

# DEVELOPING THE BUSINESS CASE FOR RESPONSIBLE MANAGEMENT OF AMD

CAROLYN OLDHAM | 5 AUGUST 2022

# Acid and metalliferous drainage

## International Network for Acid Prevention (INAP)

*Acid and Metalliferous Drainage (AMD) is one of the most serious and potentially enduring environmental problems for the mining industry.*

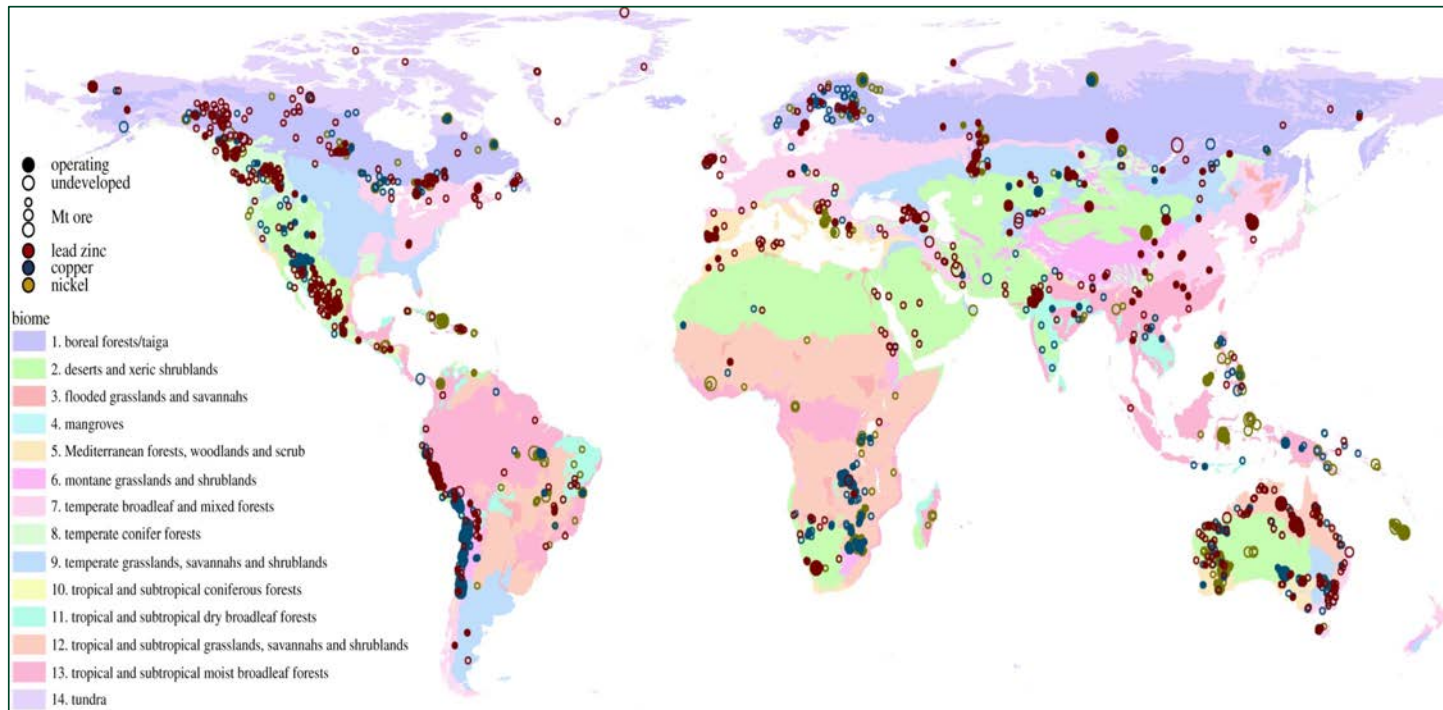
*Left unchecked, it can result in such long-term water quality impacts that could well be this industry's most harmful legacy.*

*Effectively dealing with AMD is a formidable challenge as indicated by the high liability cost carried by many mining companies.*

[www.inap.com.au](http://www.inap.com.au)



# Acid and metalliferous drainage (AMD)



Lead, copper and nickel mines (Sonter et al. 2018)

