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In Situ Recovery Keynote

OPPORTUNITIES AND CHALLENGES FOR COPPER ISR - KAPUNDA CRC-P AS AN EXAMPLE

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ABSTRACT

EnviroCopper subsidiary, Environmental Copper Recovery Pty Ltd (ECR), commenced research into potentially the first Australian fractured rock Copper ISR project in 2017, 90kms north of Adelaide at the historic mining site of Kapunda in South Australia. Initial investment came from junior Thor Mining PLC then in 2018 ECR received a Cooperative Research Centre Project (CRC-P) Grant from the Commonwealth Government of Australia for $2.85 million to take the project forward.

Presenting at ALTA 2019, ECR introduced the research aims and objectives of primarily advancing ISR as a technique that can be applied to a far wider range of deposits than previously thought, opening up a potentially significant number of previously stranded assets to profitable, low impact recovery. In the last few years ECR have seen a significant increase in interest from all sectors of the mining industry ranging from the juniors to major mining companies in investigating the potential of ISR to work effectively on some of their deposits. It is becoming apparent that there are significant number of potential ISR opportunities both within Australia and throughout the world that might be taken forward, if a suitable path in the technical, regulatory, and social license space can be found.

EnviroCopper understand the significance of this project for the mining industry and the responsibility of establishing a "template" for industry to undertake future projects. The Kapunda project has significantly advanced since last ALTA meeting with many positive technical results, however, like other similar copper projects in the world, it is clear that the path forward for ISR projects in the regulatory, investor and community spaces is currently not quite as smooth as it could be. Most of these issues revolve around education and enabling greater understanding of the ISR process and its potential impact on the environment.

South Australia has 2 permitted Uranium ISR projects, with an established regulatory framework to deal with this technique and commodity, however, the framework for regulation of uranium ISR is not necessarily a perfect fit for copper (or other metal commodities). It is becoming increasingly apparent that there needs to be some consultation on the regulatory framework for ISR of metals other than uranium that involves the different levels of state and local government and the various acts and departments that are involved in approving potential ISR operations. (382 words)

Keywords: Cooperative Research Centre - Project (CRC-P), Stranded assets, Social License to Operate, Environmental mining, Copper ISR, Innovation

INTRODUCTION

In this paper, we will look briefly at the reasons why copper is a strategically sound commodity target and review the benefits and opportunities for In-Situ Recovery (ISR) of copper to produce low cost - high profit output of copper products. We will then cover some of the challenges associated with finding and developing suitable ISR target deposits using Kapunda as an example. The key areas to be covered include – Technical, Environmental, Social, Governance (ESG) and Investor. While not being an exhaustive list, these areas form the main group of challenges in taking an ISR project forward in the current economic and ESG environment. But first a recap or reminder to the audience of current copper demand which presents opportunities for Copper In-Situ recovery and Environmental Copper Recovery's research program.

Copper Demand and COVID

No one could discuss Copper in 2020 without at least having a brief discussion around the impact of COVID-19 This pandemic has impacted every facet of life with mining being no different. COVID-19 has affected both the supply and demand sides of the copper equation, Figure 1 below shows some revised production estimates for major producers from May 2020 indicating a substantial impact on production for some companies (values in 1,000 metric tons).

	Original production	Revised production
First Qantum Minerals	855	780
Rio Tinto	550	497
Vale	44	370
Lundin Mining	284	278.5
Freeport-McMoRan	1.6	1.4
Glencore	1.3	1.25
Total reduction	-	4,600

Figure 1: Table showing revised production figures for selection of major copper producers. (source:https://www.statista.com/statistics/1125680/global-impact-of-covid-19-on-copper-mining-companies)

Demand for copper has also dropped by as much as 5%, according to some estimates, which is significant in world market terms.

Figure 2: Graph showing demand for copper 2018 – 2020 (source - https://smallcaps.com.au/copper-market-soars-inventories-decline-chinese-panic-buying)

However, it is not all doom and gloom, general consensus seems to be that the combination of fiscal stimulus packages, clean energy and digitalization programs will boost demand and lift prices above previous levels. Below are some selected quotes from various sources on the likely demand for copper post COVID.

"We expect the reactivation of economies in the U.S. and Europe to lift industrial metals demand the rebound in China, however, is pivotal to a sustained recovery in prices. The recent 6.1 trillion yuan Chinese stimulus announcement targeting infrastructure investment will help mitigate the harsh realities of a deep global recession" -
https://www.spglobal.com/marketintelligence/en/news-insights/research/covid19-impacts-metals-price-recovery-fragile-as-recession-concerns-loom

"widescale fiscal stimulus measures would help drive demand for the metal back to pre-crisis levels next year, he noted, with traders and miners expecting consumption to rebound by 4% in 2021"-
Welcome to the age of copper': Why the coronavirus pandemic could spark a red metal rally -
https://www.cnbc.com/2020/06/24/coronavirus-why-the-pandemic-could-spark-a-copper-rally.html

According to Eurasia Group's note, clean energy and digitalization programs were expected to push average annual growth demand for copper up by 2.5% this decade, which would likely drive consumption toward 30 million tons by 2030. –
https://www.cnbc.com/2020/06/24/coronavirus-why-the-pandemic-could-spark-a-copper-rally.html

The Emerging Need for In-Situ Recovery (ISR) for Other Metals

ISR offers the opportunity to:

- profitably recover previously uneconomic, lower grade resources or resources constrained by conventional extraction,
- offer large potential for value realisation if successful,
- offer relatively low capital cost to get into production, which can easily and flexibly respond to volatility of commodity markets.

From a stakeholder engagement/social license viewpoint, ISR as a mining method has several strategic advantages including:

- low visual impact
- small footprint
- reduced competing land use issues

For these reasons, ISR is much more likely to be a socially acceptable form of mining. Plus there are also strong economic reasons why ISR should be considered as a viable mining technique.

For the right deposits, the economic benefits of ISR are compelling. As an example, taking operating costs for a conventional open cut mining operation, most of the costs are incurred in the mining and communition stages (Figure 3 below). ISR does not require mining/crushing/grinding so removes several categories of this expenditure.

Figure 3: Diagram highlighting areas not required with ISR operation.

A common reason for people to overlook ISR as a potential mining technique, is because of the perceived poor recovery of an ore body, “you can only recover 60-70%” is a common argument. The following diagram highlights that although ISR recoveries may be lower than conventional operations, profit margins can be similar.

It is important to look at the margin per tonne when considering ISR.

