erosion and proximity of the proposed IWL to the Murchison. Beringarra Station - Meeting 13 July re road impacts and water drainage. Moorarie Station – 5 August meeting with CRL and DoW Perth
Indigenous Groups	CRL has meet with both the Wajarri Yamatji (WY) and Malgana Claim Groups on a number of occasions since July 2010, including: 15 July Shark Bay - Malgana Working Group 10 August Geraldton - WY Working Group 27 August Shark Bay - Malgana Working Group 2 September Meekatharra - WY Native Title Party 30 September Meekatharra - WY Working Group 12 October Meekatharra - WY Working Group and YMAC Representatives 23 November Meekatharra - WY Working Group
Employee and industry groups	4 August – CRL CEO meeting with Geraldton Iron Ore Alliance CEO, Geraldton
Utility and infrastructure groups – SKA	23 February – Meeting with Department of Innovation, Industry, Science and Research (DIISR), CSIRO, Australian Communications and Media Authority (ACMA), DMP and Department of State Development (DSD) 6 June – Meeting with Department of Commerce (DoC), Public Transport

	<p>Authority (PTA), CSIRO, ACMA 22 May – Meeting with DSD, DoC 9 April – SKA briefing with CSIRO, ACMA, Perth 5 November – Meeting with CSIRO, DSD, DMP, DoC and DIISR, Perth 10 November - Meeting with CSIRO, DSD, DMP, DoC and DIISR, Perth 11 November – Meeting with CSIRO 18 November - Meeting with CSIRO, DMP, DoC, Chamber Minerals and Energy, CCI Perth</p>
Local and regional services and businesses	4 August – Mid West Chamber of Commerce and Industry meeting with CRL CEO, Geraldton
Local government authorities	3 August – MWDC meeting with CRL CEO, Geraldton
State government agencies	
Office of Environmental Protection Authority	<p>7 July – Meeting with the Minister of Environment 22 July – Site visit to Jack Hills (Golden Gecko Site Visit) 9 August – Meeting with OEPA Perth</p>
Department of Environment and Conservation - Perth and Geraldton	<p>2 July – Meeting with DEC Perth 27 Oct – Murchison palaeochannel workshop (DoW and DEC) 6 Dec - Meeting with DEC Perth (offsets) 9 Dec – Meeting with DEC Geraldton (offsets)</p>
Department of State Development	<p>13 July – Monthly project briefing, Perth 10 August – Monthly project briefing, Perth 14 September – Monthly project briefing, Perth 20 October - Monthly project briefing, Perth 1 November – Project update with DG 20 November – Monthly Update, Perth 1 December – Monthly project briefing, Perth 2 December – Project update with DG</p>
Department of Mining and Petroleum (formerly Department of Industry and Resources)	<p>25 June – Phone call discussion with DMP, Perth 29 June – Meeting with DMP, Perth 10 July - Phone call discussion with DMP, Perth 20 July – Phone call discussion with DMP, Perth 21 July - Phone call discussion with DMP, Perth 22 July – Site visit to Jack Hills (Golden Gecko Site Visit) 23 July – Meeting with DMP re: approvals 24 August – Meeting with the Minister of Mines DMP, Perth 30 July – Meeting with DMP re: approvals 11 Oct – Meeting with DMP re: PFM 28 Oct – Meeting with DMP (project update/ approvals) 12 Nov - Meeting with DMP re: approvals 12 Nov - Phone call discussion with DMP, Perth</p>
Department of Water – Perth & Geraldton	<p>22 June – Meeting with DoW, Geraldton 20 July – Phone call from DoW, Perth 4-5 Aug – Byro and Murchison site visit 11 August – Meeting with Department of Water ,Perth 17 August – Meeting with the Minister for Water Resources, Perth</p>

	<p>15 Oct - Meeting with DoW, Perth 18 Oct - Meeting with DoW Perth, DG 21 Oct - Meeting with DoW, Perth 27 Oct – Murchison palaeochannel workshop (DoW and DEC) 12 Nov - Meeting with DoW, Perth 9 Dec – Meeting with DoW, Geraldton</p>
Department of Education and Training	10 August – Meeting with Mid West Participation Officer, Perth
Department of Indigenous Affairs	11 August – Meeting with DIA, Perth
Department of Regional & State Development	<p>13 July – Meeting presentation 10 August – Meeting, Perth 12 November – Meeting, Perth</p>

3.1 GOLDEN GECKO AWARD

CRL’s research project, in partnership with Phoenix Environmental (Phoenix), on the Shield-back Trapdoor Spider (*Idiosoma nigrum*) was awarded the Golden Gecko Award for 2010. The research project assessed the effects of past exploration drilling and the potential effects of vibration from a new drilling program. Phoenix’s survey design had two key innovations. One was the use of fibre optic technology to allow the observation of spiders in burrows without digging them up. The second was the design and development of a ‘vibration simulation device’ (VSD) that provided vibrations equivalent to drilling. This device allowed the survey to be undertaken with no new clearing as it was more mobile.

In association with Crosslands’ nomination for the DMP’s Golden Gecko nomination, an agency site visit to Jack Hills was facilitated. Representatives from DMP, the OPEA and the Department of Agriculture and Food toured around the Jack Hills mine site and were given a demonstration by Phoenix environmental scientists of non-invasive techniques to assess impacts of vibration on *Idiosoma nigrum* spiders.

3.2 COMMUNITY CONSULTATION

3.2.1 Mid-west Community sentiment

Research and engagement undertaken in the Mid-West Region over the past several years has helped build a platform of support for JHEP, while simultaneously providing information to ensure Crosslands understands community sentiment and attitudes toward JHEP and the company.

CRL has strong support from community stakeholders. The local community’s positive sentiment is based on the perceived economic benefits, particularly from direct involvement and opportunity in the project.

The community is currently positively predisposed to JHEP because they believe they will accrue economic benefits and opportunities, making the area more attractive to live and work in. In research conducted in 2010, 83% of community respondents agree that CRL is important to the local economy (Patersons, 2010).

3.2.2 Feedback from community engagement

Formal research in the mid-west shows that the main concern in relation to the JHEP is that the introduction of rail will cause less employment for local truck drivers (13% of total respondents expressed a negative sentiment with 60% of these people stating the negative effect was due to less employment). This is actually a misconception in regard to the benefits of the JHEP. Of these 13% of respondents who expressed negative sentiment, 1% of people stated the 'environmental impact' as the reason.

Eighty three percent of the total population surveyed in 2010 (Patersons, 2010) agree with the statement that the JHEP is 'important to the local economy' (with only 5% disagreeing with the statement) and 71% agree that it 'brings benefits to the community'.

4. SUBMISSIONS RECEIVED

During the public consultation period the OEPA received twelve submissions, which were forwarded to CRL. The comments received were separated into individual items that are formally addressed in this report. As many of the submissions raised similar comments, the items were grouped into aspect areas for ease of reporting.

Submissions were received from:

- Department of Indigenous Affairs (DIA);
- Yamatji Land and Sea Council (YMCA);
- Department of Mines and Petroleum (DMP);
- Department of Water (DoW);
- Wildflower Society (WS);
- Commonwealth Science and Industry Research Organisation (CSIRO);
- Department of Environment and Conservation (DEC);
- Four Private Residents (PR 1, 2, 3, 4); and
- Office of the Environmental Protection Authority (EPA).

The main issues raised during the consultation period were:

- Water supply – confirmation of the sources of water, availability of water in the region, extent and status of environmental surveys and potential impacts.
- Square Kilometre Array – confirmation of consultation with CSIRO and advice on potential impacts.
- Offset Package – recommendations on further discussions with agencies when developing the offset package.
- Comments and advice on information requirements for future approvals (Licence to Take Water (5C) and Mining Proposal).
- Indigenous Heritage – confirmation on the status of surveys and key findings.
- Integrated Waste Landform – confirmation on the location, footprint and impacts.
- Waste characterisation/Acid and Metalliferous Drainage/Fibrous Materials – further information on the status of pending studies.

5. SUBMISSION RESPONSE

This section provides CRLs response to submissions received during the public display period. As many of the submissions comment on similar aspects, the responses have been divided into individual items and grouped into aspect areas.

Note: many of the items raised by the four private respondents (PR1, 2, 3 and 4) re-iterate items listed in other submissions; as such their response has not been reproduced in full. Rather, multiple acronyms listed under the item number indicate that this item was raised by more than one respondent.

5.1 KEY CHARACTERISTICS – QUANTITIES/CHANGES TO DESIGN

Item Number	Comment												
EPA: 1	<p>The sizes of project components are inconsistent in places through the PER. Different sets of data appear in the document. I've seen 6998, 7498 and 7719ha for total disturbance. Check also the lengths and widths (and hence areas) of the service corridors. Priority flora species numbers are inconsistent across the text (p114) and tables-see Table 9.1. Page 87 states there are 8 priority species of flora along the services corridor, but p113 says 6. The text lists the Long-tailed Dunnart as a Priority 3 species, whereas the GHD report in Appendix F9 lists the same species as a Priority 4. Section 9.12.3 states that the village would be sited approximately 18km from the pit and 2km from the airstrip. Fig 5.3 shows distances more like 6-7km and 1-2km respectively. Has the site of the village been changed? The waste dump site has been changed and the documentation needs to reflect this (see next section). Please provide us with the correct numbers so that we can use the most accurate set in the 'Key proposal characteristics' table in the EPA's report.</p> <p>Table 1: Summary of key proposal characteristics</p> <table border="1"> <thead> <tr> <th>Element</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>open pits : size and production rate</td> <td>813ha and 120ha; output 40-70Mtpa</td> </tr> <tr> <td>ore treatment plant</td> <td>15-25mtpa combined products</td> </tr> <tr> <td>tailings dam</td> <td>2000m x 4000m, 40m high</td> </tr> <tr> <td>waste rock dump (extension of Stage 1)</td> <td>1785/1840ha?</td> </tr> <tr> <td>haul road and infrastructure services corridor from</td> <td>120km x 40ha= 480ha</td> </tr> </tbody> </table>	Element	Description	open pits : size and production rate	813ha and 120ha; output 40-70Mtpa	ore treatment plant	15-25mtpa combined products	tailings dam	2000m x 4000m, 40m high	waste rock dump (extension of Stage 1)	1785/1840ha?	haul road and infrastructure services corridor from	120km x 40ha= 480ha
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haul road and infrastructure services corridor from	120km x 40ha= 480ha												

	Jack Hills to Weld Range		
	natural gas pipeline spur, from N-S trunk line Compressor Station 56 (CS5)	corridor 240km x 50m=1200ha	
	water requirements: Murchison and Byro borefields	1GL yr for construction 37GL operations phase	
	village: to accommodate	300 personnel	
	gas-fired power station: output / emissions	100MW / approx. 1,424,472t CO _{2-e}	
	airstrip	dimensions and area?	
	sewage treatment and waste disposal		
	total greenhouse gas outputs	approximately 1,738,586t CO _{2-e}	
	total areal footprint	~6998ha /7498 /7719ha?	
EPA: 2	Because the waste dump position and shape has changed significantly would you please prepare and submit maps showing its new location, especially with respect to nearby 'Ecological Environmental Constraints' in Figure 2 of the GHD report of Appendix F9. The same requirement applies to any other major proposal component if its location has likewise changed since the PER. Which airstrip option is preferred (GHD Fig 4) and do the flora surveys encompass this area?		
DMP: 2	Section 5.11.1, p43, last paragraph, and section 6.2.4 DMP notes that the alternative location of the IWL has been provided in section 6.2.4 and shown in figure 6.1. The section of 6.2.4 does not elaborate on other potential environmental benefits other than a reduced footprint that could arise from a possible change in location should the negotiations with SMC to acquire part of the neighbouring tenement be successful.		
DEC: 11	Issue: Potential impacts associated with a change to the proposed location of the integrated waste landform, including vegetation clearing, do not appear to have been adequately identified or quantified or enable an assessment of their significance. Recommendation 11: That, if the integrated waste landform location is altered, the proponent provides the results of additional investigations, including but not limited to flora and fauna surveys of the newly positioned integrated waste landform area for review by the OPEA, on advice from DEC.		
CRL Response	The mine layout is consistent with the original option presented in the PER and is shown at Figure 1, Appendix A. The gas pipeline has been amended since the PER public submission, in response to heritage surveys, and the revised alignment is provided in Figure 2, Appendix A. (EPA 1, EPA 2).		

As noted above, CRL are progressing with the original footprint presented in the PER. Negotiations are continuing with Sinosteel Midwest Corporation (SMC) regarding the acquisition of land adjacent to the JHEP. If negotiations are successful, an alternative location of the IWL may be considered. **(DMP 2)**

If an alternative IWL location is considered any changes in footprint will undergo environmental and cultural heritage assessments and the implications will be discussed with relevant government agencies. It is anticipated that a change to the IWL will not result in an increase on impacts to sensitive receptors. As any changes to the IWL design will occur on the lower plain, which does not contain the *Triodia* PEC, *Idiosoma nigrum* burrows and many of the priority species recorded on the range, the impacts to these aspects due to the change in design is unlikely to change.

As shown in Figure 3 (Appendix A), a large extent of the current mine infrastructure area has been subject to previous flora and fauna investigations. The PER provides a series of figures that show the 'Ecological Environmental Constraints' of the Jack Hills area, including *I. nigrum* burrows, priority species and the *Triodia* PEC. Nonetheless, CRL commits to undertake environmental investigations for areas that have not previously been surveyed. This shall include the following:

- Flora and fauna surveys: CRL's preference will be to undertake these additional investigations when seasonal conditions are optimal.
- Indigenous heritage investigations: all areas to be disturbed will be subject to indigenous heritage surveys. CRL has commenced a number of investigations and will continue to survey the disturbance footprint in consultation with Traditional Owners (further information is provided at Section 5.5).
- Surface water and soils (where necessary): CRL has commissioned external consultants to undertake the following:
 - a revised surface water assessment based on the JHEP layout; and
 - soil quality assessment to include the current disturbed area (provided at Appendix B).

CRL will include copies of these reports as a component of the Mining Proposal, and if new/increased impacts to conservation significant matters (PEC, threatened/priority species) are identified then CRL will inform and discuss the implications with the OEPA and DEC. **(DEC 11)**

Clarification on the matters requested at **EPA 1** is provided below:

- the extent of total disturbance is 9287 ha (for all JHEP infrastructure).
- the gas pipeline is approximately 220 km in length and occupies an area of 1100 ha.
- the services corridor is 120 km in length and occupies an area of 600 ha. It should be noted that the services corridor will be located alongside the proposed Oakajee Port and Rail alignment, as such it is expected that minimal additional disturbance will be required.

- during surveys the following priority flora species have been recorded on site:
 - twelve species within the mine expansion area, of which nine are located within the disturbance area. The percent of local and regional impacts to these species is provided Table 2, Section 2.
 - eight priority species were recorded along the services corridor: as noted above, this will be located within the Oakajee Port and Rail corridor and the works for the JHEP will result in minimal further disturbance.
 - four priority species were recorded along the gas pipeline: all efforts will be made to avoid disturbance to priority species, through relocating the alignment, where this is possible.
- the Long-tailed Dunnart (*Sminthopsis longicaudata*) is listed as a Priority 4 in the latest DEC Priority Fauna List (dated 18 October 2010).
- the village and airfield locations are provided in the PER, and shown at Figure 4 (Appendix A). The village is located nine km from the pit and ten km from the airstrip.

The key characteristics table is updated and listed below **(EPA 1)**.

Element	Description
Life of Project	Approximately 35yrs
Open pits : size and production rate	813ha and 120ha; output 300 Million tonne per annum (Mtpa) waste and ore
Ore treatment plant	45 Mtpa combined products
Integrated waste landform comprising waste and tailings (extension of Stage 1)	1,785 ha
Brindal Waste and Topsoil	69 ha Brindal and 424 ha Topsoil
Infrastructure services corridor from Jack Hills to Weld Range	600 ha
Infrastructure services corridor from DBNGP to Jack Hills	1100 ha
Water requirements	1GL/ annum: construction phase 37GL/annum: operations phase

	Village: to accommodate	2500 personnel	
	Gas-fired power station: output / emissions	Mine site: 350MW; Byro borefield: 8.5MW (estimated approx. 1,424,472t CO _{2-e})	
	Airstrip	150 ha with the airstrip being approximately 2500 m by 400 m.	
	Infrastructure	3,301 ha	
	Borefields	Byro: 600 ha Murchison: 325 ha	
	Area of Disturbance	9,287 ha within a potential disturbance area of 1,035,627 ha	
PR1: 2	On page 40 of the PER Crosslands Resources Ltd propose that “Haul pit roads have been designed to 3.5 times the width of haul trucks in the mining fleet to allow for dual lane access, drains and appropriate bunding (page 40, PER). However in a concurrent PER, Sinosteel Midwest Corporation Limited (2010) state that the “accepted design rule of thumb for two-way traffic is that the roadway width should be no less than four times the truck width including safety bund” (P. 121, Sinosteel Midwest Corporation Limited, 2010). Reassuringly, Sinosteel Midwest Corporation Limited propose to have dual lane haulage ramp widths of 30 m which will be 4.5 times the typical width of 180 ton class haul trucks (Sinosteel Midwest Corporation Limited, 2010). This issue clearly needs further consultation with relevant State Government Agencies, unions and the proponent		
CRL Response	CRL has reputable engineers ensuring the road is designed to the correct standard. Such designs are peer reviewed as a component of the Bankable Feasibility Study process. CRL’s environmental policy states that “CRL are committed to avoid, and where this is not possible, minimise adverse environmental impact.” The decreased width is a reflection of CRL’s environmental commitment to minimise the JHEP footprint, where possible. If a greater width is required, CRL will consult with the OEPA, DMP and DEC to gain additional approvals. (PR 1)		