- Acid and metalliferous drainage (AMD) typically occurs due to mining and processing of base ores (e.g copper, zinc, nickel, gold) and coal
- Waters impacted by AMD can have pH 2 (~ lemon juice)

# Iron cycling and acidity



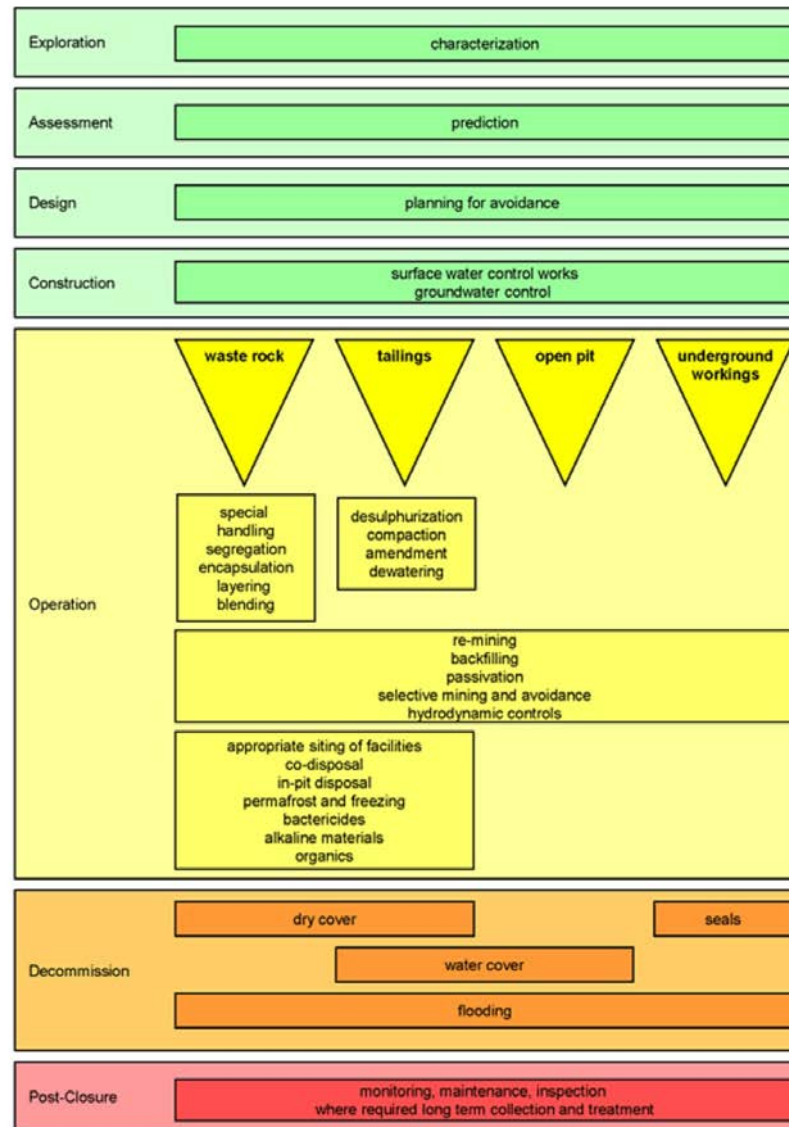
<https://mining-report.de/english/predicting-acid-mine-drainage-past-present-future/>



<https://www.usgs.gov/mission-areas/water-resources/science/mine-drainage>

# Acidity and mining

- International Network for Acid Prevention (INAP)
- Started in 1998
- GARD Guide (2009) – Best practice guide for prevention of AMD.



INAP 2019



## *Why has acid and metalliferous drainage (AMD) been such an intractable issue?*

### *What can be done about it?*



- AMD impacts from operational and closed mines continue to grow.
- Strategies for AMD prevention or mitigation struggle to meet evolving stakeholder expectations.
- How can we help closure teams better make a case for responsible management of AMD across the mining life cycle?

# Who we are

## UWA Project Team



Professor Carolyn Oldham



Ms Ana Singh



Dr Lisette Kanse



Dr Chantal Bourgault

## Partners

University of Queensland

CSIRO

Flinders University

MRIWA

FMG

Rio Tinto

Golder

BHP

Sustainable Solutions

South32

Dept Water and Environmental Regulation, WA

Dept Natural Resources, Mines and Energy, QLD

# What we did

## Global stakeholder workshops

AMD Collaborative Dialogue Workshops - May 18 & May 19/20

Created by Heidi Niskanen-Rauk.