***If you halve your production BUT double your margin – your project Net Present Value (NPV) remains the same* (Figure 4)**

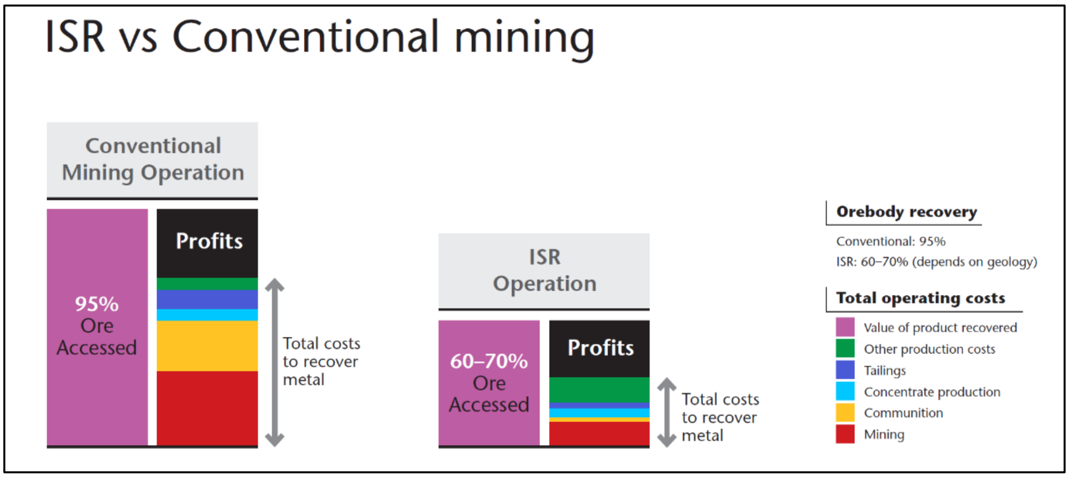

Figure 4: Comparison of differences in economics between conventional mining and ISR highlighting similar potential profit margins.

Existing Early Copper ISR Operations

As an example, we could look at some of the US operations. It can be seen that at the time of publication, they were looking at all in costs of between $USD1.11 – 1.44 per pound ($AUD3-4,000 per tonne).

This leaves a substantial margin with the current copper price hovering around $AUD8,000.

Figure 5: Figure showing locations of current U.S. ISR copper operations.

Table 1: Table showing economic parameters for some US operations (data from Ni-43101 documentation and company presentations)

Company	NPV ($US M)	IRR %	Discount rate applied %	All in costs US $/lb
Gunnison	$807	40.0	7.5	$1.23
Van Dyke	$209	27.9	8.0	$1.44
Florence	$503	29.0	7.5	$1.11

These show that in the right circumstances, ISR production of copper should make good returns on investment dollars in the near future and provide healthy profit margins.

In Summary ISR is:

- Low impact
- Scalable
- Relatively low OpEx
- Healthy margins

There is also one more significant upside for ISR - ***many potential Copper ISR Opportunities have already been identified!***

Potential ISR Opportunities

Due to recent advances in technologies associated with ISR (lixiviant systems, barrier technologies etc.), a wider range of geological settings than previously considered are likely to be amenable to this technique.
In 2019, Geoscience Australia estimates of "paramarginal" ore in Australia were:-

- 1Mt of Cu
- 150 tonnes of Au

Paramarginal: That part of subeconomic resources which, at the time of determination, almost satisfies the criteria for economic.

The main characteristics of this category are economic uncertainty and/or failure (albeit just) to meet the criteria which define economic. Included are resources which could be produced given postulated changes in economic or technologic factors.

This equates to somewhere around $20 billion of metal sitting in the ground – at least some of this is likely to be amenable to ISR and a significant portion of it will likely have already been drilled to an inferred resource level.

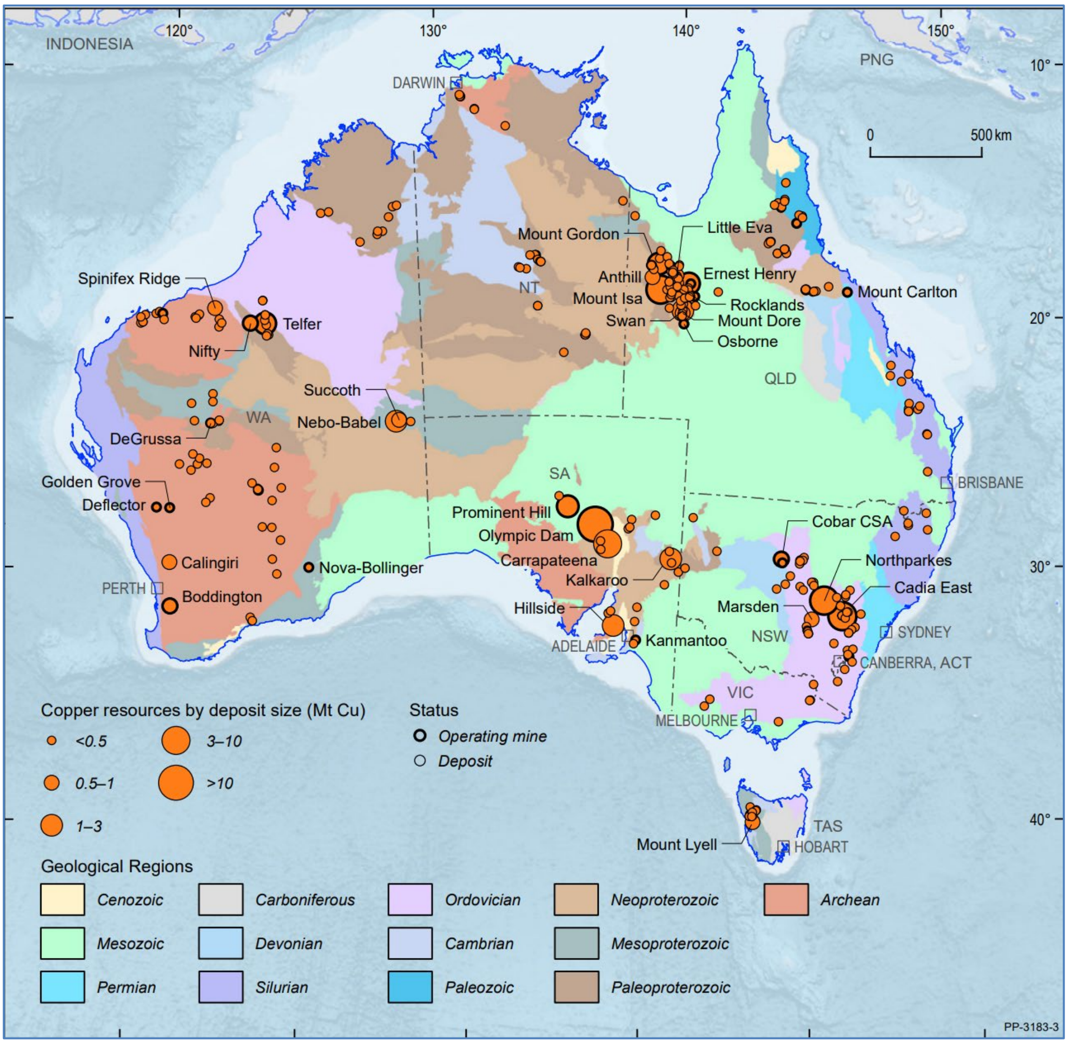

Figure 6: Map showing Australian copper resources – image taken from Geoscience Australia website.

