

THE INVISIBLE MINE

ENVIRONMENTAL
COPPER
RECOVERY

Introduction

Very early stages of development

The Project

The Kapunda project is still very much in its infancy

We are in the first stage of conducting the laboratory tests to see if copper could be recovered

No guarantee of proceeding

Some of the questions posed are very detailed, we will provide answers as best we can we at the moment but it is worth noting that as the project is in such an early stage that a lot of these questions would only really be answered fully during/after detailed engineering studies (scoping or pre feasibility level). The project is still in the initial evaluation phase and nowhere near detailed engineering stage at the moment.



Introduction

In this presentation we will cover

- What is ISR and how is it different to conventional mining
- Effects of ISR
- Access and tourism
- Potential economic & tourism impacts

Definitions

Some Government jargon

- Ministerial Determination – extensive list of questions government will want answered before mining lease is granted
- PEPR – Program for environmental protection and rehabilitation, main govt document that allows operation to commence

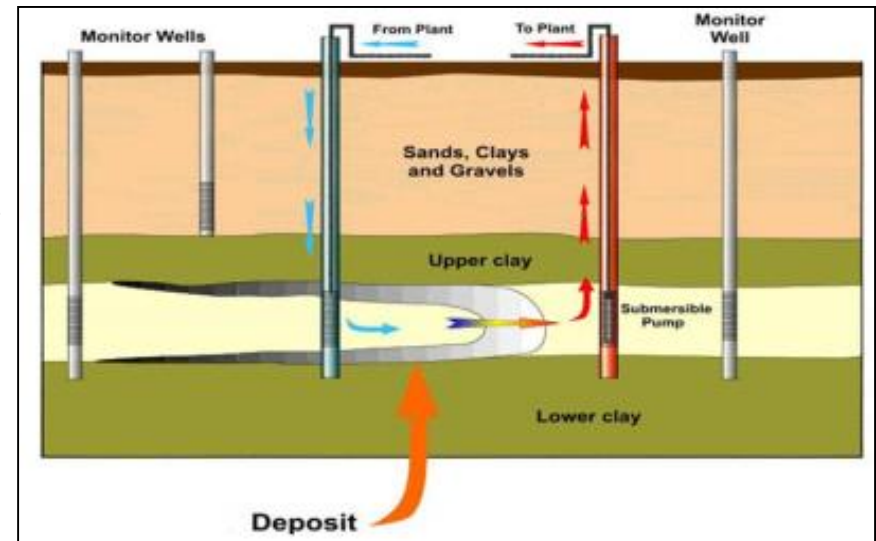
What is ISR?

At Kapunda copper is naturally leaching from the rock

In-Situ Recovery (ISR) is a method that can work with nature to accelerate this process

It has been used to mine minerals (Uranium & Phosphate) since the 1960's and also used in the remediation of environmentally contaminated sites.

- ❑ Series of wells or bores are drilled into a **targeted** host ore body.
- ❑ A benign alkaline solution is then pumped underground to dissolve valuable copper from the ore body.
- ❑ This copper containing solution is then pumped out to a recovery plant to separate and process the metal for market.



<https://youtu.be/QX3Ko4O4ryQ>

How is it different to conventional mining?

- ISR offers an effective method of extracting copper
- ISR can use environmentally benign extraction solutions
- ISR removes the requirement for substantial earthworks (no digging, no explosions, no dust)
- And hence has very low visual impact and less noise (electric submersible pumps with maybe “slooshing” noise of liquid)
- And creates relatively little land disturbance
- ISR infrastructure is temporary
- ISR will be away from heritage sites and public access