Participate Now

WELCOME to the AMD Collaborative Dialogue Workshops

Why has acid and metalliferous drainage (AMD) been such an intractable issue and what can be done about it?

THE UNIVERSITY OF WESTERN AUSTRALIA

CRC TiME Transformations in Mining Economies

Workshop Option 1: Tuesday May 18<sup>th</sup>

- London (London) 2:00 pm
- Africa (Cape Town) 2:00 pm
- South America (Santiago) 8:00 am
- USA and Mexico (Boston) 8:00 am

Workshop Option 2: Wed May 19<sup>th</sup> / Thurs May 20<sup>th</sup>

- USA (New York) (New York) 6:00 am (Thurs 19<sup>th</sup>)
- Australia (Sydney) 9:00 am (Thurs 20<sup>th</sup>)
- China (Beijing) 7:00 am (Thurs 20<sup>th</sup>)
- Australia (Perth) 7:00 am (Thurs 20<sup>th</sup>)

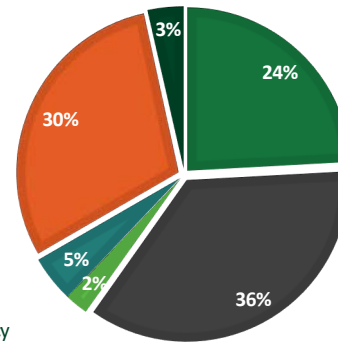
5 Present

206 Registered



## Thematic analysis of workshop discussions

- Academia / Research centers
- Consulting
- Community representatives
- Industry associations
- Industry
- Government / Regulatory agency