South Australia

In South Australia alone, there are over 900 known copper occurrences, of which greater than 100 contain oxide copper species (leachable copper) and occur in rocks that may be suitable for ISR. These represent a potentially significant opportunity for copper and gold ISR in SA, the Kapunda project is just one of these.

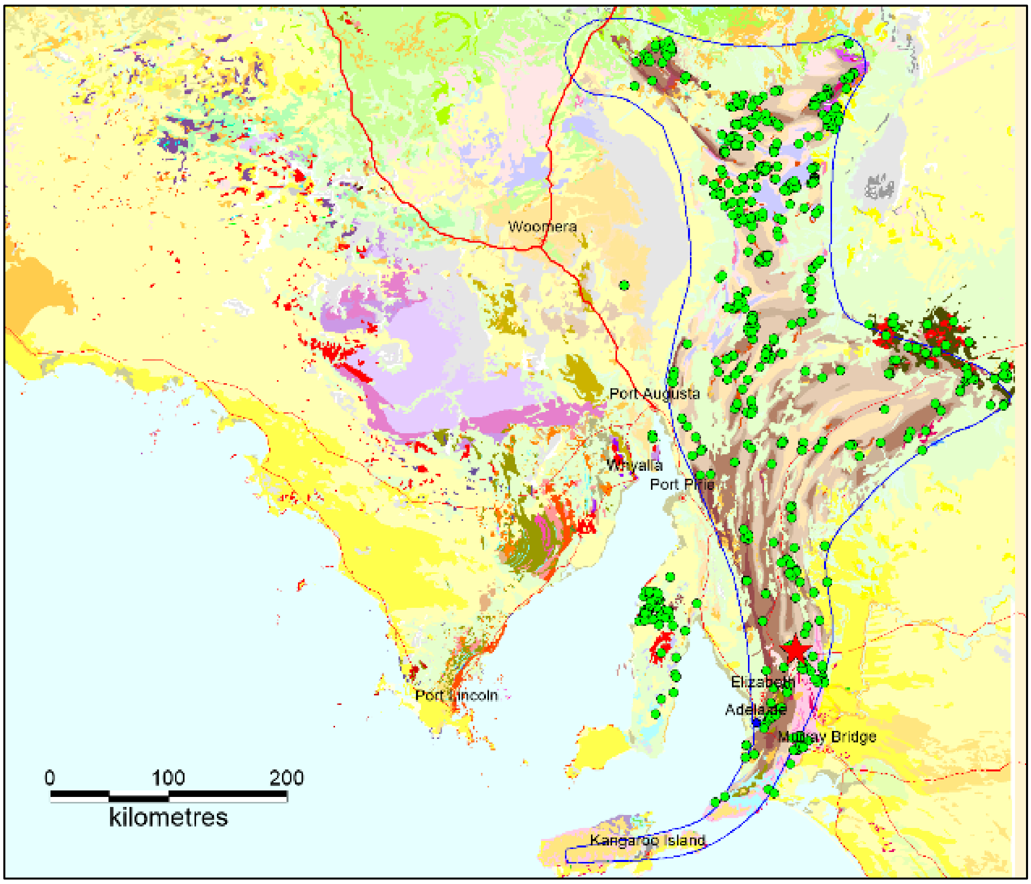

Figure 7: Map showing locations of South Australian copper occurrences (data from South Australian Resources Information Gateway (SARIG)).

KAPUNDA COPPER & GOLD ISR PROJECT

There are many already identified Copper occurrences in South Australia, ranging from the Yorke Peninsula through to the mid north to the Flinders Ranges. Kapunda sits within the Adelaide Geosyncline that has hosted a large number of the historic copper deposits in South Australia (see Figure 8).

A selection of these previously identified deposits may be suitable for In-Situ Recovery (ISR), and could add up to significant tonnes of Copper and potentially millions of dollars in royalties and other economic benefits to South Australia if the Copper can be recovered.

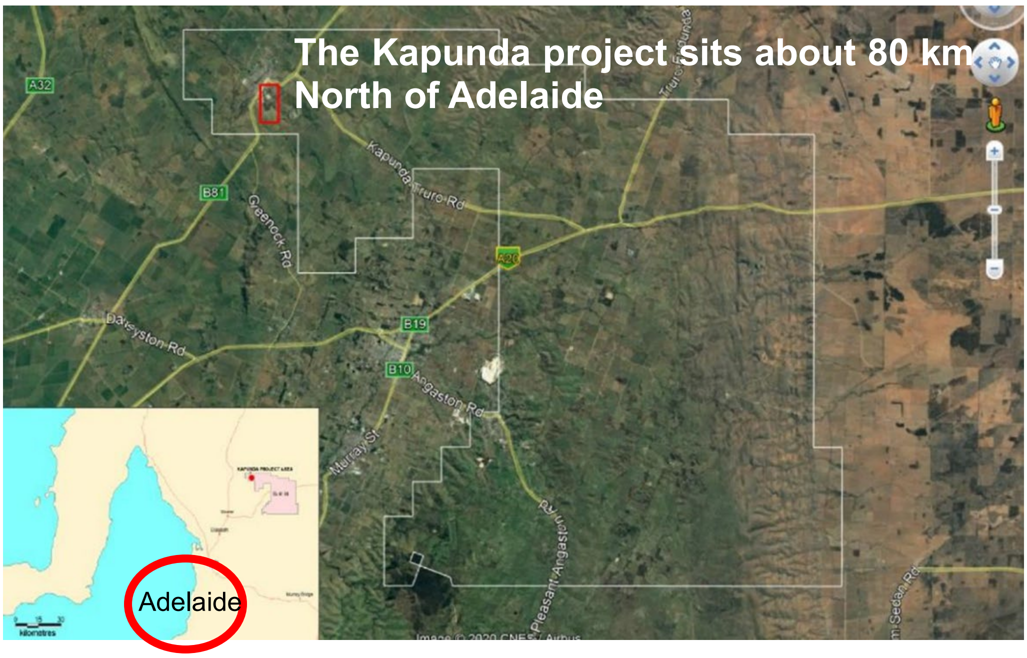

Figure 8: Map showing location of the Kapunda ISR copper research project.