5.2 WATER SUPPLY AND PIT DEWATERING

Item	Comment
	Groundwater Sources/General Comments
EPA 4	Need to know exactly where the borefields will be located and what environmental sensitivities are there (e.g. flora, fauna, phreatophytes, rockpools, stock bores etc). Section 5.5 mentions a possible water source from Sinosteel dewatering. Is this as well as, or in lieu of the other options?
EPA 5	Will need comprehensive survey assessment data of water availability (which should be developed in close consultation with the Department of Water) and the potential impacts of setting up and drawing from the proposed borefields.
DoW: 2	The PER indicated that several water source options and efficiency measures have been considered for the project. It also mentions some of the issues that may affect final water requirements. However there is no justification presented for the total volume required or explanation for the discrepancy between the figures 45 and 38 GL. More information such as a simple water balance, a description of the water qualities required and other relevant details should be provided.
DoW: 3	A full investigation of the potential groundwater sources for the project is yet to be completed. As such, the final location of production bores, volumes to be abstracted and likely impacts, are not presented in the PER. It is acknowledged that time constraints will prevent this information being available for inclusion in the document. To address this situation in part, CRL has consulted DoW about the water supply options under consideration and planned investigations. The commitments made to future investigations and monitoring in the PER indicate that CRL has an understanding of the issues that need to be addressed for DoW to assess a Section 5C licence to take groundwater. CRL has also committed to continue to consult with DoW as necessary.
DEC: 12	<p>Issue: Groundwater requirements are to be sourced from three separate calcrete and tertiary palaeochannel aquifers of the upper Murchison River or sediments of the Southern Carnarvon Basin (Carnarvon – Byro Basin). The potential impacts of this proposed will not have adequately identified or quantified to enable an assessment of their significance.</p> <p>Recommendation 12: That when the groundwater supply sources for the required 37 gigalitres per annum of water are identified, the proponent provides the results of additional investigations, including but not limited to groundwater dependent ecosystems (particularly stygofauna and phreatophytic vegetation) within the borefield disturbance footprint, for review by the OPEA, on advice from DEC.</p> <p>Recommendation 13: That the proponent provides the results of additional investigations into the proposed borefield infrastructure (i.e. production bore locations, pipeline locations, access tracks and power generation facilities) impacts, including but not limited to flora of conservation significance and threatened fauna surveys for review by the OEPA, on advice from DEC.</p>
PR 1: 1	The water resources required for the project are yet to be identified, yet alone proven, and I strongly urge that this PER be suspended pending

<p>PR 2: 1 PR 3: 1 PR 4: 1</p>	<p>confirmation and quantification of the sources of water.</p> <p>The proponents water requirements are a staggering 37 GL/yr (p 50, PER). This is equivalent to the amount of water required by 4 complete ‘Carnarvon horticultural districts’ or 5 entire ‘Geraldton scheme supplies’. This is a hugely significant amount of water and the only sustainable source of this vast quantity of water in the Mid West region is the Indian Ocean.</p> <p>On page 50 of the PER the proponent vaguely identified that 1 GL of water will be required for construction activities and this water will be sources from the current borefield and Murchison Palaeochannel aquifers. There is no reference to Appendix B4 ‘Jack Hills stage 2 water supply investigation’ and little wonder. The stage 2 investigation undertaken by Aquaterra appears to be for abstraction of 7GL/yr from Murchison Palaeochannel aquifers. The modelling showed drawdowns of 4 to 6.5 m near each of the production bores and a cone of depression extending along 64 km of the palaeochannel (Appendix B4, P 21, PER). This would have severe and permanent devastating impacts on Groundwater Dependent Ecosystems (GDE) along the Murchison River, aquatic life that find refuge in the permanent and semi-permanent pools (all of which are sustained by groundwater from the palaeochannel sediments), the avifauna that relies on the aquatic ecosystems and all other mammals and reptiles that rely on permanent and semi-permanent waterholes along the Murchison River.</p> <p>The concept of sustainable yield in inland areas, including the Northern Perth Basin, has really only been brought about in South Western Australia by widespread land clearing. It is reasonable to assume that prior to clearing there was groundwater equilibrium such that net recharge was balanced through discharge. In inland area groundwater discharge occurred by evapotranspiration (supporting GDE) or by discharge into and evaporation from semi-permanent and permanent surface water bodies. Widespread clearing for agriculture caused about a 10-fold increase in net recharge and corresponding rising groundwater levels. Rising groundwater led to widespread salinity in the wheatbelt (increasing areas of groundwater discharge) and the notion of a ‘sustainable yield’ from aquifers in the Perth Basin. The sustainable yield is the component of increased recharge that occurred following widespread clearing. It is the amount of groundwater that can be abstracted leaving groundwater levels essentially static as they presumable were prior to clearing.</p>
<p>PR1: 5</p>	<p>The reality is that the closest source of 37 GL/yr to the Jack Hills Expansion Project is Hamelin Pool in Shark Bay. There are two impediments to sourcing water from Hamelin Pool. The first is that it is in a World Heritage Area but there is sufficient precedent to give confidence that could be easily overcome (e.g. Kakadu). The major impediment is that the waters of Hamelin Pool are hyper-saline because of the high evaporative rates and restricted circulation.</p> <p>The next closest source and only identifiable sustainable source is the Indian Ocean at Tamala Station. An additional westward spur from the</p>

	<p>Dampier to Bunbury Natural Gas Pipeline (DBNGP) could supply gas for a power station to drive a desalination plant on a scale similar to the desalination plant recently built south of Perth (45 GL/yr). It would then seem expedient to lay an additional slurry pipe with the water supply pipe from the coast at Tamala Station to the Jack Hills Expansion Project to bring the ore to the coast as slurry. The Zuytdorp Cliffs are no more exposed than the coast at Oakajee and a deep water port at Tamala Station would be no more challenging to build than the proposed port at Oakajee. The slurry pipe could be extended through the proposed services corridor to the proposed Weld Range Iron Ore Project to also bring that ore to a new deep water port at Tamala Station.</p>
<p>CRL Response</p>	<p>The JHEP requires water for processing, the camp, dust suppression, waste water treatment and potable water. CRL were initially considering various options for the processing plant, with total water requirements of 45 GL/annum based on a four module case and 37 GL/annum based on a three module case (refer to Aquaterra, 2010; Appendix B). Feasibility studies have confirmed that a three module processing plant will be optimal for the JHEP. A basic water balance is shown in Figure 5, Appendix A. Specific water requirements and qualities are dependent on the processing plant design, which is dependent on metallurgy assessments. Completion of the metallurgy assessments will then inform detailed processing plant design.</p> <p>Design of the JHEP, including considerations for the processing plant, is ensuring consideration of water minimisation, conservation and recycling. Discussions with SMC, regarding the feasibility of taking water to Jack Hills is underway, however, there is no certainty on the availability and supply of this water at this point in time (EPA 4). A water efficiency conservation plan and dynamic water balance is underway. The reported 37 GL/annum represents the upper limit of water requirements. Upon completion of the processing plant design, CRL expects that less water will be required. CRL will continue to assess different water sources in consultation with DoW and DEC as a value adding exercise for BFS. The required approvals will be sought for areas that have not been the subject of this formal EIA process. (DoW 2; EPA 4; PR 1, 2, 3, 4)</p> <p>CRL appreciates the input and ideas of alternative water sources. CRL has commissioned a competent and reputable suite of experts in these fields to identify water and power sources for the JHEP. CRL has identified resources required for the JHEP and specifically, are in the process of refining the feasibility of the identified water sources. (PR 1: 5)</p> <p>The approximate location of the two proposed borefields is provided at Figure 6 and Figure 7 (Appendix A) (EPA 4). These figures show the water source area being investigated; the current exploration program will identify the final location of bores. Once bores sites are confirmed the associated infrastructure, such as access tracks, pipelines and power supply, will be designed. Based on initial estimates a maximum disturbance of 600 ha and 325 ha within the Byro and Murchison borefield extents, respectively.</p>

The final location of the borefields and abstraction volumes is subject to further studies and discussions with DoW and other stakeholders, including pastoralists. A preliminary assessment report has recently been completed for the Murchison palaeochannel (Aquaterra 2010; Appendix B) **(EPA 5)**. The pastoralists' requirements for water will be the subject of ongoing consultation between the proponent and the pastoralist. CRL is committed to engaging all stakeholders in these discussions, and reaching acceptable outcomes. **(EPA 4)**

Desktop studies for Byro (Global Groundwater, 2010) provide an estimate of total maximum stock water extraction based on the Department of Agriculture and Food Western Australia (DAFWA) station country carrying capacity and animal consumption data. The volume drawn for stock is minuscule in comparison to the aquifer storage. There are numerous stock bores with uncertain location details, many of which have been disused for many years and are unserviceable. This will form part of the report on the exploration and in conjunction with the groundwater model, potential impacts will be discussed where they appear likely and significant in terms of stock supplies. **(EPA 4)**

CRL are currently undertaking exploration programs and further assessments on baseline environmental conditions. CRL has been working closely with DoW and have entered into discussions with DEC and the WA Museum to define the scope for exploration/assessments, including stygofauna (discussed in further detail in Section 5.3). These studies are an integral component of the Licence to Take Water (5C) application process **(DoW 3; DEC 12; PR 1, 2, 3, 4)**. This application also requires the preparation of a number of supporting documents including:

- Public Consultation Plan;
- Hydrology Report (Level 3);
- Staged development timetable;
- Water conservation/efficiency plan;
- Groundwater dependent ecosystem studies;
- Groundwater Operating Strategy;
- Heritage Agreement to construct; and
- Miscellaneous Licences.

The current exploration program aims continue modelling aquifer storage and refining potential for impacts of the proposed draw on the aquifer. The predicted aquifer response will then be refined to ensure potential environmental impacts are acceptable. These studies will identify the amount of water that can be abstracted without causing unacceptable impacts.

CRL recognises that aquifers are never 'proven' in terms of capacity. Monitoring and assessment over a long period of pumping and recharge is

	<p>required to determine if aquifer behaviour when stressed matches predictions provided in hydrological models. The scope of the groundwater investigations has been developed in consultation with DoW, and is currently underway. In the PER, information was provided on the potential risks and mitigation measures where outlined that include:</p> <ul style="list-style-type: none"> • setting a drawdown limit of not greater than 3.5 m from current depth to water – this has been shown in previous studies to enable GDE to adapt to the drawdown; • monitoring impacts to GDE and groundwater depth and quality; and • contingency plans should impacts be identified, including reducing the amount of abstraction. <p>These requirements will be further developed and assessed by the DoW as part of the Groundwater Operating Strategy which will be developed in consultation with the DEC and DoW. (DEC 12; PR 1, 2, 3, 4)</p> <p>Overall, CRL needs a high level of confidence that the water will be there over the life of the mine and is sustainable: water abstraction will not result in unacceptable impacts to the environment, community or mining operation. CRL and its consultants are working towards providing this level of confidence in consultation with DoW, DEC and relevant pastoralists. DoW will require this level of confidence prior to issuing 5C licenses.</p>
	Murchison Borefield
EPA 7	Section 9.6.4.1 page 141 states that calcrete aquifers are commonly 5-20 thick and often separated from the deeper Murchison Palaeochannel by an aquitard. Noting that CRL proposes to access some 40km of this to tap water, what data (such as geophysics/drilling) are there to support this assertion ie how many drill holes tested this and are they sited representatively along the 40km length?
EPA 8	Drawdown at Kalamunda Pool is estimated to be about 0.8m. What is the potential impact of this? What is the average depth of the pool? How much smaller would it become if it were 0.8m shallower? Could other pools be affected? What are the particular conservation values that would be affected?
EPA 10	Aquaterra has pointed to several uncertainties in its assessment. It recommended a scope of work to address these, including drilling on the plain to the north of the orebody to establish the boundary between the granite and the palaeochannel, as well as aquifer testing. What is the proposed contingency plan if this proves to be the case? Has the situation been subsequently clarified, either with drill or geophysical survey data?
PR1: 3	Aquaterra conclude that "Significant uncertainty remains on the areal extent of the aquifer systems and their lateral and vertical variability (P 24, Appendix B4, PER). One thing is certain, abstraction of groundwater from Murchison Palaeochannel aquifers beyond that required for pastoral activities (stock and domestic supplies) is unsustainable and will severely impact GDE. As noted by Aquaterra on page 16 of Appendix B4, the long term average annual rainfall is only 237 mm per year. The assumption that recharge is 0.5% of annual average rainfall (Appendix B4, P 16, PER) may seem conservative but in reality is probably an overestimate. It is more likely that the recharge threshold is not reached on most years and that episodic recharge only occurs after sustained wet conditions following sustained rainfall. Flash flooding events from heavy thunderstorms often

	contributes very little recharge as runoff dissipates before significant infiltration into the profile and buildup of excess soil moisture leads to deep drainage recharge.
CRL Response	<p>To date a number of groundwater investigations have been undertaken to characterise the alluvial palaeochannel aquifer systems in Areas 1A and 1B:</p> <ul style="list-style-type: none"> • In 2008/2009 airborne electromagnetic surveys (5 km line-spacing) were completed in Area 1A. • Drilling of 15 exploration holes and five test production holes in Area 1A (2008/9). • Test pumping of four production bores in Areas 1A (2010). • 160 km of hi-resolution gravity profiling in Area 1A in order to more clearly define the alluvial palaeochannel – bedrock profile (2010). • Drilling of additional 12 exploration holes and four test production bores in the western portion of Area 1A to further investigate the thickness, extent and yield potential of the shallow ‘calcrete’ aquifer. Test pumping will be carried out on the four production bores. • Airborne electromagnetic surveys (5 km line-spacing) of the palaeo drainage system of the Murchison, Yalgar and Hope Rivers in areas 1B and 1C (2009). • Drilling of 17 exploration and four test production bores in alluvial palaeochannel aquifer system in Area 1B (2010). • Step-drawdown and 72 hr constant discharge and recovery testing of three production bores in Area 1B (2010). <p>Aquaterra have provided a preliminary assessment report (Appendix B) that summarises their findings to date. The accuracy of the model (presented to EPA under the formal EIA assessment process or at a later stage to DoW under the 5C application assessment process) can only be determined by actually abstracting water over the long term, and monitoring and measuring the performance of the aquifer to ensure the sustainability of the water source. CRL suggests outcomes based conditions relating to the sustainability of the borefields, ensuring impacts to GDE’s, permanent water pools, and pastoral bores are at an acceptable level. The measures by which CRL achieves this outcome will be determined as a component of the Groundwater Operating Strategy (in consultation with DoW and DEC). (EPA 7, EPA 8, EPA 10, PR 1: 3)</p>
Byro Borefield	
EPA 11	Appendix B5 recognises that GDEs are likely to exist in the Byro Sub-basin and that the work remains to be done to describe their values and the potential impacts to them from water extraction.
DoW: 3	Section 9.6.3.2 of the PER discusses water availability in the Carnarvon basin. The aquifer CRL will be investigation in the Zuytdorp/Ningaloo subarea is not presently over allocated, but is highly requested; meaning that several applications for water are currently being assessed. As discussed in the PER, allocation limits for aquifers may be increased if groundwater investigations show water is available.
PR1: 4	There has not been widespread land use changes in the Murchison District of the Mid West or over aquifers of the Carnarvon Basin and its is

	<p>reasonable to assume that the historical long term water balance has not changed significantly. Therefore there is no meaningful or significant sustainable yield available from Murchison Palaeochannel aquifers or sedimentary aquifers of the Carnarvon Basin (clearly the Gascoyne River and associated river bed aquifer operate somewhat differently to this, for a start it is in close proximity to the coast and there is a component of groundwater through flow that would otherwise be lost to the ocean if not harvested). The groundwater consultants engaged by Crosslands Resources Ltd, to their credit (and they are both respected credible consultants), never pretend that sustainable yields are available from the Murchison palaeochannel aquifers or sedimentary aquifers of the Carnarvon Basin (Appendix B4 and Appendix B5, PER).</p> <p>The proponent is seeking to obtain most of their water requirements from the Byro Sub-basin of the southern Carnarvon Basin (Appendix B5, P 1, PER). The information provided is woefully inadequate to assess environmental impacts. The groundwater consultants engaged by Crosslands Resources Ltd provide a desk top review but state that “No detailed groundwater investigations to locate large resources of groundwater are known to have been conducted in the Byro Sub-basin and corresponding there is a paucity of groundwater data for the area” (P 7, Appendix B5, PER). No amount of speculation or crystal ball gazing can make up for this information void. Because water resources are critical component of this proposal and the volume of water required is going to have significant impacts if sources from the arid environment proposed, this PER should be suspended until the groundwater exploration program has been successfully completed.</p> <p>The desk top review undertaken by Global Groundwater provides no certainty, nor cause for optimism, that the sought after water resources will be available from the Byro Sub-basin. Global Groundwater only present data from two bores in the Byro Sub-basin and both were tested at less than 100 m³/day (Appendix B5, pg 24, PER). IN the very next paragraph they calculate that each bore in a nominal borefield would need to produce 4320 m³/day. They then bravely conclude that anticipated bore yields might be “higher than 1000 m3/day” (P 24, Appendix B5 PER). The reality is that bore yields are likely to fall far short of what is required, groundwater quality is likely to be poor and drawdown impacts are likely to seriously affect GDE. Until sources of water for the project are identified and proven and a calibrated groundwater model is built the proposal is little more than speculation. In the absence of this critical data and information Public environmental review is farce. The relevant data needs to be acquired, interpreted and presented to the public for review reinforcing my call that this current PER be suspended pending acquisition and presentation of critically important information to enable appropriate and proper public review of the assessment of environmental impacts.</p>
<p>CRL Response</p>	<p>CRL are investigating aquifers in the Talisker Mia Mia Groundwater Sub-area, closer to the Jack Hills Mine as a primary target. Our desktop study indicated that exploration in the Zuytdorp/Ningaloo Groundwater Sub-area further west is an option for consideration if the aquifers in the Talisker Mia Mia Groundwater Sub-area prove inadequate. The preliminary information we are obtaining from the exploration of the aquifers in the Byro Sub-basin within the Talisker Mia Mia Groundwater Sub-area is encouraging. (DoW 3; PR 1: 4)</p>