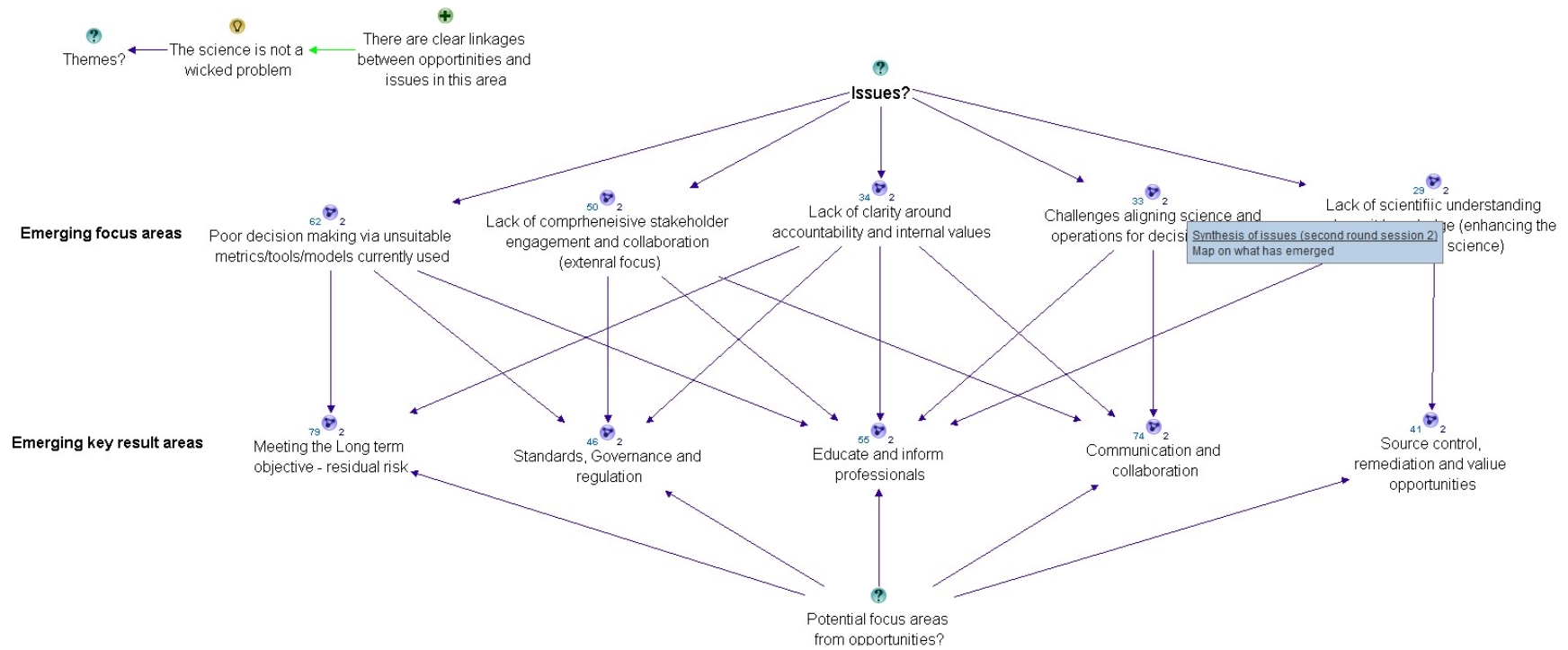




# What we did

Global stakeholder workshops

Thematic analysis of workshop discussions



# What we found

Table 3 Sub-aspects raised in relation to Issue Theme: Poor decision-making due to unsuitable metrics / tools / models currently being used.

Issue	Sub-aspects raised by participants
<b>12. Challenges aligning science and operations for decision making (developing a business case)</b>	How can we influence mine plans and operations on source control and AMD prevention? the science / engineering behind AMD generation and treatment being well understood and Science of AMD source terms is well established and occur.
	Mining engineers at the moment understand are too focussed on geotechnical stability.
	How and where to better educate all disciplines closure challenges.
	There continue to be challenges with material changes and scheduling.
	Those responsible for AMD issues are likely to be in different organisations, and will likely change over time to maintain momentum and coherence of approach.
	Approaches taken to implement solutions has been a lack of continuity in testing of methods of control and treatment issues persisting that should have been solved.
	Need to bring these initiatives back to cost valuation and value proposition is.
	Issues are increasing with more reverse osmosis, waste water and disposal.
	Bactericide technology is not yet accepted in mainstream.
	<b>15. Poor decision-making due to unsuitable metrics / tools / models currently used</b>

# What we found

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Issues – core themes

**Need for improved scientific understanding of deposit knowledge**

**Challenges aligning science and operations decision making**

**Need for greater alignment of accountabilities**

**Need for better stakeholder engagement and collaboration**

**Poor decision making due to unsuitable metrics / tools / models**

# What we found

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Opportunities – core themes

**Improve knowledge of source control, remediation and value opportunities**

**Develop a common language across professional teams**

**Enhance standards, governance and regulation**

**Enhance communication and collaboration with communities**

**Quantify residual risk to improve the business case**

# What we found

Table 1 Links across issue and opportunity themes.

Issues	I1. Need for improved scientific understanding or deposit knowledge (enhancing the biophysical science)	I2. Challenges aligning science and operations for decision making (internal focus)	I3. Need for greater clarity around accountability and internal values	I4. Need for comprehensive stakeholder engagement / collaboration (external focus)	I5. Poor decision making via unsuitable metrics / tools / models currently used
<b>Opportunities</b>					
O1. Improve knowledge of source control, remediation and value opportunities	✓	✓			
O2. Educate and inform professionals (internal focus)	✓	✓	✓	✓	✓
O3. Enhance standards, governance and regulation			✓	✓	✓
O4. Enhance communication and collaboration (external focus)			✓	✓	
O5. Meeting the Long-term objective – quantify residual risk for improving the business case		✓	✓	✓	✓