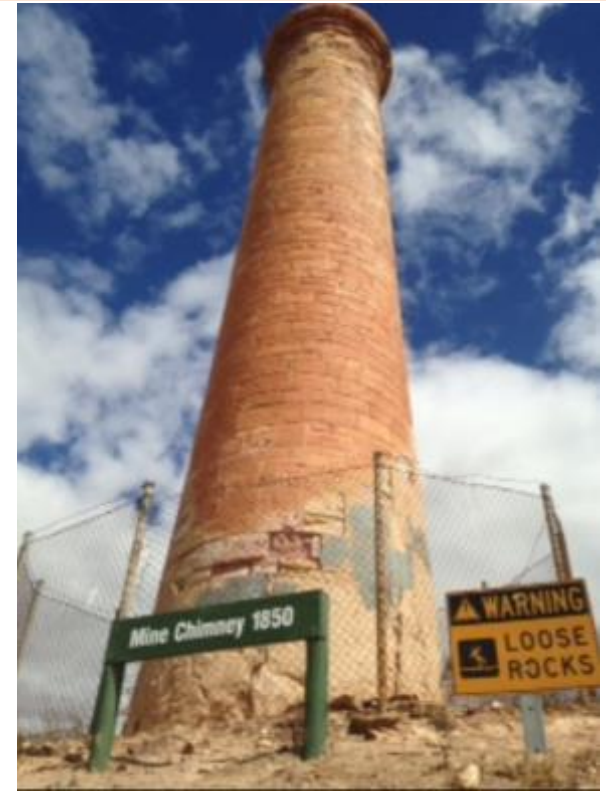


Nicholls Ranch ISR Mine (Uranium), Courtesy by Dr D.Robinson CSIRO August 2017
Small black dots are top of the bores or well heads

What will be the effect of ISR at Kapunda?

Done effectively ISR will:-

- Have no lasting negative effect on the mine aquifer water quality (possibly even some slight improvement)
- Have no negative impact on surrounding aquifers or Light River ecosystem
- Allow tourism to continue at the mine while operations are on-going
- Have little impact to heritage sites or historic mining structures
- Have very low visual impact while operating with minimal noise
- Leave little surface impact after mining
- Have a positive economic impact on the local economy
- Benefit SA and help it reach its Copper Strategy production targets



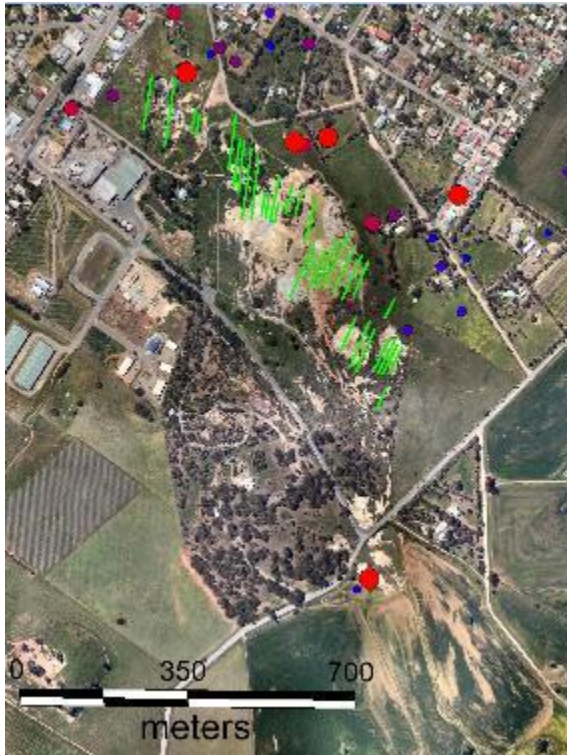
Review of Environmental reports

The Existing Facts

- Current mine aquifer is heavily contaminated with salts and copper (300 times recommended drinking level- NHMRC)
- Current mine surface water runoff is also heavily contaminated with copper
- Ground and surface water pH is variable from pH of 3.5 (acidic) to pH of 9 (alkaline)
- Soils are heavily contaminated with copper
- Light River has been classified as “poor” by the EPA (EPA reports 2011 & 2016)
- A natural acid leach process is already occurring at Kapunda and has been for over 100 years

Current Regulations under the Mining Act would not allow an un-rehabilitated mine site to be left in a similar condition today

- What is the likelihood that the solution may contaminate the aquifer outside the mine area?