Kapunda was discovered in the 1840s and was the first economic copper mine in Australia credited with saving the fledging South Australian economy at the time. Like a lot of historic mines in South Australia, considerable copper resources remain in place but are difficult to recover for a number of reasons including proximity of surrounding urbanisation. The mine is currently used as a tourism site.

Kapunda has around 119,000t of contained copper that is likely to be accessible by ISR. This ore is a mix of oxide and secondary copper species which laboratory work to date indicates are recoverable with a variety of lixiviant systems. The tenement is owned by Terramin Australia Ltd (ASX: TZN) and ECR negotiated a FarmIn Joint Venture with Terramin and have earnt 50% to date, exercising ECR's right to continue to earn in a further 75%.

Kapunda is a fractured rock system with copper species amenable to leaching and a wealth of historic drill information available.

COOPERATIVE RESEARCH CENTRE GRANT (CRC-P)

In 2018 the Commonwealth Government made a significant research investment by awarding ECR a Cooperative Research Centre Project (CRC-P) Grant of $2.85M to undertake research into the potential for ISR of Copper and Gold at the Kapunda site.

"The CRC Program supports industry-led collaborations between industry, researchers and the community"

This CRC-P seeks to extend existing aspects of In-Situ Recovery (ISR) technology to include non-uranium minerals, such as Copper and Gold; to address knowledge gaps in copper extraction with environmentally benign lixiviants and development of a coupled hydro-thermo-chemical flow model.

Another of the main objectives of this research is the advancement of an industry template for the development of small-scale non-traditional ISR projects, using Kapunda as the demonstration site. This template approach also needs to consider the regulatory approval processes for this type of project.

ECR's research partners include 3 divisions of CSIRO (Minerals, Land and Water Environmental and Land & Water Social Science) and 2 faculties of the University of Adelaide (Mining Engineering and Geophysics). Industry partners include THOR Mining, Terramin and Mining 3.

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TERRAMIN

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The research has both technical aims:

- Testing environmentally suitable lixiviant systems that extract economic amounts of copper.
- Establishment of an Environmental Scorecard specifically applicable to In-Situ Recovery operations.

- The use of geophysics in predicting/monitoring hydrogeological factors.
- The development of a coupled hydrothermal flow model to help predict flow and solution grade leading to better economic recovery estimations.

and non-technical aims:

- The establishment of an ISR Template for future, similar ISR operations.
- Social licence research into the current level of knowledge of the public on ISR and their acceptance of ISR as a future mining technique.

The following is a brief discussion on some of the technical outcomes to date, then focus on the non-technical challenges.

SUMMARY OF RESEARCH OUTCOMES TO DATE

- Mineral species characterisation carried out by QXRD and Qemscan identified major copper species as well as minerals that have the potential for a deleterious effect on a potential ISR operation. These gangue minerals may be lixiviant consumers or unwanted by-product mineral species that will also go into solution, hampering value metal recovery options;
- Suitable lixiviant systems design, testing and optimisation through bottle roll and mini column leach testing and large particle column leach test work. This test work used the existing groundwater to replicate the in-ground environment and has identified 2 potentially suitable lixiviant systems that will work with the acidic groundwater conditions (MSA, Thiosulphate system).
- Geophysical surveys (MT, Nano TEM) and geological mapping have helped to understand the sites structural geology which plays a part in mapping regional groundwater flow. Significant differences in resistivity suggest a large change in permeability and porosity in the sediments from the northern part of the project (more permeable) to the southern section (less permeable). This has helped to assess a potential impact on the major environmental receptor in the area (The Light River).
- A state of the art, probabilistic regional ground water model using the geophysical output combined with geological information has been developed which has enabled prediction of likely flow paths through particle tracking analysis, and, the likelihood of particles taking those paths given various groundwater and pumping input parameters.
- A coupled hydrothermal chemical flow model that can predict both flow and copper recovery is being developed by the University of Adelaide. Detailed fracture information from a number of sources (pit measurements, drill core, drone photography and historic structural mapping) is combined with detailed 3D modelling of historic underground workings to produce the flow model. Hydrothermal parameters of copper dissolution for the various copper species are being tested in the laboratory by CSIRO in Perth and will be validated in ground during the field-testing phase.
- Establishment of environmental baselines for appropriate indicators; have been determined by carrying out seasonal studies (ongoing) of the main receptor of the Light River. These indicators ae being drafted into an environmental scorecard system that will allow stakeholders to quickly gain information on the environmental performance of the project and allow the operators to implement control and mitigation measures in a timely fashion. The score card will be converted into digital form and be available as an "app". If the project proceeds to operational stage it is hoped to incorporate "live" environmental data from various sensors located in strategic parts of the operation.
- The results of the focus groups indicated a generally positive feel for the project, the major points centred around protection of the environment and regulation. People wanted to know how the environment will be impacted and what framework of environmental regulations apply to the project. A key outcome was that ongoing community consultation and regular information dissemination in various forms including digital and print is seen as crucial to community acceptance of Copper ISR.

Lixiviant System Design

Suitable lixiviant system design was undertaken by testing and optimisation through bottle roll and mini column leach testing then large particle column leach test work. This test work used the existing groundwater to replicate the in-ground environment and has identified 2 potentially suitable lixiviant systems that are readily biodegradable and will work with the acidic groundwater conditions (MSA & Thiosulphate).