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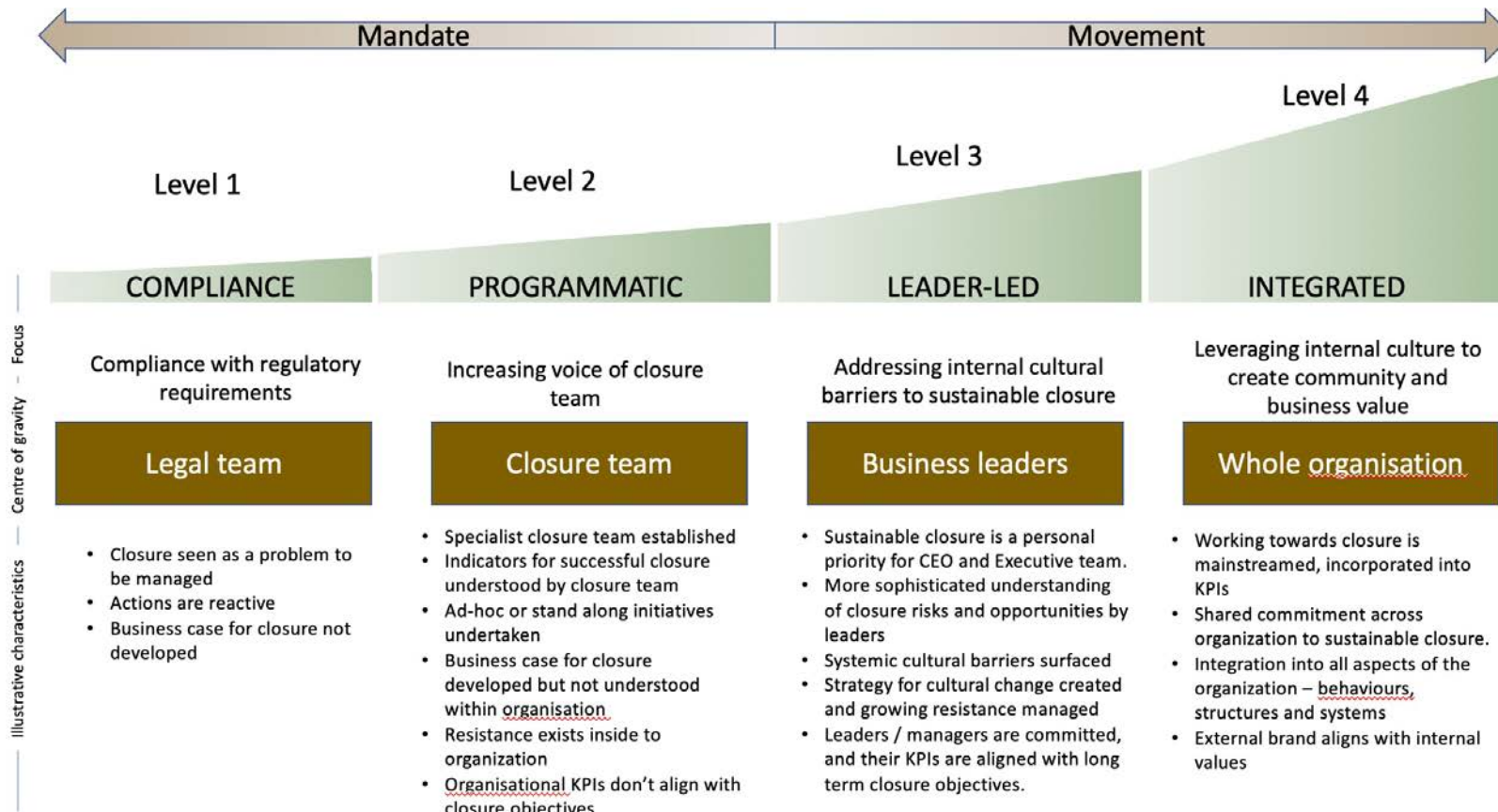
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O5. Meeting the Long-term objective – quantify residual risk for improving the business case		✓	✓	✓	✓

- A. Enhancing the business case for AMD management
- B. Engagement, communication and education.
- C. Standards and governance.
- D. Understanding the science of AMD.

# What we found



Modified from Deloitte 2018



## Where to from here

Short Term (0-3 years)	Medium Term (3-6 years)
<b>Enhancing the business case for improved AMD management</b>	
<p>Develop methodologies to support the required transitions in organization maturity relating to mine closure generally, and AMD management specifically.</p> <p>Undertake a case study audit of KPIs and their timeframes, across the whole of business, identifying where conflicts arise for AMD management.</p>	<p>Improve frameworks to adequately quantify risks and opportunities throughout mine-of-life, particularly for mine closure planning and associated residual risks.</p>

## Where to from here

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Short Term (0-3 years)	Medium Term (3-6 years)
<b>Educate and inform cross-disciplinary professional teams</b>	
Identify skills needs and education required to capture closure challenges in the business case for improved AMD management.	Deliver educational resources for cross-disciplinary teams, to facilitate a shared understanding of AMD risks.