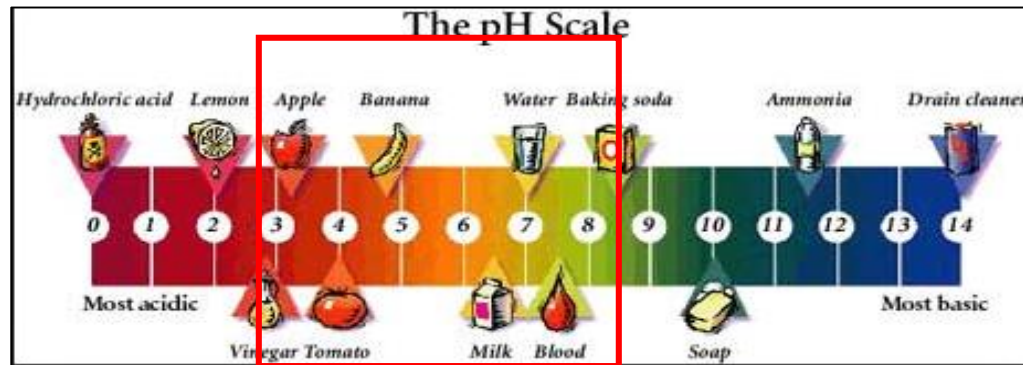


- It appears that natural hydrogeology is containing the current copper rich water in the mine area
- Management and monitoring of solutions would be large part of ISR operation Regulatory requirements

- If solution does flow into the aquifer, what are the potential consequences, and how dangerous?

Lixiviant solutions being assessed (glycine and thiosulphate) are benign, biodegradable

Any excursions would be monitored and controlled.



- What will be the quality and safety level of the water left in the mining area once mining ceases What will be the long-term impact on the aquifer?

Potentially improved - baseline environmental studies currently show high levels of salinity and copper

Above ground pumping and processing risks:

- How will the risk of leakage from bore heads and pipes be managed to prevent environmental damage?

Pipe and pumping systems are fitted with flow and pressure monitoring sensors. If high flow / low pressure (pipe failure) or high pressure / low flow (pipe blockage) is detected, then the system shuts down.



The white pole is purely to alert reversing trucks!

Tray with leak sensor to capture any excursions of the benign lixiviant

- If the extraction rate must be higher than the injection rate to ensure solution flow in the required direction, what is the net impact on water levels in the aquifer?

Water levels near the mine site will be lowered slightly, however on a regional scale the impact will not be measurable.

Public Access and Tourism

Will tourist access to the mine site be substantially as it is now?

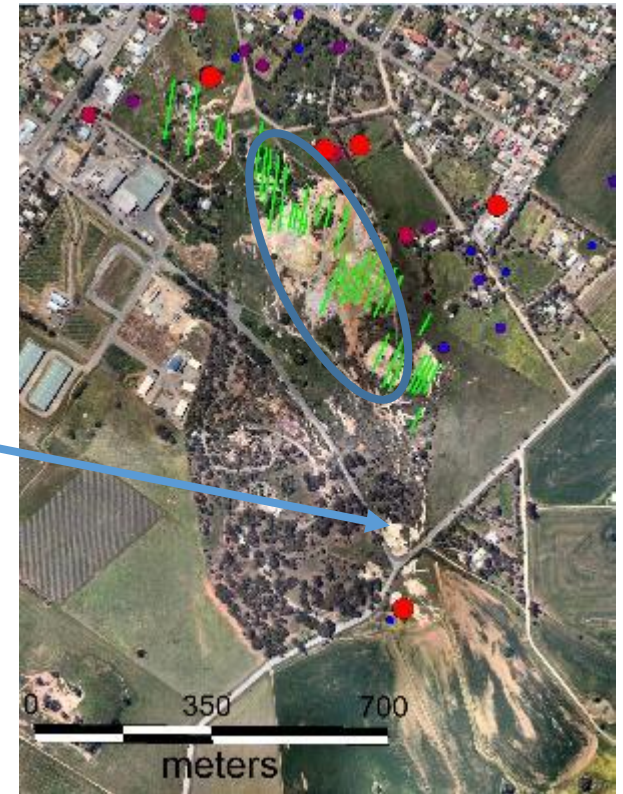
Yes within WHS guidelines

Will the above-ground infrastructure (including pipes and processing plant) be such that visual amenity is not significantly impaired or movement around the mine restricted or made unsafe in any way?

All infrastructure (trunklines and processing house) can be placed in consultation with council to allow minimal disruption e.g. southeast corner

Will the infrastructure and extraction process impact on significant historic mining structures?

No, mining activity should be able to exclude heritage areas. We will try and focus most activity within the fenced off areas or areas with little public access (see approx. blue circle)



Public Access and Tourism

Will the mining company provide, for the benefit of tourists, interpretive signage (including electronic animated signage) to explain the process being used?