	<p>Page 24 of the Global Groundwater Report (2010) states the two bores were tested at rates of 737 and 837m³/day. The respondent may be confused on this point between bore discharge rates (as indicated) and the thickness of sandstone sections (indicated as in excess of 100 m). The desktop study actually states that "bore capacities from thicker sections [of sandstone] intersected would be substantially higher than 1000 m³/day and may approach the target yields, although the upper limit is not yet known." (PR 1: 4)</p> <p>Global Groundwater are currently undertaking works at Byro, and their preliminary results show:</p> <ul style="list-style-type: none"> • Test pumping has been concluded on one bore and indicates that the site will have a capacity of up to approximately 2600 m³/day. • Constant rate tests have commenced on another bore at a discharge rate of 5789 m³/day. • The third bore was airlifting at a rate possibly in excess of 3456 m³/day during development. <p>Groundwater quality was expected to be poor and testing by Global Groundwater shows a variable range in salinity within bores that have undergone pump testing, with ranges from approximately 3000 to 12,000 ppm. Higher and lower salinity groundwater also exists in the Byro Sub-basin. (PR 1: 4)</p> <p>CRL's consultants have not identified groundwater dependent vegetation in the Byro Sub-basin area, most likely due to the depth of the aquifer that is being targeted. CRL has not sampled for stygofauna at this point in time but is scheduled to begin sampling in 2011. Regardless of the potential presence of stygofauna, the size of the aquifer and the fact that water has not been allocated to users at this time, suggests that the impact of abstraction of the borefield will be minimal (1% assuming no recharge, Global Groundwater 2010, PER 2010). On-going investigations will improve the model but as stated previously, the accuracy of the model can only be measured by abstracting water over the long term. CRL commits to undertaking stygofauna investigations but given the low impact on the aquifer it is unlikely to value-add to the program other than providing data to the WA Museums database. (EPA 11)</p>
Pit Dewatering	
EPA 9	<p>To what extent has the boundary between the orebody rock sequence and the Murchison Palaeochannel been characterised? There is a statement that the boundary between the Upper and Lower aquifers is likely to be leaky. Aquaterra notes that a hydraulic connection could also exist between the palaeochannel aquifer and the greenstone belt. It is important to establish how much water might be drained from the palaeochannel and into the pit once dewatering is commenced as significant environmental implications arise for GDEs.</p>
DoW: 1	<p>Preliminary investigations indicate that pit dewatering will not affect other groundwater users and create minimal impacts to groundwater dependent ecosystems. However, these outcomes are based on the assumption that a hydrogeological boundary existing between the fractured rock and Murchison paleochannel aquifers. Should this boundary not exist, dewatering may include groundwater flow from the Murchison paleochannel aquifer where impacts are more likely. CRL have proposed a monitoring program designed to detect flow from the paleochannel aquifer, and a</p>

	mitigation strategy of re-injecting water. The environmental trigger levels that would initiate this contingency plan are yet to be set, but would be a requirement of a Section 5C licence for pit dewatering.
CRL Response	<p>A hydrogeological investigation has focused on determining the dewatering strategies for the expansion of the Jack Hills mine. The work consisted of drilling and performing airlift recovery tests of boreholes to determine the hydraulic properties of the intersected lithological units. SRK are in the process of analysing the collected information and developing conceptual and numerical modelling. Currently, similar investigations are being carried out by other consultants in the areas where the tailings facilities are proposed and in the palaeochannel where water supply boreholes are proposed.</p> <p>Based on the drilling that has been done in the area of the proposed mine, results indicate that there is limited connectivity between the fractured rock aquifer present in the Jack Hills ridge and the Murchison palaeochannel. Immediately north of the ridge, a granitic basement outcrop is present at shallow depths and appears to provide a barrier for the flow between the two aquifers. Current investigations conducted by Aquaterra will be able to confirm this, once completed. The presence of this rock provides a barrier that will reduce, and in places, will eliminate the flow between the two aquifers.</p> <p>Furthermore, the work conducted in the Jack Hills ridge indicates that water is present in the ridge in fractured zones of Banded Iron Formation (BIF) or zones associated with BIF/schists contacts. In all cases, water production was limited. Preliminary assessment indicates that dewatering of the fractured aquifer using extraction boreholes will not be feasible.</p> <p>In summary, the low connectivity between the aquifers and the apparent lack of dewatering activities by pumping will result in a minimum or negligible impact to the Murchison palaeochannel due to mine dewatering activities (SRK, 2010; Appendix B). (EPA 9; DoW 1)</p>
	Monitoring
EPA 6	The CEMP/OEMP indicates that monitoring of riparian areas will occur adjacent to the IWF and downstream. What about the 64km drawdown strip from the borefield in the Murchison Palaeochannel? Is this all downstream of the minesite? If it's upstream, then monitoring of any potentially affected riparian areas should also occur. Has there been an assessment of how much potentially affected vegetation is phreatophytic?
CRL Response	A vegetation monitoring strategy (Cardno 2010) has been prepared (see Appendix B). The strategy doesn't include the entire 64 km length of the Murchison borefield, but will be updated to include this area once the location of bores and drawdown extents are confirmed. Early hydrological modelling shows potential drawdown impact to be localised, although this is dependent on the amount to be allocated by the DoW. Workshops involving DoW, DEC and consultants will identify a more specific monitoring program and contingency plan as a component of the 5C licence application process and will be captured in the Groundwater Operating Strategy (a document required for the 5C application assessment). (EPA 6)

5.3 STYGOFAUNA

Item Number	Comment
EPA: 12	The OEMP discusses minimising impacts to stygofauna but there is no mention of triggers being put in place for contingency plans if water levels fall to critical levels-either for stygofauna or phreatophytic vegetation. This needs to be a part of your management strategy.
CRL Response	The OEMP will be amended to include trigger levels. The monitoring methods, trigger levels and contingency plans will be further developed as part of the Groundwater Operating Strategy for the 5C licence application assessment and upon finalisation of hydrological modelling. The PER (section 9.6.4.2) provided information on the proposed monitoring and contingency measures, should adverse impact be identified. The PER stated that “if a lowered water table trend is detected in two subsequent events from any area of the monitoring bore network that has the potential to impact upon any of the environmental trigger levels, actions will be initiated at an early stage to counteract any impacts. This may be in the form of reduced abstraction rates from individual bores until local water levels increase sufficiently. Additional water will be obtained from the Byro Borefield to reduce the requirements for abstraction from the 1A, 1B, and 1C Borefield.” (EPA 12)
EPA: 13	How reliable were the stygofauna surveys: (how many bores were sampled; how long were the bores left before sampling was carried out; were they cased or uncased? What was the diameter of the bores? Has the DEC done independent stygofauna sampling in this area?
CRL Response	Stygofauna surveys were conducted with regards to EPA Guidance statement 54a (2007). Bores in Area 1A were greater than six months old before stygofauna sampling commenced. Bores were 50 mm to 150 mm in diameter and were cased. Additional stygofauna sampling has been undertaken by the Western Australian Museum in the area. (EPA 13)
EPA 14	Need to be particularly careful about this because research from WA Museum has shown that, unlike the Pilbara, there are distinctive short range endemic stygofauna (swimming beetles) associated with each aquifer in the Yilgarn. Therefore may be potential for ground water abstraction to cause extinction of species. Critical to get advice from DEC and Bill Humphreys (WA Museum) as to whether stygofauna sampling has been adequate.
CRL Response	The proponent is well aware of the potential for SRE Dytiscidae species being present within calcrete aquifers. These have been recorded from a single calcrete aquifer located near Mt Gould. This is outside of any drawdown impacts. Stygofauna sampling is ongoing and comment has been sought from Dr Bill Humphreys regarding the stygofauna sampling program. Stygofauna surveys were conducted with regards to EPA Guidance Statement 54a (2007). (EPA 14)
EPA: 15	The PER mentions that one species of stygofauna (an undescribed amphipod) has been found within the drawdown area. It is unclear whether it is also found outside the drawdown area. The survey report says that “modelling of potential drawdown impacts will enable firm recommendations regarding potential drawdown impacts on stygofaunal communities. When these data become available, additional surveys for stygofauna will be undertaken. Has the modelling been done? Have the further surveys been done? Stygofauna surveys for all drawdown areas need to be

	completed and reported on. If not it is impossible to complete the EPA assessment for this factor. If stygofauna surveys for the Byro Sub-basin borefield are deemed not necessary it will be important to provide a fully backed-up explanation from DEC and/or the WA Museum.
CRL Response	<p>Additional stygofauna sampling within Borefield 1A, 1B, and regionally has been undertaken, and is ongoing. This is being undertaken in conjunction with additional drilling in the borefields.</p> <p>Byro Sub-basin: There are currently no known stygofauna communities identified in confined artesian aquifers in Australia as yet (Dr Bill Humphreys WAM pers. Comm. Nov 2010), however, such communities have been identified in America and Morocco. The risk of impacts to stygofauna (if present) will be low as water levels are not expected to be lowered significantly within the artesian aquifer. The precise impacts will be known when current groundwater exploration programs are complete.</p> <p>Extraction from this aquifer is unlikely to impact any perched aquifers above it due to the positive pressure exerted on them from the artesian system below. Initial risk assessments found a low likelihood of impacts to stygofauna. However, surveys for stygofauna in Byro are planned to commence in early 2011 following the drilling of water exploration bores in August to October 2010. These reports will be provided in the supporting documentation required for the 5C licence application. (EPA 15)</p>

5.4 SURFACE WATER

Item Number	Comment
	Drainage Design
EPA 17	It is noted that the proposed waste dump projects into the floodplain of the Murchison River (Golder and Associates Figure 6). While the toe of the dump is to be armoured to prevent its erosion, what is to prevent the surrounding floodplain alluvials from being scoured where floodwaters are diverted?
EPA 19	Borrow pits for gravel etc should be designed to ensure that water does not pond in them. Please confirm that this would be a part of your surface water management.
DMP: 3	Section 5.11.1, p43 Noted that the IWL is planned to be rock armoured for rainfall events up to PMP calculated. However this is not mentioned in the Golder and Associated preliminary surface water management report attached in the appendices.
DMP: 6	Section 5.13.3

	The nature of the provision for site drainage shown on figure 5.3 is not explained. What is the nature of those structures? Are the required water management structures of a permanent nature?
DMP: 21	Golder and Associates Preliminary surface water assessment. Section 9.5 p 32 This section does not address the rock armouring and specification for the flood protection of the proposed IWL.
DMP: 20	Golder and Associates Preliminary surface water assessment. Section 9.5 p 32 There is no rationale to explain the choice of “approximately 500m spacing” of environmental culverts to be installed in areas identified as being sensitive to sheet flow.
CRL Response	<p>Sediment ponds will be incorporated into the design of diversion channels around the perimeter of the Integrated Waste Landform (IWL) to reduce the potential for concentrated sediment loading from drainage. The sediment pond design is discussed in Section 7.4 of Golder’s Report “Preliminary Surface Water Assessment”, dated December 2009.</p> <p>With reference to the floodplain around the IWL, the hydraulic modelling presented in Golder’s report estimates surface water velocities of 0.5 to 1 m/s for the 20, 50 and 100 year Average Recurrence Interval (ARI) flood events. These flow velocities are consistent with those that would already be experienced on the floodplain for the same flood events, prior to the construction of the IWL.</p> <p>Geotechnical investigations carried out in support of the Bankable Feasibility Study (BFS) suggest that the surface soils on the flood plain in the vicinity of the IWL comprise mainly fine to coarse sand, silty sand and sandy silt. Smedema and Rycroft (1983) suggest clear water mobilisation velocities for silt of 0.6 to 0.7 m/s and fine sand of 0.45 m/s. It is therefore expected that there will be some mobilisation of alluvial floodplain soils in the vicinity of the IWL for the 20, 50 and 100 year ARI flood events.</p> <p>Inspection of the floodplain suggests that the mobilisation of alluvial sediments already occurs during flood events. The floodplain shows evidence of channelised erosion and the deposition of sediments in the vicinity of the proposed IWL. Sediments on the floodplain are expected to become mobile during major flooding events. Erosion is expected to be reduced in areas of the floodplain that are more densely vegetated or contain well graded soils and gravels.</p> <p>There is no evidence to suggest that the current IWL design will significantly impact erosion of the adjacent floodplain. Erosion is most likely to occur where flows are channelised, and this will be addressed during operation through monitoring, maintenance and the construction of sediment management ponds. Where areas of excessive erosion are observed during operation, engineering control measures will be put in place to reduce the potential for erosion and sediment accumulation. (EPA 17)</p>

The preliminary surface water management plan dealt primarily with operational landforms. Flood events greater than the 100 year ARI event were not modelled as part of the scope of work for the preliminary surface water management report. Further modelling will be undertaken to address potential flow velocities following a Probable Maximum Precipitation (PMP) event for the purpose of designing the post closure landforms. Notwithstanding this, Golder's report notes that "Facing Class rock protection with a section thickness of 0.5 m can withstand velocities of up to 2.6 m/s". This is more than 2.6 times the approximate 1 m/s velocities predicted by modelling for the 100 year ARI flood event. Facing Class rock protection has a maximum particle size of 0.4 m. Waste rock produced by the mine is expected to contain hard rock fragments larger than 1.0 m diameter and will be placed several metres thick. On this basis, the mining operations are expected to provide suitable materials for armouring the IWL against flows from the PMP event. **(DMP 3)**

As a result of the new location of the IWL and associated infrastructure, CRL has commissioned another surface water assessment. It is expected that the distance from the Murchison River will improve surface water management during flood events. The OPR rail line surrounds most of the IWL and will form a barrier between the Murchison River and the IWL. Additional rock armouring will be required around other infrastructure including topsoil stockpiles, airstrip and processing plant. This will be designed for rainfall events up to calculated PMP (DMP 3; DMP 21). Roads will likely require culverts in areas where natural drainage lines exist. The Mining Proposal also requires detailed drawings showing site drainage.

The 500 m spacing is a preliminary estimate based on qualitative assessment of the expected flow velocities, natural topography and site inspection. It is not intended to replace rigorous engineering design of the drainage structures for the access roads. The actual spacing of culverts or floodways will vary across the site, depending on the local site conditions and the alignment of linear structures such as access roads, rail and pipeline corridors. Detailed design of the drainage structures will take account of the local surface gradients, catchment areas, culvert flow velocities, soil conditions, vegetation density and frequency of the naturally occurring drainage pathways. **(DMP 20)**

Section 9.5 of the preliminary surface water management plan is not intended to specifically address each of the proposed engineered structures. Rather, it is intended to provide guidelines that will apply to all surface water management at the site. Notwithstanding this, the IWL (referred to in this document as the Tailings Storage Facility or TSF) is mentioned on several occasions in Section 9.5 of the report. Rock armouring of the TSF is addressed specifically earlier in the report. **(DMP 21)**

The surrounding floodplain is usually inundated with water as the Murchison swells and water levels increase in the surrounding area. Protection of infrastructure will more likely be an issue. The IWL slopes will be designed to have drainage lines of similar size and frequency to the Jack Hills

	<p>Range. (EPA 17)</p> <p>Site drainage structures will likely be culverts or redirected drainage channels. (DMP 6)</p> <p>Borrow pits will be designed to ensure that ponding is minimal. This will be included in the construction environmental management plan. (EPA 19)</p>
	Sheet Flow
EPA 18	Are there Mulga groves on the plains that would be crossed by the infrastructure routes? If so, please describe what methods would be used to ensure surface drainage patterns are not disrupted in their vicinity. There were some rare flora at the foot of the range which were a consideration in the selection of the road route with Stage 1. Does the proposed diversion of floodwaters to the north and south of the airstrip affect sensitive areas of vegetation?
EPA 20	Appendix B2 (Golder Assoc Tech Memo), with reference to the proposed gas pipeline, mentions Figure A, which is supposed to show areas of sheetflow potential. This figure is missing from the report. Please provide the figure.
CRL Response	<p>Linear infrastructure (i.e. pipelines) will likely be buried unless design criteria are able to address impacts to environment, heritage and pastoral activities. If detailed design identifies aboveground infrastructure, then CRL will consult with OEPA, DEC and DMP to ensure potential to impact the environment has been addressed. Current roads (e.g. access road from Stage 1) will be used and maintained at the same levels as the surrounds except within the mine site footprint where movement of large haul trucks will require roads built to certain specifications and likely to be raised for access to pit and the IWL. These areas have been included within the disturbance footprint. (EPA 18)</p> <p>Figure A of the Golder and Associates Technical Memo is included in Appendix A. (EPA 20)</p>

5.5 INDIGENOUS HERITAGE

Item Number	Comment
EPA 21	During the site visit for the Stage 1 assessment, the EPA members noticed a prominent rock overhang near the camp and asked for a condition to be added so that this would be protected because it may have archaeological values. Will it continue to be protected with the new stage 2 project? Would the Mt Hale site be preserved? Has a survey been conducted to determine if there are other such features
EPA 22	There is little detail on what would be lost, with regard to aboriginal sites. The data presented in the PER leave some areas incompletely addressed.
EPA 23	p104 mentions that an agreement between CRL and the native title parties had provision for a review before August 2010. Was this done and were

	there any significant changes to the agreement relevant to this assessment?
EPA 24	p104-5 suggests that much consultation remains to be done with native title parties, not only over the main mine area but in the Byro Sub-basin borefield (also Appendix B5-Global Groundwater) and along the pipeline and service corridors. What progress has been made on this? What has been the outcome of discussions with relevant indigenous groups?
EPA 25	As the heritage surveys have not yet been completed it will be impossible for EPA to complete an assessment of this factor.
Indigenous Heritage: H1	The document contains a map of the Project Layout (Figure 5.3 at p33) from which it was possible to ascertain that there are four registered sites within the expansion area footprint, one of which, 25560, is on the permanent register. The sites are 23111 (Mt Hale Artefact Scatter), 25560 (Gudgeemia), 27572 (Rockshelter Three), and 27617 (GRMH – ISO – 01). Details about those sites are attached. However, there was not a map of sufficient scale provided of the corridor areas. Therefore it is not possible to provide advice on sites within those areas. Further sites may be encountered in the process of undertaking Aboriginal heritage surveys.
Indigenous Heritage: H4	It is apparent from the PER that some heritage surveys have already taken place. The PER would benefit from a map showing which areas have been surveyed and which remain to be surveyed.
Indigenous Heritage: H3	Some areas that will be impacted relate to watercourses or places of spiritual significance (p156). Sites may be affected by changes to water flows through the area, and site such as waterholes are affected by dewatering. It is important to consider the impacts to heritage of these kinds of changes.
Indigenous Heritage: H2	The PER states that there are several registered sites within the entire project footprint including site 24132, a relocated scatter site which has been fenced off so that there is no access to it. It also states that Sites 2413 and 25560 will be impacted and that the proponents will obtain s18 approval if required prior to disturbance (p156). Another comment elsewhere in the PER is that in the event that agreement cannot be reached with Traditional Owners, a s18 approval will be obtained (p14). Also it is stated that if an unknown site is to be disturbed, an anthropological and archaeological survey should be taken to determine acceptable management strategy (p104). It is highly recommended in any of the above circumstances that if the proponent wishes to avoid prosecution under the Aboriginal Heritage Act 1972 that s18 approval be obtained if Aboriginal heritage sites are to be impacted.
Indigenous Heritage: H5	It is stated that the Native Title parties are the Wajarri Yamatji and the Malgana Shark Bay. The proponents apparently have a Mining Agreement and Cultural Heritage Management Plan with the Wajarri Yamatji Native Title party which has 2 local groups: the Ngoonooru Wadjari and Wajarri elders. The Gas pipeline corridor from Dampier to the Bunbury Natural Gas Pipeline to Jack Hills will require consultation with both native title parties. The Malgana Shark Bay group are the relevant Traditional Owners of the first 50 km of the pipeline corridor. It might be advisable for the proponents to also form an agreement and Cultural Heritage Management Plan with the Malgana Shark Bay people.
Indigenous Heritage: H6	It is noted with approval that the proponents report that they provided assistance to establish a heritage consultation business and will look for opportunities for long term sustainable employment for Aboriginal people (p184). It is also noted with approval that the Geraldton Iron Ore Alliance,