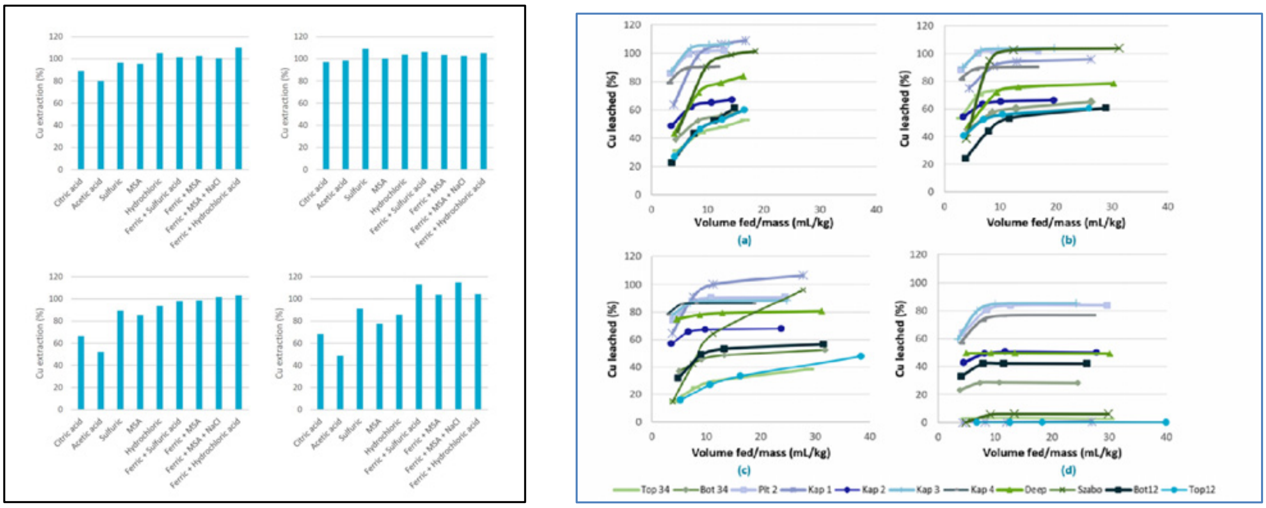

Figure 9: Graphs showing results of some of the initial acid scout leach test work (source CSIRO internal report).

Geophysics for Predicting/Monitoring Hydrogeological Factors

This probabilistic regional ground water model was created using a MODFLOW-Unstructured Grid, with a cell size of approximant 10 m² in study area. This model will be used to predict flow paths and allow particle tracking analysis, as well as for evaluating the environmental monitor network design.

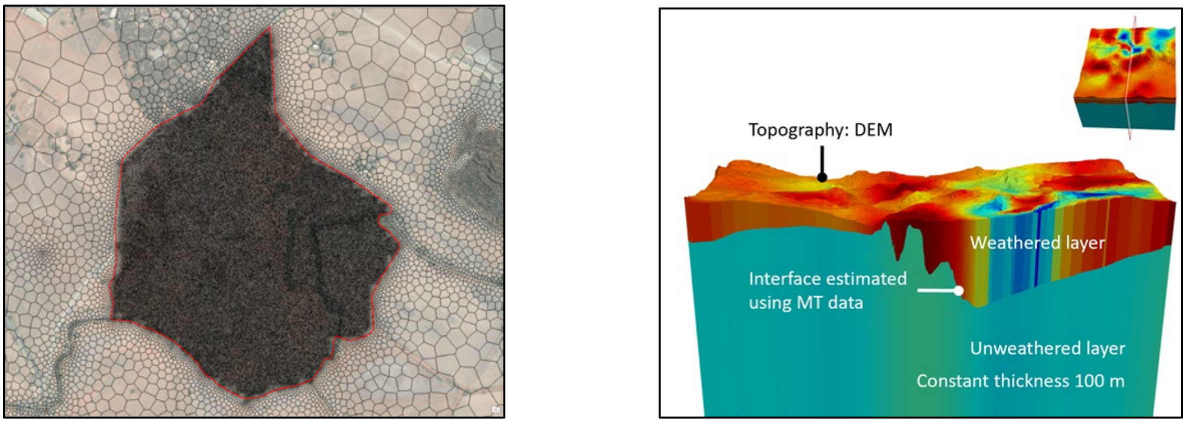

Figure 10: Images of groundwater model (source – CSIRO/ECR internal presentation).

Coupled Hydrothermal-Chemical-Flow Model

This involved accurately mapped underground workings and fracture systems to create the coupled hydrothermal flow /reactive transport model that can predict both flow and copper recovery.

Simulations have started with this model to analyse well placement, recovery and help assess project economics.

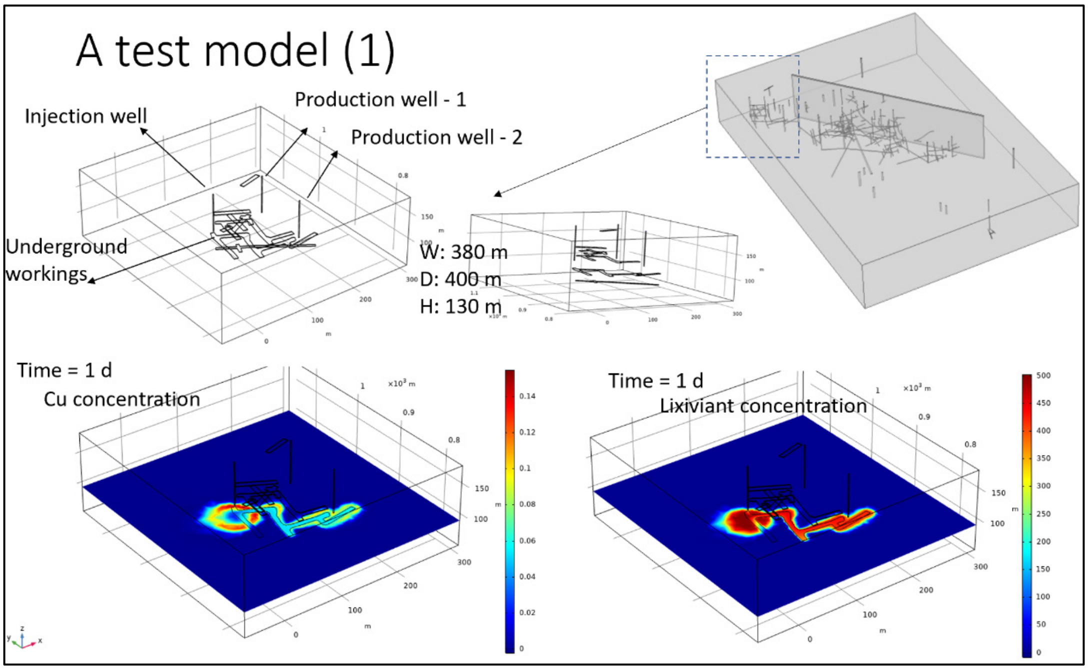

Figure 11: Images of coupled hydrothermal-chemical-flow model (source – University of Adelaide/ ECR internal presentation).

Environmental Scorecard System

Environmental Scorecard system is currently being drafted for stakeholders to monitor environmental performance of the project. After a 12-month monitoring period, water quality indicators selected were pH, Electrical Conductivity, Copper, Zinc and Dissolved Oxygen. These SMART indicators (Specific, Measurable, Achievable, Relevant, Time bound) will be presented in spatial format and be available online and App-based.