Yes, happy to work with council on enhancing tourist communication

Once mining is completed, what infrastructure will remain, and what will be its impact on the site's safety and tourism potential?

No infrastructure will remain, and the site returned to state it is today if not improved environmentally with an advanced tourism site if desired.



Trunklines can be placed in consultation



Tops of Well Heads at a mine in Wyoming

Council Safeguards

- What guarantees would there be to ensure that commitments made to secure Council agreement are met?

The Mining Act is the regulatory document under which mining companies and DPC must comply.

- In the event of one or more commitments not being met, what recourse would Council have to ensure they are?

The Act stipulates penalties for non-compliance, enforced by DEM regulation and rehabilitation section

Quick Overview of Regulatory Processes

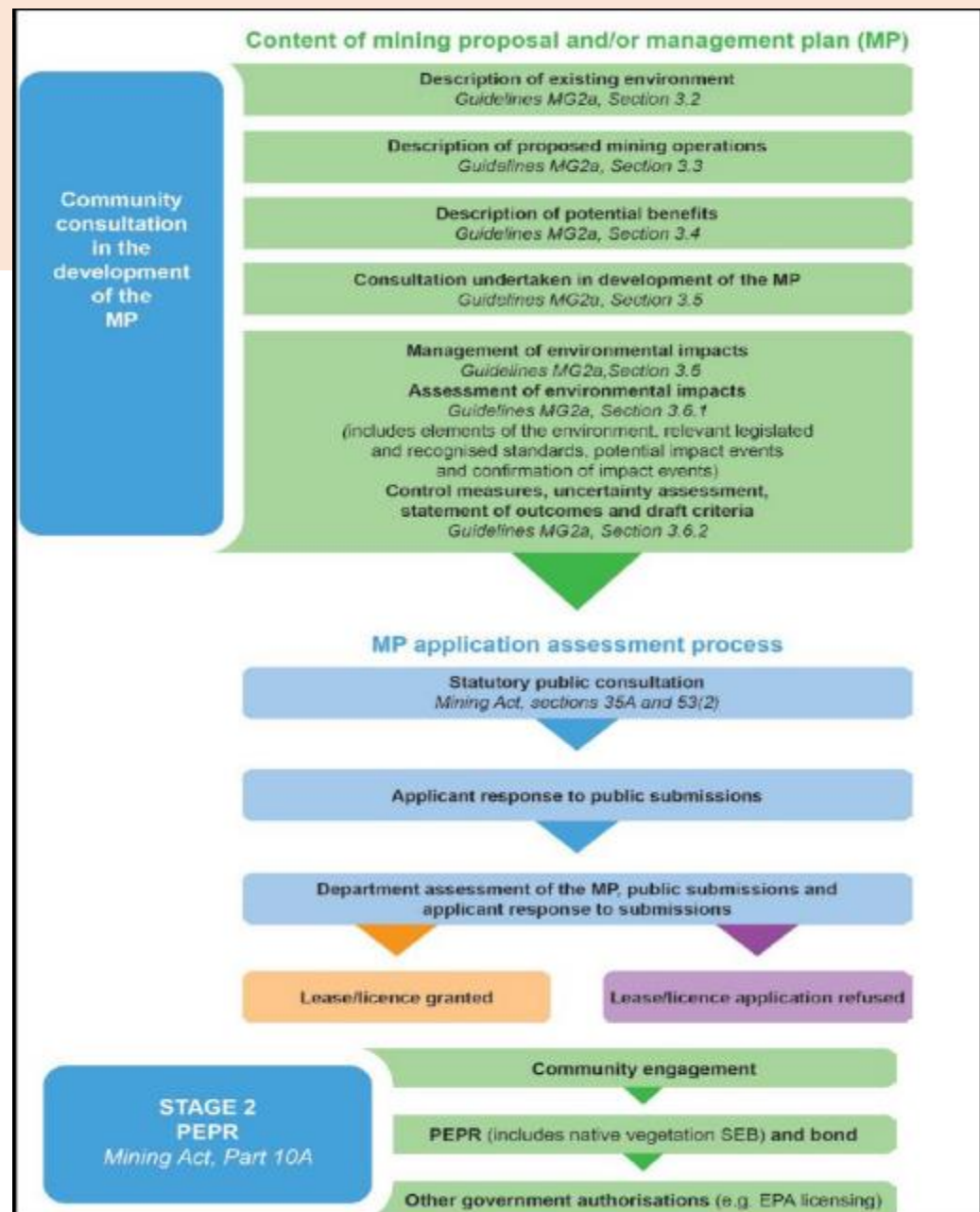
- Mining in SA is one of the most highly regulated industries in Australia!
- No project can go ahead without approvals from stakeholders (community, local council etc.) or approvals from numerous government agencies:-