	<p>which contain a number of companies with iron ore deposits in the Pilbara including the proponents has a subcommittee for heritage which works on sharing information to improve indigenous heritage and community projects. Their prerogatives apparently include entering consultation with indigenous organisations at the earliest opportunity and working with State governments (p185).</p>
<p>Indigenous Heritage: H7</p>	<p>It is stated on p180 that the proponents have met with the Malgana Shark Bay people. However, this is not reflected in the list of people consulted at p192. This consultation list could also be improved by including the dates of meeting with the groups (the month and year).</p>
<p>CRL Response</p>	<p>All areas within the JHEP footprint that require ground disturbance, mining and exploration activity have been and will be subject to full and comprehensive heritage surveys. The Survey team comprises of eight (8) traditional owners, independent archaeologist and anthropologist and CRL staff members. As per the Heritage Management Protocol the Traditional Owners will determine a management strategy in accordance with the Aboriginal Heritage Act 1972 (WA). Figure 8 (Appendix A) shows the extent of heritage surveyed areas completed to date. (EPA 22, H1, H4, H5)</p> <p>Rock overhangs are a component of the JHEP footprint. They are of value to the Wajarri Yamatji Aboriginal group and Section 18 applications will be required. CRL is seeking consent from the native title group to take these sites. (EPA 21)</p> <p>CRL activities in relation to heritage are covered by a Mining Agreement, which includes Heritage Management Protocols. There is currently a Mining Agreement review underway, which will address any concerns the Native Title parties may have and importantly address the management of the Mount Hale registered site. (EPA 23, H5)</p> <p>Negotiation and consultation regarding the extent and potential impact of current and future JHEP footprints on heritage issues including watercourses and places of spiritual significance are ongoing and continuing with the group. These include regular working group meetings, workshops, Heritage Clearances for all ground disturbance, full time Heritage monitors coverage on site and site visits with the traditional owners. (H3, H5)</p> <p>As part of the Mining Agreement review, CRL is exploring a range of commercial, employment and education opportunities for the local Aboriginal people. The proponent is an active participant and member of the Geraldton Iron Ore Alliance and the Mid-West Employment and Opportunities sub-committee. (H6)</p> <p>CRL has successfully negotiated a heritage agreement, which includes cultural heritage management protocol and procedures with The Malgana Claim Group. Relevant and appropriate heritage surveys are currently underway with the group for the proposed gas pipeline corridor, and cultural heritage monitors nominated by the group are also currently employed for all survey areas within the Malgana claim area (EPA 23, EPA 24, H5).</p>

	<p>No section 18 applications will be required for the proposed gas pipeline due to the flexibility in the planning of the corridor, which enable heritage sites to be avoided, and ongoing consultation with both claim groups. (EPA 24, H2)</p> <p>CRL has met with both the Wajarri Yamatji (WY) and Malgana Claim Groups on a number of occasions since August 2010 (H7), including:</p> <ul style="list-style-type: none"> • Malgana Working Group: 15 July 2010, Shark Bay. • WY Working Group: 10 August 2010, Geraldton. • Malgana Working Group: 27 August 2010, Shark Bay. • WY Native Title Party: 2 September 2010, Meekatharra. • WY Working Group: 30 September 2010, Meekatharra. • WY Working Group and YMAC Representatives: 12 October 2010, Meekatharra. • WY Working Group: 23 November 2010, Meekatharra.
YMAC: 1	<p>1. Aboriginal heritage is a relevant environmental factor</p> <p>We submit that the Project expansion will cause serious or irreversible damage to registered Aboriginal heritage site ‘Gudgeemia’ (site ID: 25560) on tenement M20/506 (Mt Hale).</p> <p>EPA Guidance Statement No. 41 considers: ‘Aboriginal heritage’ as a relevant environmental factor in circumstances where heritage values are linked directly to the physical and biological attributes of the environment, and when the protection and management of those attributes are threatened as a result of the proposed development. Section 8.8 of the PER details information relating to Aboriginal Heritage and registered sites. The proponent has specified that it will not access the site without approval of the Native Title party. This represents the proponents understanding that Mt Hale generally and site ‘Gudgeemia’ (site ID: 25560) specifically is of great significance to the Native Title Party. This was recognised by the Department of Indigenous Affairs (“the DIA”) when the proponent sought a section 18 AHA consent over the site and was only granted a consent with the following conditions:</p> <ol style="list-style-type: none"> 1. No drilling within the area extending 50m from the centre of the two rocks at the registered site 25560; and 2. Two Wajarri Yamatji monitors be engaged on site during the proposed exploration program to ensure that drilling is kept away from the rocks. <p>We submit that this represents the recognised importance and significance of the registered site ‘Gudgeemia (site ID:25560) and that the PER has failed to identify and recognise the proponents knowledge and understanding, communicated during negotiations, that ‘Gudgeemia’ is of great</p>

	<p>significance.</p> <p>Further, it was agreed that registered site 'Mt Hale Artefact Scatter (Relocation Site)' (site ID:24132), that was relocated and fenced off close to 'Gudgeemia' with the knowledge and support of the proponent, was not going to be disturbed because of its great significance. Section 8.8 of the PER indicates that it was relocated to Mt Hale (closer to 'Gudgeemia') and fenced off to ensure no access to the area. This relocation took place as a result of surveys conducted with the proponent and on the basis of negotiations and representations made by the proponent and their understanding and recognition that 'Gudgeemia' is off limits.</p> <p>The lack of reference to 'Gudgeemia' and the impact of any damage or destruction to it is a significant flaw in the PER. We submit that the PER clearly shows that the proponent has the intention to cause serious and irreversible damage to heritage values that are linked directly to the physical and biological attributes of the environment. Diagrams of the pit expansion (such as Fig 5.3) clearly show that 'Gudgeemia' (site ID: 25560) will be destroyed. The impact of the damage and destruction of this significant registered heritage site is not considered in the PER.</p>
YMAC: 2	<p>2. Incorrect statements of fact</p> <p>Section 8.8.1 of the PER refers to 'Gudgeemia' (site ID: 25560) that "No access will be undertaken within this areas without authority of both traditional owners and the DIA. However the proponent also states that "Should avoidance not be possible, section 18 applications under the Aboriginal Heritage Act 1972 may be required". Clearly the proponent has committed to disturb or destroy an Aboriginal site. This further lends weight to our submission that the EPA should make specific conditions for the protection of Aboriginal Heritage.</p>
YMAC: 3	<p>3. Application of the precautionary principle relating to heritage</p> <p>We submit that the Project will cause serious and irreversible damage to Aboriginal sites where those sites are to be disturbed or destroyed pursuant to a section 18 application under the <i>Aboriginal Heritage Act 1972</i>. We also submit, as detailed in point 1, that there is currently a lack of scientific certainty in relation to those sites which are under threat.</p> <p>Accordingly, the EPA should not conclude that Aboriginal heritage is not a relevant environmental factor for the purpose of the Act. By applying the precautionary principle we submit that the EPA should conclude that Aboriginal heritage is a relevant factor and that specific conditions are necessary to manage its protection.</p>
YMAC: 4	<p>4. Project not clearly defined</p>

	<p>Section 8.8 of the PER described the Project area requiring a pipeline. The exact location is not defined and accordingly it is difficult to assess the proposal in any meaningful way. Section 5.12.7 of the PER states that the pipeline corridor will run from the DBNGP to the Jack Hills minesite (see Figure 5.5). It indicates that “once all pipelines are installed there will be minimal physical impact to the land”. It gives no consideration or references to the impact that it will have on Aboriginal heritage during installation or that it will deviate from where Aboriginal heritage constraints are encountered. Studies in relation to this have not occurred and are not included in the PER.</p> <p>Of particular concern to this organisation and its clients is the appropriate delineation and protection of Aboriginal heritage sites within the Project area. Whilst the PER advises that the proponent is committed to avoiding the disturbance of sites in the final design of the Project its advise to us would seem to indicate to the contrary. Rather the proponent has indicated that it may will seek approval under section 18 of the Aboriginal Heritage Act 1972 to disturb all sites within and possibly beyond the Project area whether they will be impacted upon or not. The proponent should be required to clarify its intentions in this regard.</p> <p>When ‘Gudgeemia’ (site ID: 25560) is inserted on diagrams that illustrate the boundaries of the pit expansion it clearly shows that ‘Gudgeemia’ (site ID: 25560) will fall within its boundaries and will be destroyed. This is not written in the PER and the impact of the damage and destruction of this significant registered heritage site is not identified or considered we submit that this renders the PER incomplete.</p>
YMAC: 5	<p>5. Inaccurate information</p> <p>Section 8.8.1 of the PER identifies registered heritage site ‘Gudgeemia’ (site ID: 25560) as being ‘recently’ registered. In our view the proponent should remove this word as it suggests that the sites are not of significance. We consider that a site registered in August 2008 not to be recently registered and suggest that it appears to make the following suggestions that the proponent knows otherwise to be false:</p> <ul style="list-style-type: none"> • That the site has only been recently registered; • That the site is not of significance; • That the site does not hold the great significance to the Native title party; and • That the site has been identified and registered as a site only because of exploration and mining interest. • We submit the PER document does not contain sufficient detail to enable meaningful consideration of the proposal.
YMAC: 6	<p>6. Cumulative Effect</p> <p>We note that there are a number of other proposals for the development or extension of iron ore operations in the Yamatji region. Each proposal brings with it its own requirements and demands which are subject to assessment in isolation under the EPA. However, the cumulative effect of</p>

	<p>development and its associated demands appears to receive little attention under the EPA assessment process. We submit that the cumulative effect of development on issues such as heritage sites and water is greater than the sum of that contemplated by individual assessments. Accordingly the DoE should require a thorough assessment of the cumulative effect of development by proponents.</p> <p>An example of our concern is the significant value of registered site 'Gudgeemia' (site ID: 25560) as it is linked directly to the physical and biological attributes of the environment. In this region sites have been disturbed and relocated. We submit that this site holds great significance to the Native Title Party and the cumulative impact of disturbing this site would be greater than the sum of all disturbance to date.</p> <p>Another example of our concern is demonstrated in Appendix B: Surface and Groundwater Assessment, advice would seem to indicate that further work is required to advance the mine water supply to a feasibility level. When seen in context with the water demands of other users in the region it is clear that both the individual and cumulative effect of such demand are highly relevant to the environmental assessment process. Accordingly we submit that water demands of the current proposal, and the cumulative effect of other users, should be assessed as part of the PER.</p>
YMAC: 7	<p>We submit that the PER does not contain sufficient detail to enable meaningful consideration of the proposal. Information that should have been included in the PER are either ongoing or yet to be undertaken. This does not reflect the intent of the PER assessment process under the Act. If the EPA is to assess the Project as currently presented we would seek binding conditions to ensure that additional information relating to the Project is made available for public scrutiny and comment and when it is submitted to the EPA. This might be achieved by a process of public consultation or by referring any additional information to the Environmental Protection Authority for formal assessment.</p>
CRL Response	<p>CRL has conducted extensive consultation with the Wajarri Yamati and Malgana about the expansion of the JHEP and management of Aboriginal heritage.</p> <p>All areas within the JHEP footprint that require ground disturbance, mining and exploration activity have been, and will be, subject to full and comprehensive heritage surveys.</p> <p>Heritage surveys are conducted in accordance with heritage agreements in place with the Malgana and Wajarri Yamatji People. The survey team comprises Wajarri Yamatji and Malgana People, an independent archaeologist and / or anthropologist and CRL staff members.</p> <p>Also, consultation with the Wajarri Yamatji and Malgana People pursuant to heritage agreements assists to determine Aboriginal heritage management strategies to ensure compliance with the Aboriginal Heritage Act 1972 (WA). Figure 9 (Appendix A) shows the extent of heritage surveyed areas completed to date.</p>

In addition to undertaking heritage surveys in accordance with heritage agreements, the Wajarri Yamatji and Malgana People are present on-site to monitor all ground disturbing works conducted by CRL.

During the course of negotiating heritage agreements for bore fields the Wajarri Yamatji and Malgana People were provided with information about proposed groundwater testing activities and potential water extraction processes associated with the JHEPs operation. CRL offered the Malgana and Wajarri Yamatji the opportunity to monitor groundwater testing processes. To date the Wajarri Yamatji and the Malgana have been involved in such monitoring.

Below is further detail in relation to consultation that has taken place with the Wajarri Yamatji and Malgana.

Wajarri Yamatji

CRL has a Mining Agreement in place with the Wajarri Yamatji dated 31 August 2005 that includes an Aboriginal Heritage Protocol. The Aboriginal Heritage Protocol enables surveys to be conducted in and around the mine site. The scope of the Aboriginal Heritage Protocol is being considered through the Mining Agreement review (see below about Mining Agreement review).

The Aboriginal Heritage Protocol sets out mechanisms for the conduct of heritage surveys and consultation that is to occur if any section 18 consent is required under the *Aboriginal Heritage Act 1972 (WA)* (AHA).

The Mining Agreement provides a mechanism for a review of its terms to be undertaken approximately five years following commencement of the Mining Agreement. CRL is currently undertaking review of the Mining Agreement with the Wajarri Yamatji, and their representative, the Yamatji Marlpa Aboriginal Corporation (YMAC).

During the mining agreement review process CRL has provided the Wajarri Yamatji with information about the expansion of the JHEP and consulted on Aboriginal heritage management. In particular, extensive consultation has taken place on matters relating to Mt Hale Site ID 25560 (Mt Hale) (see further information below).

In-principle heritage agreements are in place in relation to areas that fall outside of the parameters of the Mining Agreement for feasibility work associated with the proposed infrastructure corridor and proposed bore fields.

Given the scope to relocate any bore hole, in the event any Aboriginal heritage issue is identified, it is anticipated that no section 18 consent under the AHA will be required for any bore field. Further consultation will occur with the Wajarri Yamatji in the event a bore field is proposed to be constructed within their claim.

Also, given the alignment of the water / gas pipeline corridor is not fixed there is scope to potentially minimise or avoid any potential Aboriginal heritage issue that may be identified. To illustrate, during a recent heritage survey with the Wajarri Yamatji for the proposed water and gas pipeline corridor a significant area was identified. At CRL's request the Wajarri Yamatji identified an alternative alignment for the corridor so as to avoid any impact on the above area. Further consultation will take place in relation to any construction of the water / gas pipelines.

To date CRL has undertaken heritage surveys with the Wajarri Yamatji in relation to the proposed pipelines, bore fields and areas in and around the mine site, including the pit area. In addition, the Wajarri Yamatji have been and will be present on-site to monitor all ground disturbing works that are undertaken by CRL in relation to the Wajarri Yamatji claim area.

Set out below are meetings that have been convened in 2010 to discuss either the mining agreement review, Aboriginal heritage agreements for the proposed infrastructure corridor and proposed bore fields and Mt Hale, or combination of the same:

- WY Mining Agreement Review Team and YMAC 27 / 28 May 2010, Meekatharra;
- WY Working Group members: 10 August 2010, Geraldton.
- WY Mining Agreement Review Team and YMAC 23/24 August 2010, Meekatharra.
- WY Mining Agreement Review Team and YMAC: 30 September 2010, Meekatharra.
- WY Mining Agreement Review Team and YMAC: 12 October 2010, Meekatharra.
- WY Mining Agreement Review Team and YMAC: 23 November 2010, Meekatharra.

Malgana

Potentially bore fields and a section of the proposed water and gas pipeline corridor may be located within the Malgana claim.

CRL met with the Malgana Working Group on 4 June 2010 in Denham to discuss the JHEP and proposed bore fields and pipelines.

CRL has successfully negotiated a heritage agreement with the Malgana that includes mechanisms for the conduct of heritage surveys in relation to

the proposed infrastructure corridor and proposed bore fields. The heritage agreement also provides consultation mechanisms for any section 18 consent that may be required under the AHA.

Heritage surveys are currently underway with the Malgana for the proposed gas pipeline corridor. Heritage surveys have been completed in relation to the proposed bore field. Malgana people have been and will be present on-site to monitor all ground disturbing works that are undertaken by CRL in relation to the Malgana claim area.

It is anticipated that no section 18 consent under the AHA will be required for any bore field given the scope to relocate any bore hole if an Aboriginal heritage issue is identified. Further consultation will occur with the Wajarri Yamatji in the event a bore field is proposed to be constructed within their claim.

Also, given the alignment of the water / gas pipeline corridor is not fixed there is scope to potentially minimise or avoid any potential Aboriginal heritage issue that may be identified during the course of an Aboriginal heritage survey. Further consultation will take place in relation to any construction of the water / gas pipelines.

YMAC Comments

The YMAC has commented on Aboriginal heritage issues and, in particular, matters relating to Mt Hale. Set out below is CRL's response to YMAC's comments.

YMAC:1

Consultation about Mt Hale commenced in 2008 in relation to a section 18 consent under the AHA for exploration activities.

YMAC refers to the proponent seeking section 18 consent under the AHA over Mt Hale and was "only" granted a consent with the following conditions:

- No drilling within the area extending 50m from the centre of the two rocks at the registered site 25560; and
- Two Wajarri Yamatji monitors be engaged on site during the proposed exploration program to ensure that drilling is kept away from the rocks.

To clarify, CRL only sought consent in relation to exploration activities and the two conditions above were included as recommendations by CRL in the section 18 notice. Therefore, CRL did not seek undertake exploration activities within the area extending 50m from the centre of the two rocks at

the registered site 25560.

In December 2009, the Minister provided section 18 consent for CRL's exploration activities on Mt Hale. CRL then undertook exploration drilling on Mt Hale with Wajarri Yamatji monitors being present.

As indicated above, CRL is currently consulting with the Wajarri Yamatji about the JHEP. In particular, CRL is consulting with the Wajarri Yamatji about the potential impact on Mt Hale given it is located wholly within the area of the proposed mine pit.

YMAC say that the diagrams of the pit expansion clearly show that Mt Hale will be destroyed. We note that the extent of proposed mining activity within the area of Mt Hale is the subject of current consultation with the Wajarri Yamatji and such consultation has been ongoing since 24 August 2010.