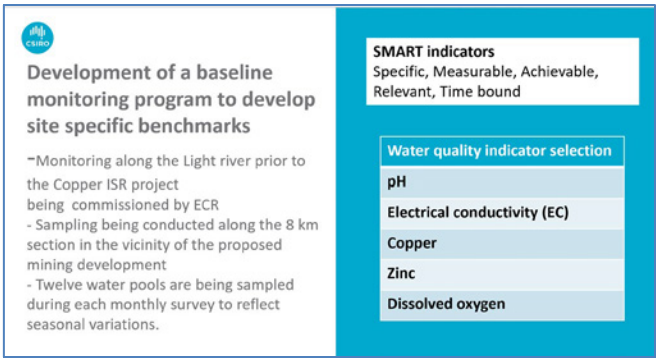

Figure 12: Diagram showing sampling points along the Light River used to establish water quality indicators (source- CSIRO/ECR internal presentation)

Social License Research via Focus Groups

Under the CRC-P, CSIRO Land & Water social scientists led by Dr Tom Measham, were commissioned to undertake Social Licence research into how residents of Kapunda view the mining sector in general and how mining fits with town identity. Focus groups and interviews explored the extent to which a potential renewed mining industry would align to community values, considering the possible application of copper ISR from an historic deposit in the town. The methodology involved the Social Licence framework around:-

- Trust in Procedural Fairness,
- Distributional Fairness and
- Confidence in Governance,
- Leading to Acceptance.

(Zhang, Measham & Moffat 2017). The research is now complete, and the report can be found on the ECR website.

The main results found that most participants are open to the prospect of a new copper ISR operation, provided it is well regulated and environmentally responsible. Participants generally conveyed a high degree of confidence in the technical research process currently being undertaken and, in the assessment, processes conducted by regulators, such that the mine would only go ahead if it met all appropriate safeguards.

There was also a sense that mining would go hand in hand with tourism. Kapunda was Australia's first economic Copper mine, now Kapunda could host Australia's first Copper ISR mine.

The key recommendations were for ECR to genuinely listen to issues and concerns and to engage early and often. Opening an office in the main street of town in February 2019 has proved very beneficial, especially seeing it is in the old Kapunda School of Mines building.

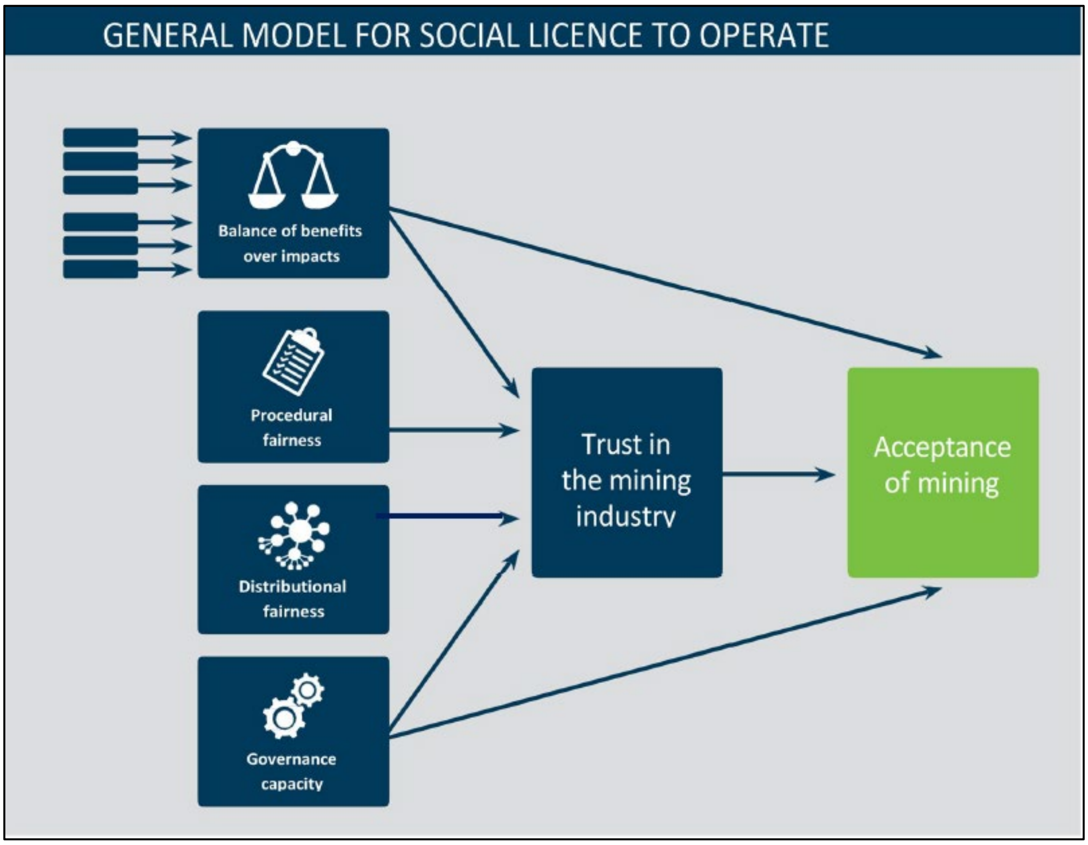

Figure 13: Moffat & Zhang 2013

In Ground Test Work

ECR undertook its first phase of in groundwork in December 2019 which involved drilling 2 water bores and carrying out a pump test and a tracer test using Sodium Bromide.

The boreholes were logged with a variety of geophysical tools including the borehole optical scanner. This allowed the accurate logging of fracture number and orientation.

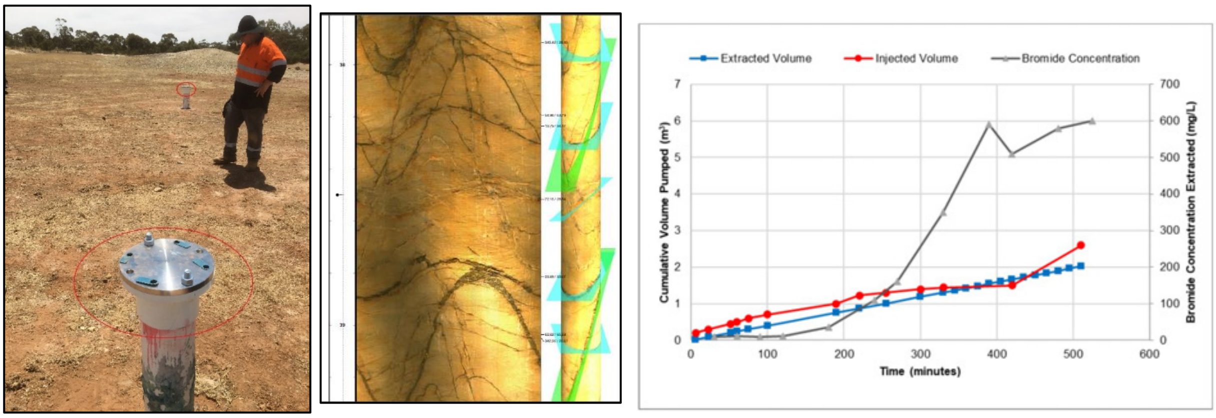

Figure 14 Images showing test bores, downhole fracture logging and tracer test results (source – ECR internal technical report)

Hydrogeological tests were deemed successful, with tracer passing from injection to extraction well in approximately 200 minutes. During the tracer test, ECR inadvertently produced the first copper from the Kapunda mine in a long time! Figure 15 below, shows the submersible pump coated in copper after being extracted from the trial bore.