(Department of Energy and Mines, EPA, DEWNR, Department of Heritage, DPTI)

- Mining Act states that companies must negotiate with all stakeholders and interested parties get to have their point of view assessed on projects
- Approval process is rigorous and well defined
- Once a project is in operation, compliance issues can be lodged by parties to the Mining Regulation and rehabilitation branch and penalties for non compliance are severe.

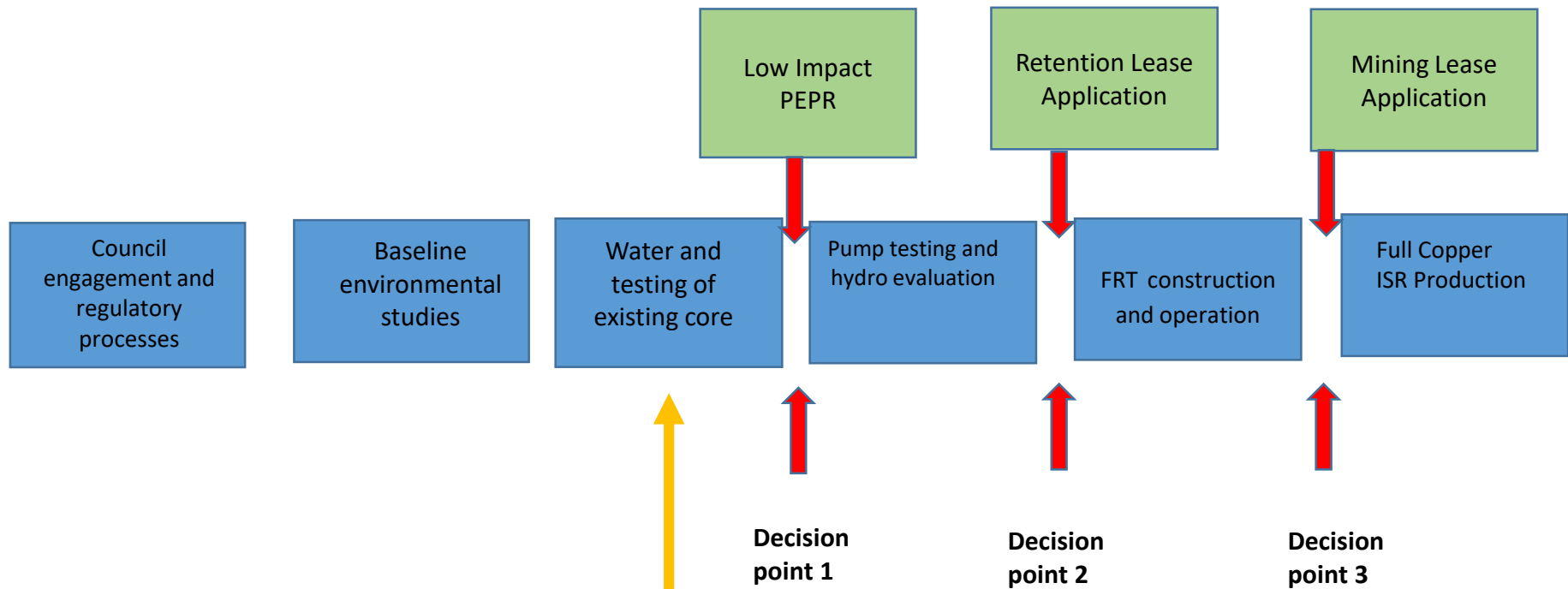
Regulatory Processes

- The document right is an attempt to explain the regulatory processes set out by DPC under the Mining Act.
- ECR do not envisage even contemplating this process until at least 2020/21



What does Kapunda process look like?