YMAC:2

Consultation is ongoing with the Wajarri Yamatji in relation to the extent of any proposed disturbance to Mt Hale. Reference to section 18 consent merely identifies the process under the AHA should an application need to be made to the Minister for Indigenous Affairs to destroy or disturb an Aboriginal site as defined under the AHA.

YMAC:3

Heritage agreements are in place with Wajarri Yamatji and Malgana for the conduct of heritage surveys. Heritage surveys will be undertaken prior to any ground disturbing activity by CRL in order to identify any potential impact on Aboriginal sites.

In addition to consultation on Mt Hale, consultation is currently taking place in relation to other Aboriginal sites (identified during the course of heritage surveys) that will be impacted by mine site infrastructure and mine pit. Consultation is also taking place with the Wajarri Yamatji about potential section 18 AHA notices outside of Mt Hale that will need to be made in relation to the mine pit and mine site area. CRL has offered to enter a cultural heritage management plan in order to manage sites that will be impacted by ground disturbing work.

The Mining Agreement sets out terms relating to consultation required for any section 18 consent that may be required under the AHA for the current "Project Area" which includes Mt Hale. However, CRL reiterates that it is currently consulting with the Wajarri Yamatji about the extent of any proposed disturbance to Mt Hale.

YMAC:4

The YMAC comments that the location of the pipeline is not clearly defined. An infrastructure corridor has been identified within which there is flexibility to alter the final location of the pipelines. The final route of the pipelines cannot be determined until further heritage surveys have been completed. CRL is undertaking heritage surveys with the Wajarri Yamatji and Malgana over the area of the proposed pipeline route.

Information gathered from heritage surveys is being used to design the route of the proposed water and gas pipelines in order to mitigate or avoid disturbance of Aboriginal sites. The final pipeline route will not be determined until further information about Aboriginal sites that may be located within the proposed pipeline route is obtained through heritage surveys. As indicated above the Wajarri Yamatji has assisted CRL in designing the pipeline route in order to avoid impacting Aboriginal sites.

The YMAC comments that CRL seeks approval under section 18 of the AHA to disturb Aboriginal sites whether they will be impacted or not.

CRL is conducting heritage surveys pursuant to heritage agreements and will, where possible, avoid disturbing an Aboriginal site. Consultation with the Wajarri Yamatji is ongoing in relation to potential section 18 AHA notices around the mine site and mine pit area outside of Mt Hale. Before any disturbance to Aboriginal sites is proposed CRL will consult with the Wajarri Yamatji and Malgana People about mitigation measures and any ability to avoid disturbance. CRL has offered to enter a cultural heritage management plan in order to further address Aboriginal heritage site management.

As noted above, extent of proposed mining activity within the area of Mt Hale is the subject of current consultation with the Wajarri Yamatji and such consultation has been ongoing since 24 August 2010.

CRL will not, and will have no need to lodge, any section 18 AHA notice for Aboriginal sites not impacted by the JHEP.

YMAC:5

The date that Mt Hale was registered on the Aboriginal sites register held by the Department of Indigenous Affairs is referred to in the PER at section 8.8.1. CRL notes the conclusions drawn by the YMAC are not supported by information in the PER and are opinion only.

	<p>YMAC:6 Consultation with the Wajarri Yamatji and Malgana People has taken place in relation to groundwater testing activities and potential water extraction processes associated with the JEHPs operation. CRL offered the Malgana and Wajarri Yamatji the opportunity to monitor groundwater testing processes. To date the Wajarri Yamatji and the Malgana People have been involved in such monitoring.</p> <p>In relation to Mt Hale, we again note that the extent of proposed mining activity within the area of Mt Hale is the subject of current consultation with the Wajarri Yamatji and such consultation has been ongoing since 24 August 2010.</p> <p>In relation to cumulative impact, CRL notes the parameters of assessment processes are provided for in the <i>Environmental Protection Act 1986 (WA)</i> and <i>Environmental Impact Assessment Administrative Procedures 2010</i>.</p> <p>YMAC:7 CRL submits that the PER and the above information is sufficient to enable an assessment to be undertaken on matters pertaining to Aboriginal heritage.</p>
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5.6 FAUNA

Item Number	Comment
EPA 26	For the Stage 1 assessment we included a condition requiring that clearing be carried out so as to isolate fauna (lizards etc) in islands of vegetation but to allow them to move into new habitat before mining.
EPA 27	The Construction EMP does not detail the strategies that would be used to minimise trauma to fauna that might be trapped in open trenches for pipelines. The details of the length of trench that would be open at any time, plus the maximum times that trenches would remain open before daily fauna inspections and clearances should be planned and discussed with DEC staff. The outcome of that consultation should form part of your response to submissions.
EPA 28	For the river crossing there is a note (p124) that <i>E. victrix</i> trees may be used by Major Mitchell Cockatoos for nesting. Has a survey been done to confirm or dismiss this? If there are nesting hollows, are they occupied, or do they show signs of recent occupation? Would such trees be avoided?
EPA 29	Molhar's bat survey (Appendix F2) indicates that caves and adits were entered. There is reference to work done at Weld Range and Wilgie Mia. Are these a part of the project footprint? Are any of these caves (excluding Wilgie Mia) also significant for indigenous people?

DEC: 9	<p>Issue: There is high potential for entrapment of fauna via the construction of a 220 kilometre underground natural gas and water pipeline and their construction of an additional underground water supply pipeline.</p> <p>Recommendation 8: That formal management requirements for terrestrial fauna be identified and mandated with respect to pipeline trenching. These requirements to be developed in consultation with DEC and cover all relevant matters similar to those outlined in the approved Dampier to Bunbury Natural Gas Pipeline (DBNGP) Stage 5 fauna management protocol detailed in the DBNGP construction environmental management plan (CEMP) 2006.</p>
CRL Response	<p>CRL agrees to develop fauna management procedures for the construction of the services corridors. These management procedures will include trapped animal management. The procedures will be developed in consultation with the DEC (EPA 27; DEC 9). Likewise, during construction of the mine site, CRL will consult closely with the DEC to ensure fauna management procedures are equivalent or leading industry in terms of best practice as well as being cost effective. (EPA 26)</p> <p>GHD has recently completed a level 2 fauna survey for the mine expansion area (October 2010 – report pending). During this survey no Major Mitchell Cockatoos were recorded. The gas pipeline has also been relocated at the Murchison River crossing to avoid an indigenous heritage site. The revised location is in an area that is largely devoid of larger trees. As the density of <i>Eucalyptus victrix</i> species is generally sparse, and the pipeline and other infrastructure (associated with the borefields) can be relocated it is expected that <i>E. victrix</i> species can be avoided. (EPA 28)</p> <p>Rock overhangs are a component of the JHEP footprint. They are of value to the Wajarri Yamatji Aboriginal group and Section 18 applications will be required. CRL is seeking consent from the native title group to take these sites. (EPA 29)</p>

5.7 TROGLOFAUNA

Item Number	Comment
EPA 30	<p>p130 states that several troglomorphic species have only been found in the project area and Brindal deposit. This statement seems to be inconsistent with an earlier one which states: The troglofauna in the Jack Hills Range appear to form a single, low-abundance community dispersed through multiple rock types along most of the 50 km length of the Jack Hills Range. If these taxa have not been found elsewhere (ie beyond the potential area of impact) the EPA would have difficulty in agreeing that the proposal can meet its objective for subterranean fauna. Returning to the first statement, would you please confirm that the Brindal deposit is a part of the current proposal?</p>
DEC: 8	<p><i>Issue:</i> Several troglofauna species have been recorded only from within the Brindal and Mine Expansion mine void disturbance footprints.</p>

	<p><i>Recommendation 7:</i> That the proponent uses the results of sampling and habitat analysis (including three dimensional diagrammatic representation) to undertake a risk assessment to demonstrate whether or not the identified species are likely to be restricted to the Brindal and Mine Expansion mine void disturbance footprints.</p>
<p>CRL Response</p>	<p>CRL confirms that the Brindal pit is a component of JHEP. This smaller pit will ultimately be extended and incorporated with the larger pit.</p> <p>The extent of habitat for troglofauna has been analysed through the examination of photos of diamond core from drill holes throughout the JHEP area. All cores examined showed some evidence of cavities and voids at varying depths. This indicates that troglofauna habitat and distribution is likely to be widespread along strike due to connectivity of subterranean voids at depth.</p> <p>Sampling for troglofauna has occurred, in some form, along almost the entirety of the disturbance footprint of the range with troglofauna detected in multiple lithologies along strike, indicating that suitable habitat for troglomorphic taxa is likely to be widespread throughout the entire 50 km length of the range. This suggests that troglofauna are unlikely to be restricted to specific lithologies, such as those targeted for proposed mining activities.</p> <p>Repeated sampling in reference areas at Jack Hills by GHD has shown that several of the troglomorphic taxa recorded (e.g. Tyrannochthonius sp., cixiid sp., and polyxeniid sp.) have been recorded in other locations beyond the Jack Hills range and, therefore, have significantly wider distributions than were previously known. This shows that the troglofauna community within the entire range is very unlikely to be a single community. It is, therefore, a reasonable assumption that any taxa recorded from JHEP areas are likely to occur throughout the entire Jack Hills range, and population viability will not be affected by the current proposal.</p> <p>GHD (2010) show in Figure 1 (PER, Appendix F13) that the lithologies are not confined to the disturbance footprint and is well represented in the surrounding areas. Unless drilling occurs across the entire Jack Hills Range, it will be impossible to produce a three dimensional diagrammatic representation. The JHEP mining footprint currently represents less than 10% of the entire Jack Hills Range. Resource characterisation drilling has enabled a comprehensive sampling program within the disturbance footprint. However, this is not the case for the other 90% or more of the Jack Hills Range. (EPA 30; DEC 8)</p>

5.8 SHORT RANGE ENDEMICIS

Item Number	Comment
DEC: 7	<p>Issue: There is a high level of uncertainty regarding the specific identity and conservation status of six of the 15 potential short range endemic (SRE) invertebrate species of interest collected from the Jack Hills SRE survey.</p> <p>Recommendation 5: That the proponent undertakes work to better determine the identity and potential SRE status of any invertebrate species that has not yet been classified.</p> <p>Recommendation 6: That, if the SRE status of each of the 15 invertebrate species cannot be determined, the proponent uses the results of sampling and habitat analysis to demonstrate that no species or their associated habitat/s are likely to be restricted to the proposed disturbance footprint or significantly impacted.</p>
CRL Response	<p>The six potential short range endemic (SRE) species that have not been assigned a species level identity or associated conservation status are <i>Nemesiidae</i> Aname Species 2; <i>Actinopodidae</i> Missulena sp.; <i>Garypidae</i> Synsphyronus sp.; <i>Buthidae</i> Lychas 'MML1'; <i>Buthidae</i> Lychas 'MML2'; and <i>Armadillidae</i> Buddelundia sp. These species are discussed in detail below and their local distribution near the JHEP is considered. The habitat used by these species within the JHEP area is widespread within the Jack Hills Range and the JHEP is not considered to have an impact upon any invertebrate species identified during SRE surveys. (DEC 7)</p> <p><i>Nemesiidae</i> Aname Species 2 This species was recorded from 12 locations during the SRE survey, three of which are outside of the impact area. This species was recorded from a combination of ridges, slopes and valley floors indicating that the species is not habitat specific and therefore unlikely to be affected by the JHEP development.</p> <p><i>Actinopodidae</i> Missulena sp. This species was recorded from three locations one of which is outside the impact area. The species was recorded from a combination of habitats including slopes, ridges and valley floors. The habitat in which the species is found is locally continuous in the Jack Hills area and occurs widely in the region, making it unlikely that the species' will be adversely affected by JHEP development.</p> <p><i>Garypidae</i> Synsphyronus sp. This species was recorded from two locations, one of which is outside the impact area. This species was recorded from both ridges and valley drainage lines both of which are continuous in the Jack Hills area and occur widely in the region, making it unlikely that the species' will be</p>

	<p>adversely affected by JHEP development.</p> <p><i>Buthidae</i> Lychas ‘MML1’ The scorpion species Lychas ‘MML1’ was recorded from six locations, spread widely across the main ridge of the JHEP area. This species was recorded from both ridge and slope habitats within the JHEP area. This species may represent SRE taxa, however, the taxonomic framework is inadequate to fully determine this. The habitat in which the species is found is locally continuous in the Jack Hills area and occurs widely in the region, making it unlikely that the species’ will be adversely affected by JHEP development.</p> <p><i>Buthidae</i> Lychas ‘MML2’ The scorpion species Lychas ‘MML2’ was recorded from a single location on a slope but this is not likely to represent its full distribution as this habitat is very common throughout the entire Jack Hills Range. This species may represent SRE taxa, however, the taxonomic framework is inadequate to fully determine this. The habitat in which the species is found is locally continuous in the Jack Hills area and occurs widely in the region, making it unlikely that the species’ will be adversely affected by JHEP development.</p> <p><i>Armadillidae</i> Buddelundia sp Buddelundia is a common and widespread genus in the arid zone of western Australia (Dr Simon Judd pers comm. Nov 2010). The species found at Jack Hills was recorded from 23 separate locations, which would indicate it is not restricted to particular micro-habitats within the survey area. This species was recorded from ridges, slopes, and valley drainage areas, indicating that the species is not habitat dependent. All the habitats this species occurs in are continuous and widespread within the Jack Hills range making it unlikely that the species’ will be adversely affected by JHEP development.</p>
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5.9 WASTE DUMP/WASTE CHARACTERISATION

Item Number	Comment
EPA 31	The characterisation of all the materials proposed for the waste dump and the subsequent documentation of their whereabouts in the dump needs to be fully considered and integrated into the mine plan. It is noted that characterisation studies are due to be completed in December 2010.
DMP: 5	Section 5.13.1, water requirements

	<p>The section states that tailing may be dewatered by a conventional TSF or by thickening and filtering. Where is the proposed location of the TSF should that option be chosen (not shown on figure 5.3)? Is this the TSF location shown on the Golder and Associates reports (Preliminary Surface Water Assessment) show in figure 1. The bulk of the document mentioned an integrated waste landform (IWL) with tails deposited in cells within the waste rock dump.</p>
DMP: 19	<p>Golder and Associates Preliminary surface water assessment.</p> <p>The document refers to a separate TSF when the case seems to be for an Integrated Waste Landform.</p>
DMP: 4	<p>Section 5.11.2, p43, Waste Characterisation</p> <p>The proponent should demonstrate how the lithologies associated with stage 1 relate to the proposed stage 2 in order to state the there is an expectation that the waste rock present in stage 2 will have similar properties to stage 1 previously tested.</p> <p>Typically a deeper pit (planned to 260m, the stage 1 pit depth is not listed in section 4) and less oxidised rocks tend to be more problematic in terms of AMD generation potential.</p> <p>DMP notes that further studies are underway to confirm the result of previous AMD studies (also section 8.2.3.3. and p66).</p> <p>Waste characterisation needs to look at the physical properties of the waste rock types as well as the chemical properties (also mentioned in the Landloch report in appendices).</p>
CRL Response	<p>CRL acknowledges the comments received above, and recognise that it is quite common for the risk of encountering potentially acid generating waste to increase with increasing depth. For this reason, it is essential that sample selection includes representative samples from the major lithologies at all depths, including below the maximum proposed depth of the pit. To further address AMD and waste characterisation concerns CRL has commissioned additional waste characterisation and kinetic testing studies of representative waste and tailings samples. This includes analysis of material below the proposed depth of the pit. An AMD progress report is appended (SGS, 2010; Appendix B). Studies by Landloch (Appendix A, PER) to characterise the waste from a physical perspective will ensure that wastes containing dispersive materials (argillites, shales, sodic saprolites) do not result in erodible slopes (Draft Report, Landloch 2010; Appendix B). (DMP 4; EPA 31)</p> <p>Physical and geochemical characterisation of the mine waste materials is currently underway as part of the Bankable Feasibility Study. Based on the current JHEP schedule, these studies are expected to extend beyond December 2010. Waste materials with different geochemical and physical properties will be identified within the mine plan. The waste materials will be scheduled and placed within different parts of the integrated waste landform based on their properties. (EPA 31)</p>

Physical and geochemical characterisation of the mine waste materials is currently underway as part of the Bankable Feasibility Study. Lithologies sampled and tested from Stage 1 occur across the ore body and will be related to those present in JHEP as part of the ongoing studies.