Figure 15 Plates showing groundwater from well KPFRT03 and copper coating on submersible pump after tracer test (source – ECR internal technical report)

Technical Conclusions

These studies have resulted in a strong understanding of the mineralogy, geology, hydrogeological, environmental and the social licence setting at Kapunda and gives confidence that from a technical standpoint, all of the major technical challenges are likely to be solvable.
However, several significant challenges remain. These include:

- Establishing the regulatory framework for the ISR project to proceed
- Navigating the interconnectivity of different parts of various state and local government legislation
- Convincing investors that both economics and ESG factors for the project are imperative

NON-TECHNICAL PROJECT CHALLENGES

This section discusses some of the non-technical challenges that the Kapunda project is facing. It is currently at the stage of In-ground testing - circulate solutions and measure recovery rates to calibrate some of the laboratory models.

This stage throws up a number of distinct challenges: -

- Navigating a Regulatory Framework to allow the assessment of the suitability of a deposit for ISR efficiently and cost effectively for junior miners
- Dealing with overlapping land access jurisdictions

- Conveying information in a suitable form to attract capital from Investors

Regulatory Framework Challenges

One of the challenges in progressing small-scale non-traditional ISR projects is to ensure that new projects remain attractive to junior companies (and their investors) by not being cost and time prohibitive in the early stages of project development - all whilst still managing environmental and social risks. Part of this early stage is navigating the various levels of local and state legislation that cover project areas. The Kapunda project is not unique in having to deal with multiple land uses, various different stakeholders and a variety of associated regulatory processes required to allow access and work to be carried out.

It is common for historic mine sites to have been acquired by local government bodies (shires or councils) and have at least some tourism aspect in place. In South Australia this land is managed under the Community Land Management Plan which is part of the Local Government Act. Mine tourism operations in South Australia are also covered under the South Australian Work Health and Safety Act with a mine owner/mine operator required to be responsible for public safety.

Historic mine sites will also usually have at least some portion of the site deemed to have either State or National Heritage value which in South Australia is covered by the State Heritage Act.

Overlying this, exploration and mining activities are covered under the Mining Act 1971 (SA) which awards the tenure status that regulates what activities can take place on the site and what approval processes are required. Another factor that comes into play with potential ISR operations (because of their impact on the groundwater environment) is the Environmental Protection Act.

The Kapunda Mine is affected by a number of legislative frameworks :-

- Light Regional Council (light blue & pink) are the owners of the site and operate under the Local Govt Act (SA) 1999,
- Part of the mine area is on the State Heritage Register (yellow) in 1987 affected by the Heritage Act (SA)1993,
- The project sits on an Exploration License (dark blue) within a registered JV area (Mining Act (SA) 1971 & EP (SA) Act 1993),
- SafeworkSA Classification Mine Owner/Mine Operator (blue rectangle) as a Tourism Mine under the WHS Act (SA) 2012

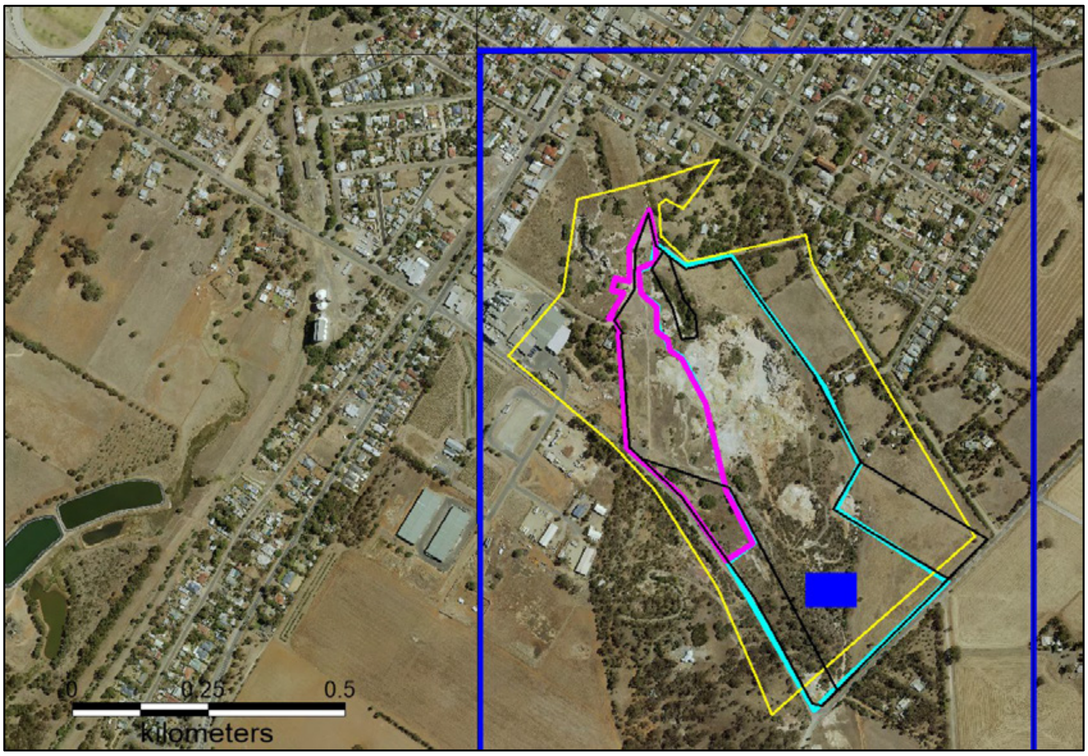

Figure 16: Diagram highlighting overlapping land use categories, each colour representing area covered by a different regulatory bodies.

Mining Act (SA) 1971 and the Environmental Protection Act (SA) 1993 implications

Although South Australia has long-standing regulatory framework to deal with Uranium ISR mines (Beverly and Honeymoon), it's not a perfect fit for non-Uranium ISR projects, due to the frameworks' significant focus on radionuclides generating a very specific range of hazards and risks that are not shared when developing projects involving Copper or Gold species.