Community Consultation & Regulator Consultation



Time Line

May 2018

2020+

What is ISR's economic impact?

25+ Direct Employment opportunities

- What contribution to the local and state economy will this project make?

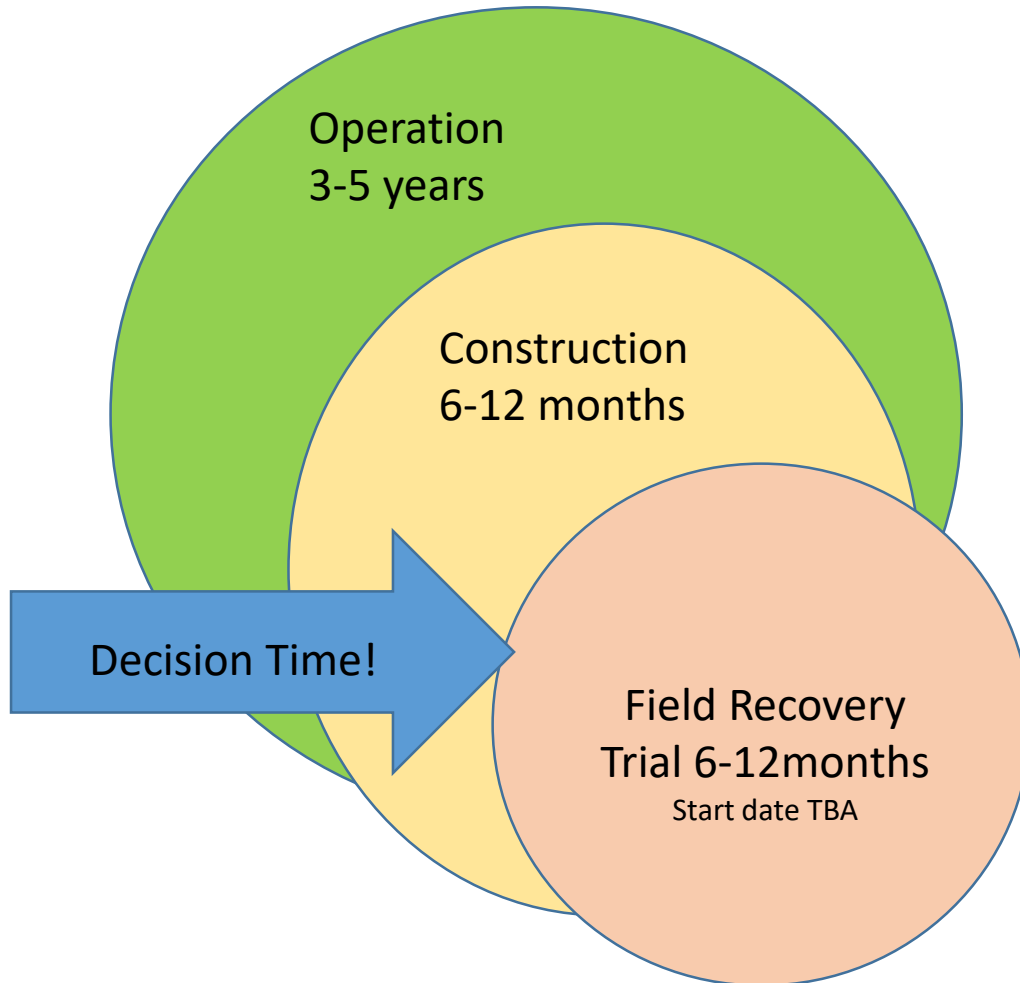
Local economy – under the Mining Act compensation must be negotiated with the landowner (LRC)

Between 15 - 25 local jobs sourced from within Kapunda for both construction and operation

State economy – contribute \$1-2 million in royalties as well as supporting the Copper Strategy to triple this states copper production by 2013

How many jobs?