Distribution of Potentially Acid Forming (PAF) materials identified by studies completed to date are provided graphically on Page 7 of the SGS report “Addendum to Acid and Metalliferous Drainage Study, October 2009”, dated April 2010, included in Appendix C of the PER. The distribution indicates that PAF materials occur throughout the ore body, particularly between elevations 300 m and 500 m AHD (surface level adjacent to the Jack Hills is approximately 420 m AHD). Further studies on AMD potential and distribution are ongoing and will be incorporated into the mine plan and waste storage design. **(DMP 4)**

Furthermore, CRL understands that it may not be appropriate to extrapolate the findings of waste characterisation from one project area to another without a detailed understanding of how the geology of one site relates to that of the other. CRL’s consultants are experienced geologists, who are familiar with the JHEP site geology (having prepared the waste characterisation report for Stage 1. Additional sampling has been undertaken and Crosslands have currently commissioned a further Waste Characterisation Report due for completion in the second quarter of 2011 which will collate and review studies conducted by SGS: AMD assessment, Landloch: physical soil properties, Golders Associates: IWL Study & PFM assessment, Coffey Environments: PFM assessment and CRL geological expertise to validate any comparisons or extrapolations. The waste characterisation report will form a component of the Mining Proposal. **(EPA 31; DMP 4)**

The Integrated Waste Landform (IWL) comprises waste storage locations and tailings storage cells. Development of the tailings storage concept over the period of the supporting studies means that this landform has been referred to interchangeably as a Tailings Storage Facility (TSF) in some documents. This is the same landform. The use of the term IWL more accurately reflects the nature and composition of the proposed waste and tailings storage facility. **(DMP 19)**

The tailings will be thickened at the plant and pumped to tailings storage cells within the IWL where the tailings will be deposited and supernatant water removed. The tailings are produced from the process in several process streams. Conventional thickeners, high rate thickeners, paste thickeners and filters may be used, as appropriate, for each of the tailings streams to produce the desired tailings solids content for transport to the IWL. **(DMP 19, 5)**

5.10 ACID AND METALLIFEROUS DRAINAGE

Item Number	Comment
EPA 32	This type of climate (arid with occasional rain events) is high risk for acid generation. What capping system is proposed to prevent generation of AMD? You need to make a convincing case at this stage that AMD can be managed, given the site characteristics and climate. (Note that the existing national leading practice handbook on AMD specifies that proponents need to make a “convincing case” in their AMD plan presented as part of EIA that AMD can be managed to avoid pollution).
EPA 33	I note that the PER text states that a “high level” AMD review has been carried out and concluded that there is only a small amount of material with AMD potential. A “small amount” of material may still cause substantial and long term pollution problems if not managed properly. How reliable is the “high level” review – was it based on drill core data, and if so, how many drill cores? Is the sample representative?
EPA 34	What information is available on AMD from the Stage 1 project? Was AMD an issue—or was the geology quite different (hematite as opposed to magnetite)?
EPA 35	How will PAF material be recognised – is it visually distinctive?
EPA 36	What management system will be used to track the PAF material and make sure it is disposed of to the correct disposal area (eg GIS tracking system as at Mt Whaleback)?
EPA 37	The PER says that PAF material will be encapsulated in carbonate waste which will buffer any acid. Has this been properly demonstrated? How will the encapsulation be accomplished to avoid the problems of “armouring up” of the buffering material? (one solution which has recently been developed is use of alkaline capping – thereby avoiding armouring-up problem).
EPA 38	Kinetic studies were yet to be done to establish whether or not carbonate rocks would act as an effective buffer for PAF materials. Has this been completed?
EPA 39	Appendix 4 section 2.6 notes proposed additional work. What is the timeframe for this and are the results now available? Sections 5.1, 6.2 and 6.4 note that the results from these tests would be needed to determine if mitigation is required.
EPA 40	Page 22 of the OEMP states that CRL would test for acid leachate in the IWL traps. Also section 9.8.4.3 describes actions to be taken if acid leachate is found. How long after mine closure would monitoring of these potential streams continue? This does not appear to be a walk-away strategy.
CRL Response	AMD management has been addressed in the PER (Section 9.8.4) and an AMD Management Strategy is also provided in the PER (Appendix A, PER, 2010). The capping system is detailed in the Golders Report on the IWL, with effective capping system (store and

release) storage in an arid environment does not normally present high risk due to limited opportunity for infiltration of surface waters and therefore generation of acidity. In addition, low humidity in arid areas means that the potential for progressive oxidation and hydrolysis reaction is limited (**EPA 32**). CRL are currently conducting characterisation at a level outlined in the national standards. A progress report on the first three months of kinetic testing is provided in Appendix B (SGS, 2010) (**EPA 38**). The final report will be completed by May 2011 and presented in the Mining Proposal. (**EPA 39**)

Essentially, CRL and SGS only called the initial study a “high level” review due to the assumptions made about the mineralogy of the ore (and hence the neutralising capacity of the ore). The normative mineralogy has proven to be a reliable indicator for the testwork to date, so in hindsight those assumptions appear to be reliable. There is no question regarding sulphur levels (i.e. Maximal Acid Potential) as assays appear consistently throughout the deposit and are reported as part of the measured resource. The joint distribution of acid potential and adjusted (calibrated) neutralising potential of waste material in the “high level” study can be considered reliable, and the recent interim testwork results provide preliminary confirmation of these expectations. The initial “high level” study included ALL samples in the drill hole database, so there should be no question regarding representivity. The subsequent “high level” investigation of the block model included ALL blocks within the pre-feasibility pit shell (again, full representation). (**EPA 33**)

The geo-metallurgical approach we have used for ALL testwork sample selections in the current and previous programs ensures that they proportionally represent the target populations (i.e. AMD characteristics) within the resource. These target populations cover the full range of anticipated AMD characteristics. Samples were also carefully chosen to provide wide spatial representation. No unexpected results have been reported to date, again indicating the reliability of the “high level” study. Full justification of samples selections has been detailed in reports to date (and will also appear in the final report at the end of the kinetic testwork program). (**EPA 33**)

The “small amount” of higher risk material is quite localised and should be easily managed with appropriate blending or targeted neutralisation when this area is mined. It should be flagged in the mining schedule. (**EPA 33**)

Overall, the investigation to date presents a reliable indication of the likely acid and metalliferous drainage risk for the JHEP. It has demonstrated there is a gross excess of neutralising capacity in the ore, and that small pockets of higher risk material are likely to be effectively neutralised, or easily flagged and managed. The results and assessment of the current testwork are expected to provide further validation in this respect. (**EPA 33**)

The Jack Hills Iron Ore Project Environmental Protection Statement (2006) stated:

“Wastes will consist primarily of five groups of oxidised and fresh rock, which are defined in Appendix B (MBS, 2005). The predominant materials will be low iron grade iron oxide – quartz rocks (magnetite – hematite quartzite, banded iron formation); inter-laminated banded iron formation and (quartz) –chlorite schist; with lesser amounts of argillite, granitoid and pegmatitic intrusives and thick chlorite/talc-chlorite schist which are derived from mafic rocks of both sedimentary and possibly intrusive affinities.

Eighteen samples mainly consisting of six metre drill hole composites, representing all rock types from the proposed first open pit were microscopically examined. Only four of these samples contained trace amounts of microscopically visible sulphide. No samples reacted with hot 1N hydrochloric acid. No apatite or other phosphate minerals were recorded and all samples were free of radioactive minerals.

On the basis of the microscopic examination, these samples have been submitted for acid digestion and circum-neutral leaching procedures for 18 elements, pH and Electrical Conductivity. The results and a geochemical interpretation are included as Appendix B (MBS 2005). Table 5.1 lists the pH, EC, soluble arsenic, bismuth, cadmium, cobalt, copper, lead, molybdenum, nickel, zinc, and total sulphur values, the latter indicating clearly, that there is no likelihood of any acid generation from the wastes.

Based on Dr Martins’ examination, none of these wastes have chemical properties that may cause heavy metal toxicities or environmental pollution. They also have no capacity to generate acid in volumes and concentrations that will give rise to environmental concern. The same will apply to wastes generated from other iron resource areas within the tenements.”

To date, the Jack Hills mining operations have not experienced AMD issues. **(EPA 34)**

Apart from visual and geological identification, the PAF material could be identified firstly in block model (data is already available), then confirmed by grade control during production. Sulphur would need to be included in the regular grade control assay suite and it may also be necessary to use the normative mineralogy calculator on grade control assays to predict neutralising capacity. This would provide practically “real time” AMD classification of ore parcels and allow instant mitigation of any PAF materials. **(EPA 35)**

The report “Acid and Metalliferous Drainage Management Strategy” (GHD, July 2010), included in Appendix A states that:

“Progressive rehabilitation of the facility using a ‘store and release’ cover system will provide long term mitigation of environmental risks”

Studies are currently underway to identify and characterise mine waste and naturally occurring materials within the JHEP site that will be

used in the design of the cover system. Modelling will be undertaken to simulate performance of the proposed cover system under the climatic conditions present at the site. **(EPA 32)**

Testing is currently being undertaken to increase CRL's understanding of the AMD characteristics of the waste rock. This will allow a better understanding of the distribution and mineralogical variation of PAF materials in the waste. It will also assist in the selection of appropriate management strategies for AMD. **(EPA 37)**

Presently, the management strategy does not include a GIS tracking system for PAF material. The specific details of how PAF material is managed from pre-mining to post-closure will depend on the final prediction, prevention and treatment options selected. These will depend on the outcomes of testing currently being undertaken. A GIS tracking system would only be implemented if it was an appropriate tool for the management strategies selected.

It should be noted that, based on the results of studies completed to date, the AMD conditions present at Jack Hills vary significantly from those present at Mt Whaleback. Management strategies will be tailored to suit the conditions present at Jack Hills. **(EPA 36)**

In the event that acid leachate is identified, CRL will implement treatment strategies in accordance with PER Section 9.8.4.3 Remediation: Monitoring of drainage will continue until such time as CRL can demonstrate that it has satisfied the objectives outlined in PER Section 9.8.1 EPA's Objectives. **(EPA 40)**

5.11 DUST AND ASBESTIFORM MINERALS

Item Number	Comment
EPA 41	With respect to effects on vegetation from dust, page 149 states that it is not considered to be a significant concern, even though current dust levels are stated to be high and would be expected to rise with the expansion of the mine. Would you explain the reasoning for this conclusion?
EPA 42	Figure 3 of the Golder Assoc. report on asbestiform minerals shows widespread talc shear zones in the mineralised zone. It is assumed that at least some of these contain asbestiform chrysotile although the logging states that no distinction was made between the fibrous and non-fibrous varieties.
EPA 43	Advice from DSD that the asbestiform materials are typically very localised and patchy, therefore if there is a need to exclude some areas from mining these decisions can only be made from very detailed drilling immediately prior to mining.
EPA 44	According to the Golder report (page 10) the asbestiform minerals would be mined and would need to be monitored and managed through the processing plant.
EPA 45	Given that dust levels are already “high” (Cardno Table 1) and expected to increase with the proposed expansion, how can such an environment be expected to be a safe working environment with respect to airborne asbestiform fibres?
EPA 46	Because of the large volume of materials to be mined, while the percentage of the asbestiform minerals may be relatively low, the overall quantity produced could be significant.
EPA 47	When read with paragraph 5 on page 4 of the Cardno report, Table 1 makes no sense. Is there a typo? Please clarify.
EPA 48	DMP advises that processing of magnetite at (another minesite) causes such materials to “fluff up”. Therefore we have concerns that processing (to produce concentrate) may exacerbate the risk from such materials.
EPA 49	The Golder report indicates that asbestiform exposure could be a significant issue, not just for OHS reasons but from an environmental perspective, particularly after closure.
EPA 50	Note the following comment in the Executive Summary indicating that further work is needed: “The remaining 35% of unidentified PFM should be identified by laboratories to verify whether the conclusions drawn are still valid”.
EPA 51	I could find no information on environmental aspects / implications for mine closure (how will the material be identified, segregated and contained to avoid possible surface contamination with fibrous materials and potential for impacts on public health if there is future public access to the area).
EPA 53	Is it possible that these materials may be of concern to people working at the SKA and elsewhere? There is no technique at present to manage fibrous dust from blasting.

H 8	<p>Dust deposition levels across the site are much higher than the DEC recommended guideline of 4g per metres squared per month (p111). Levels ranged from 24 g per metre squared per month at Station 2 to 9 grams per metre squared per month at Station 3 (Appendices Volume 2, D2 p4). It seems that there may also be risks from asbestos (p150-151). Reverse circulation and diamond drilling below and to the side of the current operations has intersected asbestiform minerals (Appendices Volume 2, E1 pi). This would seem to be contrary to the predicted outcome that dust impacts on human receptors and vegetation are unlikely during construction and operation of the proposed Project (p151). It is commented that there are no nearby communities or potential sensitive population groups in close proximity to the Project. However, it is understood that there will be an accommodation village in the vicinity of the project (p12). Perhaps it may be advisable for the proponents to assess employees in terms of their likelihood of developing respiratory difficulties.</p>
DMP: 1	<p>Section 5.8 mining method p39 and section 8.2.3.2 on p65. Presence of Possible Fibrous Material/Asbestiform Minerals. Presence of Possible Fibrous Material noted. Please refer to comments from DMP Resource Safety Division attached to this correspondence. Mike Rowe from DMP Resource Safety has stated that the DMP Resource Safety Division will handle the Occupational Health aspects of the proposal under the Mines Safety and Inspection Regulations.</p>
DMP: 16	<p>Appendix 3, DCMP Section 8.2.3.2, p31, 2nd paragraph The use of a dust suppressant agent maybe a better option than fine water sprays to manage dusting from desiccated tails prior to capping.</p>
DEC: 3	<p>Potential dust and drainage impacts should also be considered for populations of conservation significant species close to the mine footprint, and it is therefore recommended that they be specifically identified in commitments or conditions, for monitoring of adverse effects.</p>
CRL Response	<p>Fibrous Materials</p> <p>The study carried out by Golder indicated that approximately two-thirds of the chrysotile and actinolite-chrysotile intervals are associated with talc shears. The study recommended that further investigation be carried out to determine whether actinolite intervals are asbestiform or non-asbestiform and whether the fibrous nature varies depending on proximity to talc shears. The report also recommended that the inferred link between chrysotile and talc shears be investigated further. These recommendations are the subject of additional studies that are currently underway. (EPA 42)</p> <p>CRL has engaged consultants (Coffey Environments, Golders) to undertake further assessment of the potential fibrous minerals within the resource. The results of these studies are pending, but will be completed prior to the commencement of the JHEP and where appropriate engineering controls will be incorporated into the site. (EPA 42, 43, 44, 45, 46, 48, 49, 50)</p> <p>Current indications are that mining of some asbestiform minerals may be unavoidable because of the thickness and distribution of these minerals in the ore body. Studies are currently being undertaken to provide further information on the distribution of asbestiform minerals in</p>

the ore body. As described in Section 8.2.3.2 Asbestiform Minerals:

- A management and decontamination plan including encapsulation within the IWL will be formalised as a greater understanding of localised potential for presence of asbestiform minerals is realised.
- Monitoring during trial processing at Crosslands' Pilot Plant will be conducted to gain further understanding of the likely exposures to airborne dust and fibres prior to full-scale processing being undertaken. **(EPA 44)**

EPA Comment 49: it is assumed that this is referring to Golder's report "Ore Evaluation Services, Review of Asbestos Extent at Jack Hills Deposit, WA", dated July 2009. We cannot find specific reference in this report to the environment or closure. Notwithstanding this, CRL agrees that the potential for asbestiform exposure must be managed appropriately both in terms of operation and long-term containment. For this reason, we have engaged several experienced consultants in this area to provide us with guidance. CRL is committed to implementing appropriate strategies for the management of fibrous minerals. **(EPA 49)**

CRL agrees: *The use of a dust suppressant agent maybe a better option than fine water sprays to manage dusting from desiccated tails prior to capping.* The strategy adopted for the management of dust from the tailings will be influenced by the tailings and asbestiform minerals characterisation studies that are currently underway. **(DMP 16)**

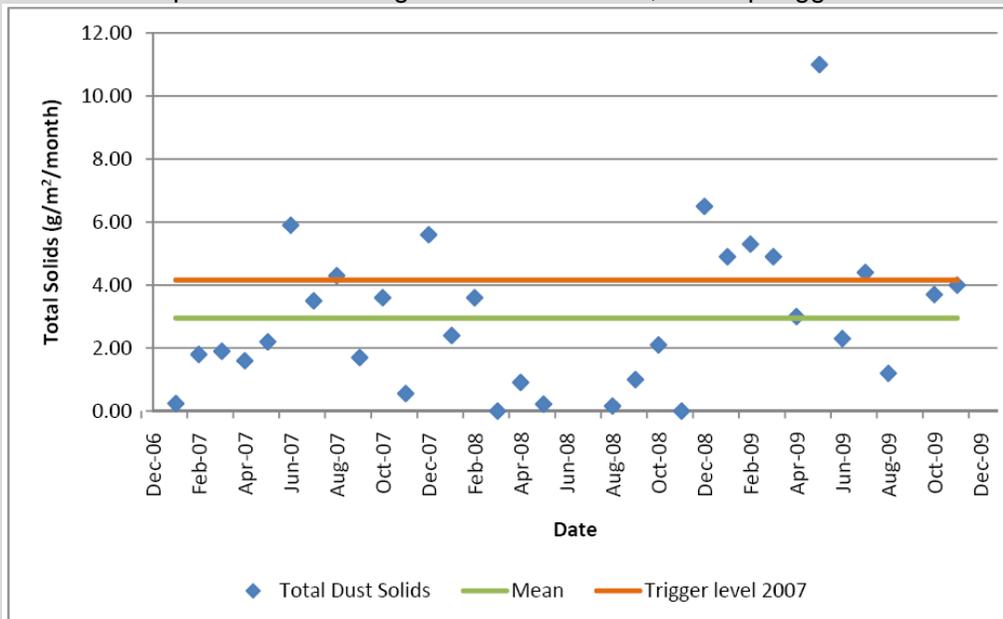
CRL has and will continue to consult with the DMP to develop appropriate fibrous minerals management. Management will comply with the Mine and Safety and Inspection Regulations and will take into account closure considerations. The results of the studies defining the extent of fibrous materials and management strategies will be detailed in the Mining Proposal and Project Management Plan, submitted to the DMP. Impacts to environmental receptors are addressed as per dust monitoring and management described below. **(EPA 42, 43, 44, 45, 46, 48, 51, 53, H 8, DMP 1)**

Dust Monitoring and Management

Dust management strategies are outlined in the Construction Environmental Management Plan (CEMP) and the Operation Environmental Management Plan (OEMP) (PER Appendix A). CRL has engaged an external organisation to prepare a Dust Management Plan for the JHEP. This plan will outline:

- Dust management measures to be implemented;
- Monitoring and reporting requirements; and
- Contingency plans.