In South Australia, tenure categories allow different levels of work ranging from exploration through to the grant of a mining license which allows the extraction and processing of minerals and most states have something similar.

Typically in South Australia, a uranium ISR project would carry out initial exploration on an Exploration License with approvals covered off in "Program for Environmental Protection and Rehabilitation" (ePEPR). This document is an electronic pro forma and can typically be approved in 1-2 months and covers work like sampling, drilling etc.

The next phase of work in a Uranium ISR project (the first phase of in groundwork commonly known as an FRT) typically requires application for a Retention Lease (RL). This tenure status requires significant environmental studies and a period of compulsory public consultation, taking up to 12 months to approve and is only applicable to Uranium ISR due to the scale of activity and risks associated with radionuclides. This risk is obviously not likely to be present in non-uranium-based projects and would be too cost and time prohibitive for junior explorers to progress ISR projects for other metals, let alone not necessary.

This is then one of the major challenges in progressing small-scale ISR projects, as stated earlier, to ensure that new projects remain attractive to junior companies and their investors.

This first stage of in-ground testing represents the fundamental go/no-go point in the assessment of a mineral deposit for suitability to ISR and needs to be able to be conducted quickly and cost effectively so that if a project is unsuitable, little capital is wasted and other potentially suitable deposits can be tested.

To this end, ECR has worked closely with the State Government of South Australia to map out a regulatory pathway which is fit-for-purpose. The outcome of this has been the generation of a set of specific requirements to conduct preliminary ISR for other metals in-ground test work on Exploration Licenses in South Australia. This has the potential to encourage many smaller companies to look at ISR for copper and other metals within South Australia and Australia and potentially stimulate a new arm of the mining industry.

Local Government Act 1999 (SA) implications

As we have stated already, there are many opportunities for development of stranded resources from heritage, or legacy mines, across the country. Mining has been and will remain the backbone of Australia's economic development and many mining communities are proud of their mining history and it is likely that local government bodies will have at least some interest in these legacy sites invoking their respective Local Government Act.

Light Regional Council was gifted the Kapunda heritage mine in the early 1970s and, up until the early 1980s they allowed various exploration companies to drill for copper but due to the constraints of developing an open pit with close proximity to a town, the projects went no further. The area has recently been developed as a tourist site by the local council with fencing, signage and walking pathways and plans to continue to develop more infrastructure.

When ECR approached the council in 2016, to commence discussions in relation to investigating the ISR potential of extracting the remaining copper, the Council was cautiously optimistic. Excitement at reopening their mine, was met with concerns of this "new" mining technique of ISR and the potential environmental risks, perceived or real.

When future projects develop near townships, the proponents must be fully aware of the relevant Acts that they will need to understand. In the case of Kapunda, the Local Government Act 1999 states that any business wishing to conduct a commercial operation on publicly accessible council owned land, needs to apply to the Council for a Lease/License arrangement under a Community Land Management Plan (CLMP).

Many existing CLMPs do not have a reference to mining as potential current land use so will need to be re drafted accordingly. Being community land there has to be a process of community consultation. This process will differ according to the various bodies undertaking it but is a time consuming process that needs to be factored into project schedules.

WHS Act (SA) 2012 implications

The WHS Act's Work Health and Safety Regulations Guide; Chapter 10 Mines requires the definition of Mine Owner/ Mine Operator to be negotiated between the landowner and the Tenement holder/Project operator. This division demarcates legal liability for the various mine areas for any safety incidents that occur. Deciding who will be responsible for which area is up to the parties to hammer out and can be time consuming but is necessary as the division of the site into the 2 areas above will allow clear lines of responsibility under the Act. ECR are undertaking this with the Light Regional Council with a great deal of consideration on extent of land assumed under ECR's liability and time frames for activities.

Heritage Act (SA) 1993 implications

Portions of the mine site were listed as State Heritage sites in 1987. Understanding what triggers the relevant section of The Heritage Act was imperative to protect any archaeological artefacts, known or unknown. The use of an archaeologist whenever ground disturbing activities take place is required to ensure preservation of these artefacts or sites. To date ECR have had full support from the Heritage group within the Department for Environment and Water.

Dealing with the interplay of the above pieces of legislation requires long and detailed negotiation.
In ECR's case, working with the various regulatory bodies has taken over 2 years, and despite delaying the project, has resulted in potential solutions to some very complex land access issues and, (particularly regarding the Local Government Act) has gone a long way to contribute to establishing this ISR template for carrying out the early stage evaluation of potential projects. Solving these land access issues is viewed as critical to allow further meaningful discussions with potential future investors which leads us to the next major area of discussion – investment.

Investment

The investment market looks for low risk, high returns, ISR in part, makes good sense as it requires low capital expenditure, provides that quick turnaround from exploration to production, and can be scaled up or down in response to varying commodity prices. On the other hand, selling an investor on new technology can be seen as risky because;

- Learning and teething problems will always be part of the process
- Aspects of geological host environments are significantly different from conventional geology projects and will differ for every ISR project
- These different geological host environments can make resource estimation on ISR complex
- Regulatory frameworks and social hurdles need to be managed

Currently, ISR of copper and other metals is seen as "new technology" so is assigned a relatively high-risk profile. When in fact, ISR as a principle has been around since the 1960's. To counter this viewpoint ECR adopted a strategy of educating potential investors on rather than ISR "being new technology", it was "advancing existing ISR knowledge".

ECR has also spent time highlighting some of the so called "soft" benefits of ISR including the fact that;

- ISR is seen as a sustainable, low C02, ethical and "green" form of mining and
- There is an increasing pool of investment funds that will only invest in sustainable, ESG considered projects.

This last point is important, as more and more corporations are bowing to shareholder calls to only invest in ethically produced commodities, an example is the International Copper Association's Copper Mark for responsible /ethical copper production. In August this year Rio Tinto's Kennecott in Utah was awarded the 1st Coper Mark for responsible production. This "socially responsible" pool of investment dollars is tipped to grow substantially in the coming years and could provide a ready source of funding for small scale ISR projects.

SUMMARY

ISR for metals other than uranium has advanced significantly in the last 5-6 years, with the potential economic and social benefits of relatively low impact metal recovery now being recognised by the investment community.

The capacity to more easily attain social license to operate coupled with an increasing pool of investors seeking sustainable forms of metal production, mean that the number of ISR projects for mainly copper and gold, should increase over time.

What is required to assure that this happens is a method for navigating the complex land access issues that can arise when dealing with legacy mine sites and having a regulatory framework that is fit for purpose.

The Kapunda Copper and Gold ISR Project has gone a long way in establishing a “template” for these processes and should make the path much easier for subsequent companies that wish to investigate whether a deposit could be suitable for InSitu recovery.