25+ Direct Employment opportunities



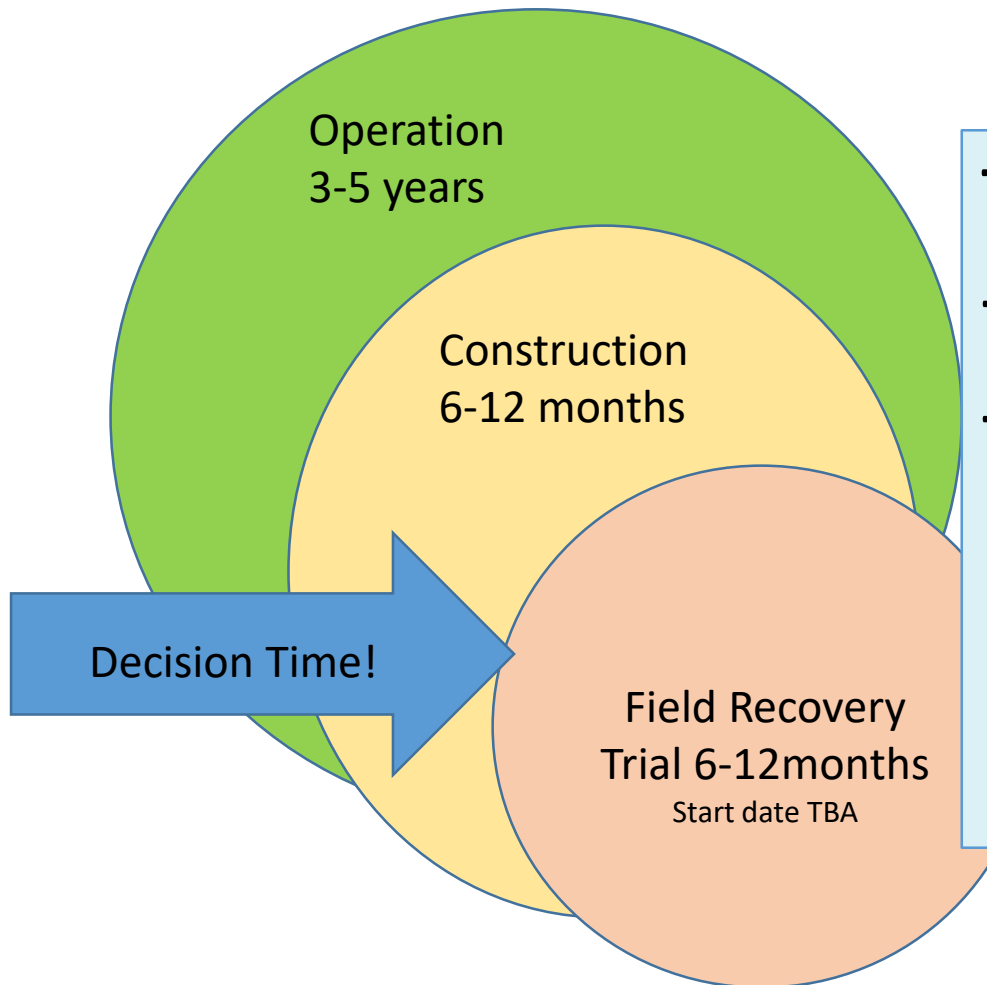
- Office staff
- Well field techs
- Plant operators
- Supervisors
- Drilling
- Earthworks
- Labourers
- Electricians
- Plumbers
- Poly welders

← Accessed Locally

← Accessed Locally

How many jobs?