CRL have been monitoring dust generation for current operations. Background dust levels at Jack Hills exceed the DEC trigger level (even though the reported mean value over the reporting period is less than the 4 g/m²/month), see below graph (EPA 47). A trigger level of 4 g/m²/month is not applicable to the Jack Hills operations. Annual vegetation monitoring reports have found that dust has not impacted the surrounding vegetation at Jack Hills (Cardno 2009; Appendix B). Regardless, CRL has commissioned a UWA Masters Project (2010-2012) to assess the impact of dust on vegetation at Jack Hills, develop trigger levels and identify indicator species. (EPA 41, H 8, DEC 3)



Graph: Total solids recorded on a monthly basis at the Jack Hills control site. (Cardno, Jan, 2010)

In addition, CRL are the first mine site to test a dust suppressant on its product. Results are impressive and CRL are assessing the feasibility of using this product for JHEP operations. CRL recognises that an integrated approach is required to manage dust as per current operations including, but not limited to:

- covers on truck trailers transporting ore (not applicable for JHEP);

	<ul style="list-style-type: none"> • water sprays; • dust suppressants; • wind direction during blasting activities; and • vehicle speed limits. (EPA 41, H 8, DMP 16, DEC 3) <p>CRL have committed to monitoring the effects of dust on sensitive receivers, including the PEC and conservation significant species. (EPA 41, H 8, DEC 3)</p>
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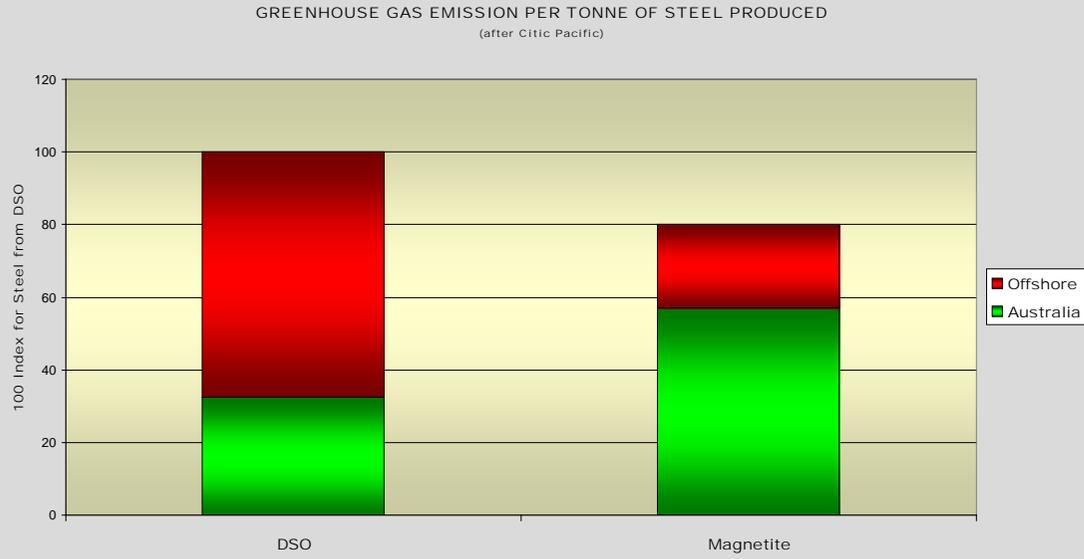
5.12 REHABILITATION

Item Number	Comment
EPA 53	The EPA objective in table 1.2 is outdated. It should say: <i>Ensure that a planning process is in place to ensure that the mine can be closed in an ecologically sustainable manner, consistent with agreed final land uses and without unacceptable State liability.</i>
CRL Response	Noted – this will be amended. (EPA 53)
EPA 56	In the first assessment the condition used was based on DMP conditions requiring CRL to implement the proposal “consistent with the rehab plan”. What was the outcome of this? Was the waste dump built so as to “optimise” rehab as was proposed originally? Have there been trials to establish what will grow on the waste dump? What are the learnings from Stage 1 in this regard which can be applied to stage 2?
WS: 2	<p>Rehabilitation and Revegetation</p> <p>In this context it is very important what is left behind after the mining is finished. That is particularly the land form and vegetation. It is vital this aspect is fully considered prior to any mining taking place in the expansion area. It has been our experience that insufficient attention is paid to this. Characterisation of all the materials that will be going into the waste dumps needs to be done prior to mining commencement and then this incorporated into the mine plan. We note this is discussed on page 43 of the PER.</p> <p>Extensive drilling prior to mining taking place is necessary and also programming of mine operations to suit rehabilitation and revegetation requirements. This has not been the case with a lot of mines particularly in the Yilgarn and therefore the standard of rehabilitation and revegetation is unacceptable. In some cases reversal of this situation is very difficult and expensive and on might say almost impossible. We would be happy to provide further details of our experience in that area.</p>
WS: 3	We note the proposed top soil storage sites. These seem large and it is to be hoped clearing will be progressive through the life of the mine as top soil deteriorates on storage. Many studies have shown that top soil is best used within a year or two and the best regeneration is that

	done with germination from the seed in the topsoil.
WS: 4	Due to a variety of events it has been difficult to study each page of the PER documentation but we have not found a report or audit on the rehabilitation of the existing mine. This should be provided and The Society would like to receive a copy. Approval of the expansion should be conditional on favourable progress with rehabilitation. Monitoring sites in the adjacent vegetation should be established prior to mining.
CRL Response	<p>CRL has built the Stage 1 waste facility as per the specifications outlined in the Environmental Protection Statement. The footprint has, however, since receipt of Stage 1 Approvals, been modified to exclude an area identified as having Aboriginal Heritage significance. Positive comments, made during the agency site visit for the Golden Gecko award assessment, included a statement that the visual aspect of the waste dump was aligned with the surrounding environment. No rehabilitation has been trialled on the waste facility to date. At this stage, JHEP plans would result in the disturbance of any rehabilitation undertaken. (EPA 56; WS 2)</p> <p>CRL agrees with the importance of rehabilitation, to ensure that the end result at closure is both environmentally and socially acceptable. CRL has commenced rehabilitation planning early in the mining process, preparing a rehabilitation strategy that outlines the processes involved in preparation and implementation of rehabilitation measures on site. CRL has engaged consultants, Landloch and G&G Environmental (won Minara Resources a Golden Gecko Award for excellence in rehabilitation), to begin planning and initiate research. Since submission of the PER, Landloch has completed further assessment of topsoil and soil profiles (In draft; Appendix B), and further work outlined in the planning phase of the rehabilitation strategy is underway. Seed collection will commence, once sufficient rainfall has fallen to encourage the setting of seeds. A shade house is being constructed on site, and once this is established (early in 2011) vegetation propagation trials will also commence. (EPA 56; WS 2)</p> <p>Large areas for topsoil storage is planned to ensure storage height is no greater than 1-2 m and as much topsoil is collected as possible and is segregated by source location. (WS 3)</p> <p>Rehabilitation of drill pads has been commenced and has been successful. Details on the drill pad rehabilitation are reported in the G&G Environmental (2010) document provided at Appendix B. Monitoring sites have been provided in a study conducted by G&G Environmental (Appendix A5, PER, 2010). (WS 2; WS 4)</p>

5.13 SUSTAINABLE POWER SOURCE

Item	Comment
EPA 58	Is the gas option for power definitely locked in? Indications are that natural gas for new developments is in short supply.
EPA 59	Why has solar power not been designed into camp and office buildings, especially for heating, given that the Cardno study showed it to be a favourable option compared to other sources of energy?
PR1: 6	<p>The above discussion assumes gas supplies are available. A concurrent PER submitted by Sinosteel Midwest Corporation Limited for their Weld Range Iron Ore Project to produce 15 million tons of iron ore per year requires ~ 20 MW of electricity. In their PER document, Sinosteel Midwest Corporation Limited (2010) identify that it is “recommended that the power source be...diesel generators” because “although a power station with gas-fired engines would be a cheaper solution, both the piped natural gas and LNG options are currently not feasible because gas supplies are extremely difficult to obtain and are unlikely to be secured” (P. 15, Sinosteel Midwest Corporation Limited, 2010). Yet Crosslands Resources Ltd assume a new gas pipeline spur from the DBNGP will supply their proposed 350 MW power station to produce double Sinosteel’s output. In addition, Crosslands Resources Ltd will use 350,000 L of diesel per day (P. 45, PER). This equates to 128 ML/yr of diesel in addition to 37 GL/yr of water and 350 MW of gas fired electricity to mine a mere 30 million tons of iron ore per year. I trust the Australian Stock Exchange is fully informed!</p>
CRL response	<p>Solar power has been considered as a component of an Eco-village Investigation (Cardno, 2010; Appendix B). This information has been delivered to CRL’s infrastructure engineers to assess the viability of using solar power at the camp. This will be presented in the Bankable Feasibility Study (BFS) and summarised in the Carbon Reduction Assessment Report (Cardno, underway) commissioned to assess consideration of carbon emissions in the BFS, which forms a component of the strategy outlined in the first Carbon Emission Reduction Assessment report (Appendix D1, PER; Cardno 2010). (EPA 59)</p> <p>The option to use the gas for power is preferred. This option was identified in the Carbon Emission Reduction Assessment report (Appendix D1, PER; Cardno 2010) as being the more environmentally sound choice. (EPA 58; PR 1: 6)</p> <p>CRL are in discussions with various parties over the supply of gas and has a team of experts working to progress this option. Greenhouse emissions are high during the mining and processing of magnetite (majority of ore to be produced at Jack Hills), however, are significantly lower overall from mining to product in comparison to Direct Shipping Ore (DSO) (see graph below). CRL, in consultation with all stakeholders, is aiming to source its water requirements from sustainable aquifers. (PR 1: 6)</p>



5.14 SQUARE KILOMETRE ARRAY

Item Number	Comment
EPA 60	Given the reassurance in the text of the PER that this proposal is outside of the potential area of disturbance for the SKA it is surprising that the CSIRO (and others) have raised this issue. This is an area where the Commonwealth Government is likely to take a close interest. Please document where current discussions are with regard to this issue.
CSIRO: 1	Interagency discussions have indicated that the Jack Hills Expansion Project has the potential to significantly impact on the radio-quietness of the Murchison Radio-astronomy Observatory (MRO). CSIRO therefore considers that the PER document should list the MRO users as stakeholders that could be significantly impacted by the proposal, and further, that it should outline measures that will be adopted by the Jack Hills Expansion Project to ensure that the Project will comply with radio-quiet regulations and requirements.
CSIRO: 2	Figure 5.3 of the PER document indicated a planned location to site the accommodation block and airstrip. CSIRO suggest that the project proponent consult with CSIRO regarding best placement of these facilities to facilitate compliance with radio-quietness requirements.
CSIRO: 3	Section 5.12.6 of the PER documents stated that the primary road access to the Jack Hills Expansion Project will be from the Great Northern Hwy through Cue. Using this route rather than a route further west will help minimise radio-frequency impact on the MRO, CSIRO notes that significant use of the Beringarra Pindar Road, which passes close to the MRO, would cause unacceptable radio-frequency interference on the MRO. CSIRO suggests that, to protect the radio-quietness of the MRO, approval for the Jack Hills Expansion Project should include a condition that the Beringarra Pindar Road not be used to access the mine site by vehicles associated with the mining activity at Jack Hills, except in emergencies.
CSIRO: 4	Section 12 of the PER document, which discusses social impact, would be more complete if it included consideration of the impact on the radio astronomy activities at the MRO of the Hack Hills Expansion. Poor control of radio-quiet could lead to the MRO not being able to operate, leading to damage to Australia/New Zealand's SKA bid and consequent loss of benefits from the radio astronomy projects to the region, to WA, and to Australia and New Zealand. Section 13.3, Table 13.2 lists discussions with DoC regarding interaction with SKA, but should also mention ongoing discussions with CSIRO, DIISR and ACMA regarding radio-quiet regulations and how the project should comply with the regulations and conduct its operation in a radio-quiet manner.
CSIRO: 5	The Australian Communications and Media Authority already has measures in place under the Radio communications Act 1992 (Cth) (RALI MS32 and Embargo 41) to control radio-quiet. The policy framework section of the PER document should therefore mention the requirements for the mining operations to comply with these regulations. Section 3.2.2, which mentions Commonwealth legislation of relevance, should mention the protection mechanisms that are already in place under the Radio communications Act.
CSIRO: 6	Appendix A2 is the Operations Environmental Management Plan. This plan should list the requirements for radio-quiet compliance as a

	factor to be considered in Operations, and explain the steps that will be taken to minimise radio-frequency interference.
CSIRO: 7	CSIRO will continue to provide scientific and technical advice on an ongoing basis to assist the Jack Hills Expansion Project to satisfy the radio-quiet regulations. CSIRO suggests that a representative of CSIRO MRO Management be invited to participate in a CRL Liaison Group to ensure that the issues are aired and solutions identified.
PR 2	<p>The proposed Jack Hills Expansion project is virtually on the perimeter of the core of the RQZ covered by Embargo 41 and lies well within the Radiocommunications Assignment and Licensing Instructions MS32 zone which extends up to 260km from the centre of the RQZ (ACMA 2010).</p> <p>The proposed Jack Hills Expansion Project presents numerous sources of RFI many of which are significant enough to wreck the integrity of the RQZ and annihilate Australia's bid to host the SKA. I don't pretend to have expertise in radio astronomy or RFI or to have complete knowledge of all potential sources of RFI that may arise from the proposed mining activities. The proponent and the Environmental Protection Authority (EPA) need to liaise closely and thoroughly with the CSIRO to work through all the issues. I will however bring to the attention of the EPA through this submission some of the potential sources of RFI that occur to me and I acknowledge that experts within the CSIRO may dismiss some of these sources as irrelevant or readily managed.</p> <p>On page 47 of the PER document the proponent proposes to construct a new airport and terminal with a sealed runway to service Code 3C aircraft carrying approximately 80 passengers. I could be wrong but I suspect that the Civil Aviation Authority (CASA) would require such an airport to have robust radio communication capacity. Any radio communication capacity associated with the proposed airport will require licensing from ACMA. From the discussion paper released by the ACMA on 8 October 2010 (ACMA 2010), it would seem unlikely that the ACMA would be forthcoming with such a license.</p> <p>To me, the nub of this issue is radio communication from aircraft in airspace over, or in any proximity what-so-ever to the RQZ. Further to this, a concurrent proposal by Sinosteel Midwest Corporation Limited to develop their Weld Range Iron Ore Project outlines plans to build a second similar airport also on the perimeter of the inner core of the RQZ (Sinosteel Midwest Corporation Limited, 2010). It is easily envisaged that a commercial airline operator would seek to service both mines sites with flights to and from Geraldton and Perth. Given the proposed size of each mine workforce and standard Fly in Fly Out (FIFO) work rosters, it is likely that there will be at least 3 commercial flights over the ASKAP site each day. This proposal will wreck the CSIRO's ASKAP telescope and terminate Australia's bid to host the SKA. To avoid RFI from airports and aircraft the proposed FIFO method of workforce management could be replaced with Drive In Long Distance Drive Out (DILDDO). There would still be RFI from DILDDO vehicles but if the sources of RFI are restricted to ground level (as opposed to</p>

	<p>being airborne) it may be possible to use distance and curvature of the Earth to screen out the noise.</p> <p>Ultimately this issue may come down to Commonwealth Legislation and the rejection of a radio communication license from the ACMA resulting in the rejection of a licence to operate an airport from the CASA. None of this is identified in the PER document. There are obvious sources of RFI, some of which may not be within the frequencies of radio astronomy interest or are readily managed. Close and thorough communication with the CSIRO will identify concerns.</p> <p>Clearly there will be mine site communication between vehicles. If this is all conducted within the 27 MHz band it may be below the CSIRO's and the SKA's bandwidth of interest. However, signals from Global Positioning System technology to track vehicle movements within and around the mine may be a problem. I believe this issue would be RFI from transmissions reporting a vehicle's position back to a central control room.</p> <p>The detonation of Ammonium Nitrate Fuel Oil to undertake mining activities is also potentially a source of RFI particularly with remote controlled detonation. Again, close liaison with the CSIRO is required.</p> <p>Lastly, and probably least of the issues that are obvious to me, is the use of remote controlled recreational devices. Remote controlled toys, for example model nitro cars, are popular amongst remotely based FIFO mine crews. These devices usually operate in the 27 MHz bank and are therefore probably at a lower frequency than of interest to radio astronomy. None-the-less the issue needs to be examined by the proponent and presented to the CSIRO for consideration.</p>
CRL Response	<p>CRL acknowledges the Embargo 41 (2005) and RALI MS32 (2007), particularly the 150 km 100 Mhz – 25.5 Ghz and the 100 km 230 Mhz – 25.5 Ghz RQZ zones, as well as the coordination zones out to 260 km, and have considered these as high priority criteria in design of facilities. CRL also fully acknowledges the state MRM zones restricting allocation of mining tenements and their use within 70 km and 80 km of MRO centre of operations near Boolardy Station. Infrastructure has been positioned outside of these zones.</p> <p>CRL further notes ACMA's Discussion Paper 'Mid West Radio Quiet Zone' released in October 2010, which annexes and discusses and draft Band Plan, which is intended to replace Embargo 41. CRL has submitted a detailed response to the Discussion Paper which it expects will be available in the public domain in due course. In the submission, CRL expresses a number of concerns with the proposed Band Plan, and makes suggestions for compromise which have arisen out of detailed consultation with key stakeholders including mining and infrastructure companies Sinosteel Midwest and Oakajee Port and Rail, the CSIRO, State and Federal Government agencies and industry</p>

bodies including the Chamber of Commerce and Industry, Chamber of Minerals and Energy and the Geraldton Iron Ore Alliance.

One of the outcomes of these discussions has been the publication of a Joint Communiqué between the State and Federal Governments, which recognises the need for co-existence between the MRO and other industry users, in particular in the region between a radius 70 km and 150 km from the RQZ centre. As CRL understands it, it is intended that the principles expressed in the Joint Communiqué will be enshrined in a new, revised Band Plan, into which CRL expects to provide further input.

Thus CRL, along with other major organisations in the Mid-West, has taken an active role to work with its neighbours in providing feedback to the CSIRO, ASKAP and ACMA. As part of the proposed changes to the legislative regime, CRL would like to see the ongoing utilisation of technically focused working groups as well as suitable amendments to ensure all projects, including agriculture, tourism, mining and radio observation are least impacted.

CRL has a current operational procedure for all personnel in terms of 'remote areas access' and this includes applying restrictions on access through the Beringarra Pindar Road as well as other movements through the MRM 80km restriction zone.

From a technical point of view and concurrent with the development of new legislative framework which includes an appropriate co-existence framework, CRL is seeking to develop detailed working relationships with CSIRO, and others as identified, to coordinate mining and radio observatory activities. A number of items have already been identified for further discussion including the potential to utilise common Geo-Thermal Power Generation projects, Solar PV arrays, fibre optic networks, etc as well as coordination of mining activities and use of radio equipment to minimise impact on MRO activities. Some options currently being investigated include common licence allocations for use of specific equipment in the area such as FM radio broadcasts and radio telemetry equipment as well as other potential concepts such as schedule based frequency swapping to allow periods of observatory use in highly desired parts of the radio spectrum.

All current design plans for proposed equipment for JHEP operations have been completed with priority in design to eliminate radio emissions where possible, for example by the use of fibre optics; or to design equipment for focused radiation, for example by the utilisation of directional antenna design, location of antennae behind geographic features and design of arrays to focus beams downwards; and to employ the concept of increased numbers of lower power units over low numbers of high power units to limit and focus radio propagation. However, these will all be subject to continued consultation with CSIRO.