## Where to from here

Short Term (0-3 years)	Medium Term (3-6 years)
<b>Understand community aspirations for AMD-affected lands</b>	
<p>Explore how to improve traditional owner and community awareness of AMD.</p> <p>Explore opportunities for two-way science with traditional owners of AMD-affected lands.</p> <p>Use traditional owner and community aspirations for the future use of AMD-affected lands, to drive AMD and closure research.</p>	<p>Develop effective AMD communication resources with adequate language and messages for different stakeholder groups, based on their concerns.</p> <p>Develop platforms to share (anonymised) operational data for benchmarking and to improve community and investor engagement.</p> <p>Select demonstration sites and develop case studies of both failures and success in AMD management and the relinquishment of AMD-affected land.</p>

## Where to from here

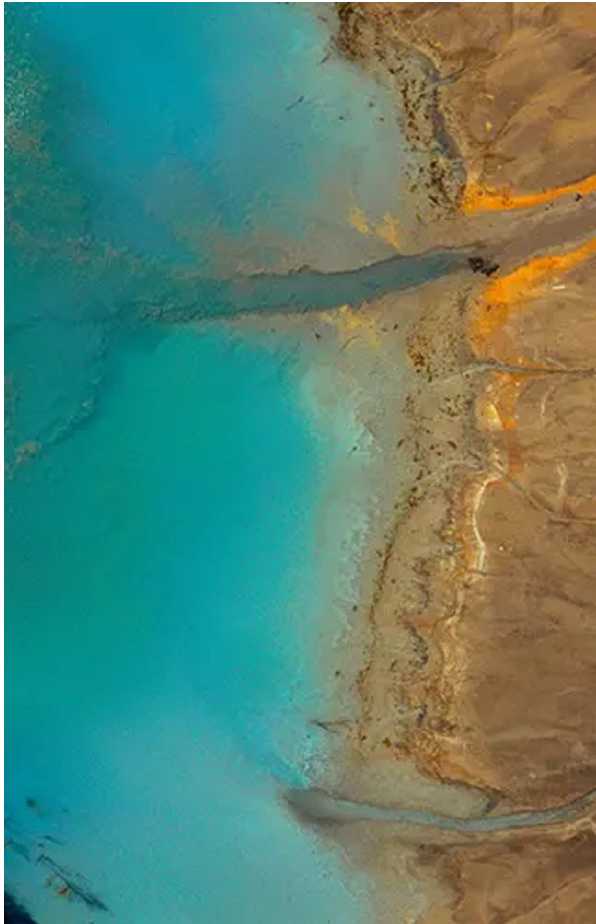
Short Term (0-3 years)	Medium Term (3-6 years)
<b>Enhance standards, governance and regulation</b>	
<p>Develop approaches for governance of regional-scale AMD management, with consideration for cumulative impacts on regional economies.</p> <p>Assess operational and regulatory barriers that may limit social and environmental monitoring and reporting, and the associated liabilities.</p>	<p>Review and evaluate the decision-making processes that underlie the existing permitting conditions with respect to AMD (water pollution).</p> <p>Develop new regulatory approaches that can be used to improve outcomes, based on specific site-level environmental constraints.</p>

## Where to from here

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Short Term (0-3 years)	Medium Term (3-6 years)
<b>Improve knowledge of source control, remediation and value opportunities</b>	
Improve our understanding of source control and materials handling through accurate forecasting of AMD.	Develop predictive models of current and future AMD risk, to support long-term AMD governance.

# Implications



- Insight into socio – economic – political barriers to implementing acidity reduction approaches throughout life of mine
- Clarified where CRC TiME can contribute to the issue
- Our findings are being embedded within CRC projects e.g. pit lakes project
- Work on organisational cultural change will require strong engagement with partners.
- Understanding aspirations of mining communities will require strong engagement with communities
- Demonstrated of the usefulness of open space technology approaches on contested issues.



Lake Kepwari, relinquished coal pit lake, Collie WA

# THANK YOU

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