25+ Direct Employment opportunities

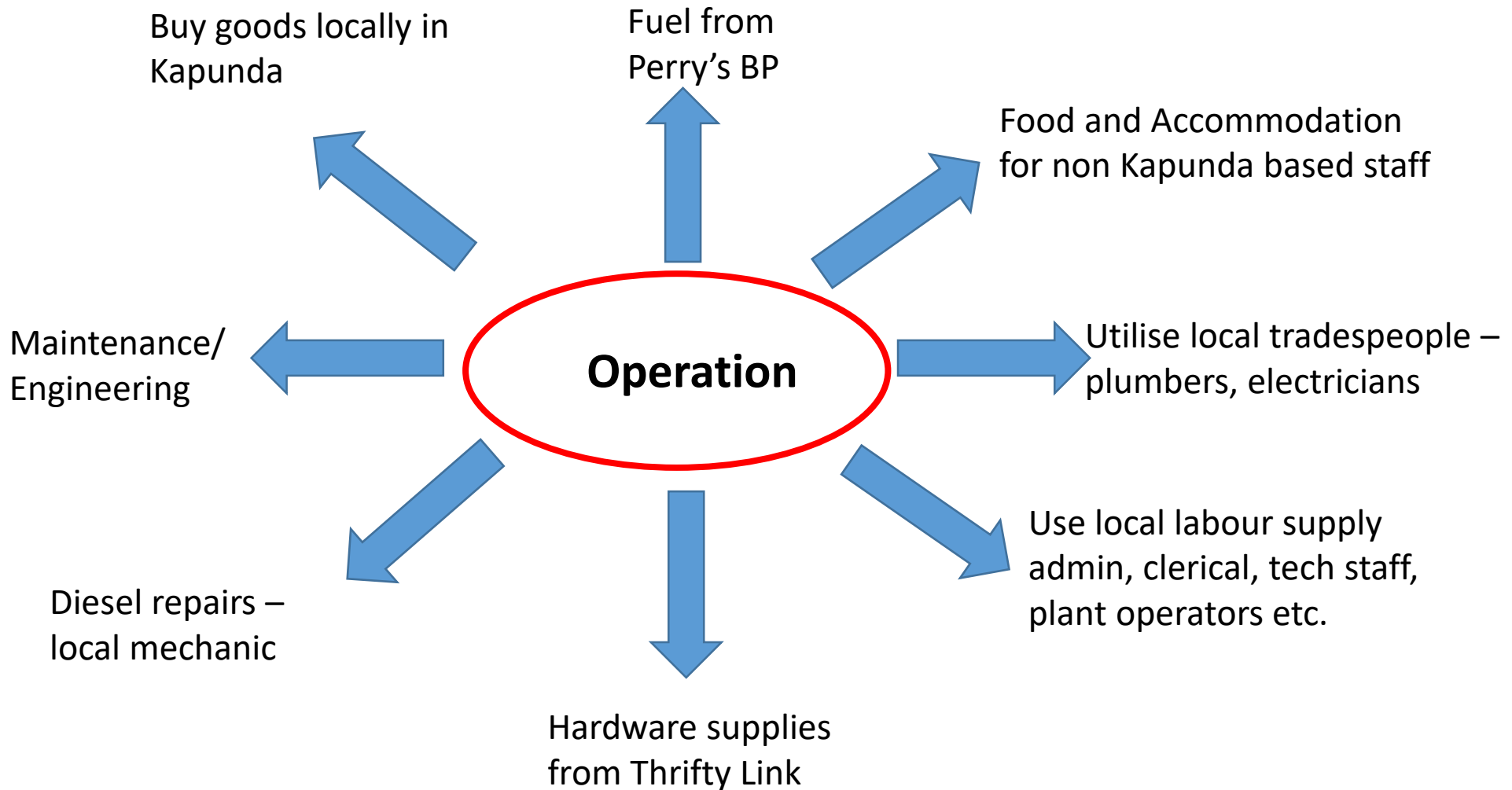


Then all the indirect flow-on opportunities for Kapunda and SA

- ✓ Tourism
- ✓ \$\$Compensation
- ✓ Copper Strategy

Economic Impact

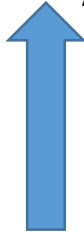
Use local service providers



Economic Impact Example

Use local service providers

Driller Leon Dickinson (Leon @ DrillSmith) – buys goods locally in Kapunda



Maintenance – Engineering



Fuel from Perry's BP



Diesel repairs – local mechanic

Longer term implications

*Rehabilitation
Tourism
Future mining
REEs*

Rehab

As per Mining Act SA 1971

Environmental impact

Potentially improved

Light Regional Council

Economically advantageous, as the land owner

Rare Earth Elements (REEs)

- Are rare for a reason, extremely difficult to extract and process
- Known REEs can be isolated and localised with the ISR process
- Can we mine them? There is no economic value of REEs at Kapunda

In Summary

*Lab work
Pump testing
Access
Tourism*

Early stages of investigation based on results of:-

Lab work - Water sampling to ascertain copper levels & core and rock chip sampling to ascertain if copper can actually be extracted by benign lixivants

Next stage (assuming lab work success):-

In field pump testing

Baseline environmental studies show existing issues

If anything goes ahead, economic benefits to LRC

Public access will be maintained with some restrictions

Kapunda could be the **first** Copper In-Situ Recovery mine in Australia
Tourism opportunity during and after

www.environmentalcopper.com.au