	CRL understands there is currently very limited legislation or understanding of electromagnetic RFI/EMI issues and will seek to work with CSIRO toward common goals on the management of this as appropriate. (EPA 60; CSIRO 1-6; PR 2)
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5.15 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

Item Number	Comment
DMP: 7	Appendix 1, CEMP Table 4, p20, sheet flow surface water management and monitoring for potential detrimental impacts. Monitoring and reporting should be included for areas where sheet flow drainage needs to be maintained. What is the rationale for the 3% grade given in the PER that this will cause minimal impacts?
CRL Response	<p>The 3% crossfall from the centreline is standard for design of all weather roads. An all weather road would likely be unnecessary unless a haul road was to be built in this corridor between Weld Range and Jack Hills. It is not anticipated that this will be required given the Oakajee rail line. The corridor will be used for potential water or power line services and will require a service road.</p> <p>The JHEP, including roads, access tracks and infrastructure, will be designed to maintain hydrology across the site. With the use of appropriate on-site drainage management, there is likely to be little impact on the surface water hydrology of the surrounding landscape. Surface drainage features will prevent water pooling on roads and changes to sheet flow due to road embankments.</p> <p>Preliminary engineering designs intend to prevent environmental effects of altered hydrology and include diversion channels and sediment ponds around the IWL and diversion channels and culverts across the main access road. Regular vegetation monitoring around these facilities will ensure early detection of potential effects to altered hydrological regimes. This is a component of the Vegetation Monitoring Strategy (Appendix B). (DMP 7)</p>

5.16 DECOMMISSIONING AND CLOSURE MANAGEMENT PLAN

Item Number	Comment
Decommissioning and Closure Management Plan - General	
DMP: 8	Appendix 3 DCMP Section 3.1, p5, 1 st bullet pt. Overall objectives should be landform compatible with the agreed end land use not the previous land use.
DMP: 12	Appendix 3, DCMP Section 4.3.2 Guidelines Draft EPA/DMP Mine Closure Plan Guidelines are now available for public comment. See link below. http://www.dmp.wa.gov.au/documents/Mine_Closure_Guidelines.pdf
CRL Response	Noted – Section 3.1 of the DCMP will be updated, with the overall objectives listed on p5, 1 st bullet point amended to the landform being compatible with the agreed end land use not the previous land use. (DMP 8) CRL acknowledges that Draft EPA/DMP Mine Closure Plan guidelines are available for public comment. (DMP 12) The DCMP will be updated to reflect results of additional studies and relevant comments received in the PER submissions. The revised DCMP will be lodged with the DMP as a component of the Mining Proposal.
Decommissioning and Closure Management Plan - Financial	
DMP: 9	Appendix 3, DCMP. Section 3.3, table 2, page 7, and section 5.2, p 14. Closure cost and company's financial provision. CRL could elaborate further on how its financial obligations are met with respect to mine closure (e.g. Asset Retirement Obligation cost estimate). Section 5.2 states that its financial Provision for mine closure meets Australian Accounting Standards Board (AASB) 137. How does AASB compare to international accounting standards that apply: Financial Accounting Board (FASB) Statement 143 (FAS 143) or the London Based International Accounting Standards Board (IASB) Standard 37 (IAS 37)?
DMP: 14	Appendix 3, DCMP Section 8.1.1, demolition, p24 CRL should check if the estimate for salvage value for the plant or other items at closure is allowed to be used against the closure cost estimate accounting standard used (AASB 137). I don't think that is allowed under FAS 143 or IAS 37.
CRL Response	For financial reporting purposes, CRL is not a 'reporting entity' and prepares Special Purpose Financial Reports for its shareholders; Murchison Metals and Mitsubishi Development. Accordingly, CRL is not subject to the disclosure requirements of the Australian Accounting Standards (AASBs), however follows the measurement and recognition requirements prescribed by the standards. (DMP 9) CRL adheres to AASB 137 to ensure all financial obligations in relation to providing for closure costs are adequately measured and recognised, and AASB 137 incorporates International Accounting Standard 37 (IAS 37). CRL is not required to report under US Generally

	<p>Accepted Accounting Principles (GAAP) standard FAS143 (now referred to as ASC410-20). (DMP 9)</p> <p>Although not specifically referred to in AASB 137, in practice, CRL separates salvage values from the calculation of the closure cost estimate. AASB 137 prohibits recognition of gains and losses from disposal of plant and equipment against the closure cost estimate. (DMP 14)</p>
Decommissioning and Closure Management Plan - Groundwater	
DMP: 10	<p>Appendix 3, DCMP Section 3.3, table 2, page 7. Groundwater impacts not mentioned. Groundwater KPI need to be included not just surface water.</p>
CRL Response	<p>CRL propose the following groundwater KPI for the JHEP:</p> <ul style="list-style-type: none"> • Groundwater monitoring is met. <p>This will be updated in the revised version of the DCMP, to be lodged with the DMP as a component of the Mining Proposal. (DMP 10)</p>
Decommissioning and Closure – Care and Maintenance	
DMP: 11	<p>Appendix 3, DCMP Unplanned Closure/Care and Maintenance scenarios.</p> <p>There is no mention in the DCMP of unplanned mine closure or the mine going under care and maintenance. How CRL would address such two scenarios?</p>
CRL Response	<p>Section 9: Suspension of Operations of the DCMP provides information on the strategies for unplanned closure or the mine going under care and maintenance. A Suspension Plan would be developed that meets the Mines and Safety and Inspection Regulations 1995, which governs care and maintenance periods. Table 9 of the DCMP provides Suspension Plan Criteria, which along with the provisions of the Mines and Safety and Inspection Regulations would form the basis of the Suspension Plan.</p> <p>The criteria for Suspension Planning would include:</p> <ul style="list-style-type: none"> • Surface Water: All disturbed areas will not be stabilised, so potential for erosion will remain. Suspension plan will address ongoing drain and sump maintenance to ensure continued sediment control. • Hazardous Substances: Storage of large volumes of chemicals and fuel will not be required with closure of mine, processing plant and power generation. The suspension plan will address removal of surplus quantities of hazardous materials. • Waste Management: Empty all rubbish bins on site. Remove bulk bins. Empty out all oil/water separators, wash down bay sumps etc. Close the active faces of the industrial and domestic landfill sites and remove all quantities of recyclable materials. • Reporting: With no activities on site, continues requirements for environmental reporting need to be reviewed (e.g. DEC Licence and National Pollutant Inventory trigger thresholds). The suspension plan will address the issues of renewal or cancellation of license and what reporting functions may still be required during the suspension period.

	Unplanned Mine Closure – should the mine be closed in perpetuity the DCMP will be implemented and the management actions undertaken in Section 8 of the DCMP will be implemented. (DMP 11)
Decommissioning and Closure – Consultation	
DMP: 13	Appendix 3, DCMP Section 6.1 and 6.3 Stakeholder Consultation Identification. P 16 & 17. The pastoral lands board is a key stakeholder and would have to be involved in any discussions relating to the use of facilities for use by the pastoral leases and transfer of liabilities post closure.
EPA 54	In your closure documentation you state that consultation will commence in the feasibility stage, however it appears that it has not yet commenced. Please check this.
EPA 55	Both EPA and DMP view stakeholder consultation as critical for mine closure planning. It is also critical that final land uses are identified “up front” (i.e. now) based on the stakeholder consultation.
CRL Response	Noted – CRL will amend 6.1 and 6.3 to include the pastoral lands board and consult with the board on the use of facilities for pastoral leases. (DMP 13) CRL has not formally commenced discussions with stakeholders, but acknowledge the importance of stakeholder consultation in closure planning. CRL is still in the Bankable Feasibility Stage of the JHEP, and will commence closure consultation as a component of this phase. (EPA 54, 55)
Decommissioning and Closure – Capping Material	
DMP: 15	Appendix 3, DCMP Section 8.2.3.2, p31, 1 st and 2 nd bullet points. The proponent will need to demonstrate that suitable capping material (which may require 2 different sorts of material) is available to: Form a suitable capping material for the tails to reduce potential seepage into the groundwater. Form a capillary break.
DMP: 17	Appendix 3, DCMP Section 8.2.3.2, p31, 4 th paragraph and 3 rd bullet point The proponent will need to demonstrate that there is suitable (inert and impermeable) material to cap the IWL to the stated depth of 5m.
EPA 57	It appears that topsoil will be in short supply (DCMP p25). How will effective cover for rehabilitation/revegetation purposes be achieved in this case?
CRL Response	Section 8.2.3.2 of the DCMP states that: <i>“capping would minimise the potential for:</i>

- *leaching of salts from the IWL into the groundwater; and*
- *capillary rise which could result in the salt from the tailings rising to the surface and affecting the vegetation on the rehabilitated surface.”*

However, there is currently nothing to suggest that the tailings produced from the JHEP will leach salts from the IWL into the groundwater or be susceptible to capillary rise of salts. The potential for these issues to occur will be subject to the final process water quality, the tailings properties and design of the IWL. A cover system will be designed to use the available construction materials to address these issues if they are identified as a concern. **(DMP 15)**

The statements made in the paragraphs referenced are incorrect. A cover of this composition and depth may not be necessary for the IWL. The studies completed to date with respect to Acid and Metalliferous Drainage (AMD) suggests that there will be an abundance of inert waste materials generated by the mine. However, the quantity of low permeability materials, such as clay, at the site is limited and would be insufficient to construct a 5 m thick cap, as this paragraph suggests.

Studies are currently underway to identify and characterise mine waste and naturally occurring materials within the JHEP site that will be used in the construction of the cover system. Modelling will be undertaken to confirm that the proposed cover system will achieve the closure objectives under the climatic conditions present at the site. **(DMP 17)**

In addition, it is recognised that the amount of topsoil harvested may not be adequate for addition to all areas of the JHEP that will require rehabilitation. CRL has since determined the maximum amount that will be available (Landloch 2010, Appendix B).

The current plan is to construct very rocky un-topsoiled batters, and place the topsoil in discrete zones where erosion potential is low i.e. on flatter zones on the top of the IWL that are surrounded by rock profiles with high infiltration rates. Therefore, if this style of landform is acceptable, topsoil will simply be applied to as wide an area as possible to zones that have suitably low gradient and suitably short slope lengths (Landloch 2010, Appendix B).

The soils from the flats are sandy and were measured to be unacceptably erodible when placed on the outer batter, even when mixed with rock (1:1 rock: soil mix and 2:1 rock: soil mix were tested). Use of rocky armoured batters is therefore likely to be the best opportunity Crosslands has to develop stable batter profiles. The intent would be for vegetation to grow within the waste rock (it does contain some fines that would increase water holding capacity and that may provide suitable support for vegetative growth). **(EPA 57)**

Decommissioning and Closure - Investigations	
DMP: 18	Appendix 3, DCMP Section 8.2.4 Workshops, p35, 36 and Section 8.2.6, p37 Contractor's yard The concrete pads/footings will need to be checked for hydrocarbon contamination and the affected areas treated/removed prior to being broken up and buried on site.
CRL Response	Noted – the DCMP will be amended to include investigations for hydrocarbon contamination, with any affected areas treated/removed prior to being broken up and buried on site. (DMP 18)

5.17 VOID MANAGEMENT

Item Number	Comment
EPA 16	Please explain why backfilling of the pits to above the water table is not proposed after mining is complete.
WS: 1	What should be considered however is the back filling of the pit, particularly as one long pit of several kilometres is proposed at present. Backfilling would result in a significantly improved environmental outcome.
DEC: 10	Issue: The current proposal will leave permanent water-filled voids at closure. These present a residual risk to native species due to changes in water quality over the long term and provide more favourable conditions for introduced herbivores and feral predators due to the artificial availability of water. Recommendation 9: That the mine void is backfilled to a level that will prevent the formation of permanent surface water. Recommendation 10: That in the event that permanent water-filled voids as proposed in the PER, are found to be environmentally acceptable and approve, the following provisions be mandated for implementation of the proposal: <ul style="list-style-type: none"> • Management of void water quality; • Fencing (and funds to manage the fence in perpetuity) of the mine void post closure to restrict access by fauna; • Monitoring and control of introduced grazing animals resulting from an increase in fauna attracted to the water-filled void; and • Monitoring and control of increases in feral predators.
CRL Response	The PER is based on known reserves for the JHEP. Several hundred millions of tonnes of Inferred resources are known to exist beneath the current Reserve pit. CRL plan to continue exploration activities in order to prove up these resources. Future development plans for the mine will likely utilise backfill of the pit as part of the mining strategy to recover this ore. (EPA 16; WS 1; DEC 10)

	<p>Kalamunda Pool is a permanent water source, located approximately seven kilometres from the pit. This water source supports herbivores and feral predators in the local area. A pit void with water will not add to the number of feral animals in the local area. It is likely that, upon consultation with pastoralists regarding closure, they are going to prefer a permanent water source for their introduced herbivores. There is a conflict of interest that is beyond CRL's control, although CRL will engage all stakeholders to resolve these issues and come to a compromise. (DEC 10)</p>
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5.18 OFFSET PACKAGE

Item Number	Comment
DEC: 1	The proponent's initiative in developing indicative conservation land management and research projects as potential elements of an offset package is commended. A detailed and targeted conservation offsets package prepared in collaboration with stakeholders, include DEC, could be further developed to address the identified residual impacts on flora of conservation significance and threatened fauna should this proposal be approved.
DEC: 2	<p>Issue: The proposal will require the clearing of approximately 7,719 hectares of native vegetation (including the loss of approximately 1,100 hectares of upland banded iron formation (BIF) communities), and will directly impact on nine priority listed flora species including, three priority 1 and six priority 3 taxa.</p> <p>Recommendation 1: That changes to design and location of infrastructure are made where practicable to demonstrate a reduction in the potentially significant impacts of the current proposal on the regional conservation status of flora of significance (i.e. <i>Stenanthemum mediale</i> (priority 1), <i>Prostanthera ferricola</i> (priority 3), <i>Prostanthera petrophila</i> (priority 3) and <i>Homalocalyx echinulatus</i> (priority 3) through avoidance or locating additional plants/populations in the local area.</p> <p>Recommendation 2: That when the proponent has either clarified or reduced the impact on the identified significant flora species through changes to proposal design as recommended, DEC is engaged in discussion of potential offset opportunities to address significant residual impacts on these species.</p>
DEC: 4	DEC supports the commitment made by the proponent that the impacts on nine priority flora species, as part of the Jack Hills project proposal, necessitate the development of an offset for the species identified in this advice. It is preferred that the offset package include further targeted surveys to clarify the size and conservation status of other populations in the region.
DEC: 5	Issue: The proposal will result in a 76 per cent loss of the Jack Hills vegetation complexes on banded ironstone (<i>Triodia melvillei</i> vegetation

	community) priority ecological community (PEC). Recommendation 3: That the proponent further engages DEC in discussions of potential offset opportunities to address the impact on the Jack Hills Triodia PEC.
DEC: 6	Issue: The proposal will result in an 18.57 per cent loss of the largest known and most northern population of the declared threatened fauna species <i>Idiosoma nigrum</i> (shield-backed trapdoor spider). Recommendation 4: That conservation offset measures are implemented to mitigate the residual impacts on the <i>Idiosoma nigrum</i> (shield-backed trapdoor spider).
EPA: 3	Noting the large extent of vegetation loss as a direct result of clearing for the proposal and the impacts on priority species, an appropriate offset package will need to be prepared in consultation with the DEC.
CRL Response	CRL has undertaken measures to avoid impacts on sensitive receptors and agrees that the adoption of techniques to minimise impacts will be undertaken at every reasonable opportunity to ensure significant impacts on biodiversity or ecological function do not occur. CRL has initiated negotiations with DEC to progress the development of an offsets package. (DEC 1-6; EPA 3) The agreed offsets package will be developed in line with comments made in this submission response. Unavoidable clearing and impacts on protected or conservation significant species will be mitigated through a combination of contributing and direct offsets. The offset package will provide long-term benefit to the area by improving knowledge, research, conservation and restoration. (DEC 1-6; EPA 3)

5.19 AGE OF ROCKS

Item Number	Comment
WS: 5	Other Matters: the age of some of the rocks in the area Several of our members have raised the point that the Jack Hills contain the oldest known rocks on the earth. We are surprised that this aspect has not been addressed. We would have expected this matter to be discussed at least in a regional context and the impact on the sites of the oldest known rocks. We request this matter to be investigation and appropriate action taken and included in the EPA report.
CRL Response	The JHEP lies in the Narryer Terrane of the Archaean Yilgarn Craton of Western Australia. The JHEP area is near the northern edge of the Yilgarn Craton in an area of strongly outcropping meta-sedimentary and metavolcanic ridges surrounded by poorly outcropping granitoid and gneiss basement.

The Jack Hills range syncline is of Archaean age (before 2500 Ma). The meta-sediments and met-igneous rocks that make up the prominent ridges of the Jack Hills range are some 60 km long and up to 7 km wide. The proposed JHEP is 7km long situated toward the north-eastern end of the range. The JHEP occupies approximately 10% of the Jack Hills Range.

Geochronological studies undertaken in the Murchison Domain show that most greenstones and granitic rocks were deposited or emplaced between c.3000 and 2600 Ma (Pidgeon and Halberg, 2000). Previously all meta-sedimentary rocks in the Jack Hills greenstone belt were thought to be Archaean, but it has now been recognised that some are Proterozoic (Cavoise et al., 2004; Dunn et al., 2005). It is generally difficult to distinguish the Proterozoic rocks from Archaean meta-sedimentary rocks due to lithological similarity, deformation, and recrystallisation (Spaggiari, 2007).

A number of detrital zircons have been analysed from the Jack Hills greenstone belt, with most of the work focused on zircons that are 4000 Ma and older (Hadean eon), and much of the work has come from a single pebble metacomglomerate outcrop in the mature clastic rocks at Eranoondoo Hill (Spaggiari, 2007) situated approximately 40 kms west from the proposed Crosslands JHEP. **(WS 5)**

6. APPENDICES

A – Figures

- Figure 1 JHEP Footprint
- Figure 2 Gas pipeline Corridor
- Figure 3 Flora & Fauna Surveyed Areas
- Figure 4 Camp and Airstrip
- Figure 5 Preliminary Site Water Balance
- Figure 6 Byro Sub Basin Borefield
- Figure 7 Murchison Borefield
- Figure 8 Heritage Surveyed Areas

Golders Figure A

B – Further Studies

- Vegetation Monitoring Strategy (Cardno, 2010).
- Draft Soil Quality Assessment of the Jack Hills Project (Landloch, 2010).
- Draft Rehabilitation Guidelines for Jack Hills Waste Landform (Landloch, 2010)
- Review of Waste Management Services (Bowman and Associates, 2010)
- AMD Progress Report (SGS, 2010)
- Eco-village Sustainability Report (Cardno, 2010).
- Memo on Pit Dewatering Assessment (SRK, 2010).
- Preliminary Murchison Borefield Assessment (Aquaterra, 2010dix B).
- Stygofauna Progress Report (GHD, 2010; Appendix B).
- Annual Vegetation Monitoring Report (Cardno, 2010; Appendix B).
- Assessment of Rehabilitated Exploration areas at CRL, Jack Hills Operation and a Proposed Research Framework for *Triodia* Restoration (G&G Environmental, 2009; Appendix B).