



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA

CREATE CHANGE

# HRO and Environmental Management

Higher reliability through strengthening the environmental function

Associate Professor Claire Côte

Director, Centre for Water in the Mining Industry (CWIMI), *UQ*

# Environmental Management

Water	Residue & AMD	Rehabilitation	Closure and Relinquishment	Dust, Noise and Vibration	Others
<ul style="list-style-type: none"><li>• Catchment and regional initiatives</li><li>• Surface water and hydrology</li><li>• Groundwater and hydrogeology</li><li>• Water balance and accounting</li><li>• Water quality</li><li>• Monitoring and data analysis</li><li>• Erosion and sediment control</li></ul>	<ul style="list-style-type: none"><li>• Disposal strategy</li><li>• Geochemical aspects and pollution risks</li><li>• Acid Mine Drainage</li><li>• Geotechnical stability</li><li>• Tailings to Soils</li><li>• Mine waste</li></ul>	<ul style="list-style-type: none"><li>• LoM Planning</li><li>• Baseline assessment</li><li>• Material characterisation</li><li>• Landform design and construction</li><li>• Monitoring</li><li>• Ecological engineering</li><li>• Ecosystem establishment</li><li>• Species selection and propagation</li></ul>	<ul style="list-style-type: none"><li>• Financial provisioning and residual risks</li><li>• Closure plan development and review</li><li>• Technical aspects: mine waste characterisation, final landform and drainage, post-closure water balance</li><li>• Ecosystem resilience</li></ul>	<ul style="list-style-type: none"><li>• Air contaminants</li><li>• Noise</li><li>• Vibration</li><li>• Blasting</li></ul>	<ul style="list-style-type: none"><li>• Cultural heritage</li><li>• Biodiversity</li><li>• Greenhouse gas emissions</li><li>• Waste and Circulate Economy</li></ul>

# Public perception

Tailings dam failures

Acid mine drainage

Slow rates of progressive rehabilitation

## Six - Tentative - Actions

Weigh up the costs of safeguards vs accidents

Recognise the cost of redundancy and training is lower than the cost of accident aftermath.

'Look carefully at interdependencies' and develop special ways of managing them

When critical systems are tightly coupled have compensating strategies

Make sure your decision making strategies are appropriate.

Analyse the components of high reliability cultures.

# But there are many good stories...

Glencore has achieved its seventh Australian certification for rehabilitation of land at Oaky Creek coal mine

*Screenshot from Australian Mining 16 March 2021*

## Glencore recognised for Oaky Creek's 'impressive' rehabilitation

🕒 March 16, 2021   📁 News   👤 Henry Ballard



# SHE Management System

## Environment Teams

- Identifying and reporting environmental incidents
- Tracking compliance through Approvals, Obligations and Compliance module
- Conducting site inspections and implementing mitigation strategies

Them

## At organisation level, little evidence of

- Visualising potentially catastrophic environmental consequences
- Articulating the mistakes to be avoided
- Restating goals in terms of these mistakes to be avoided

Us



Sensitivity to Operations

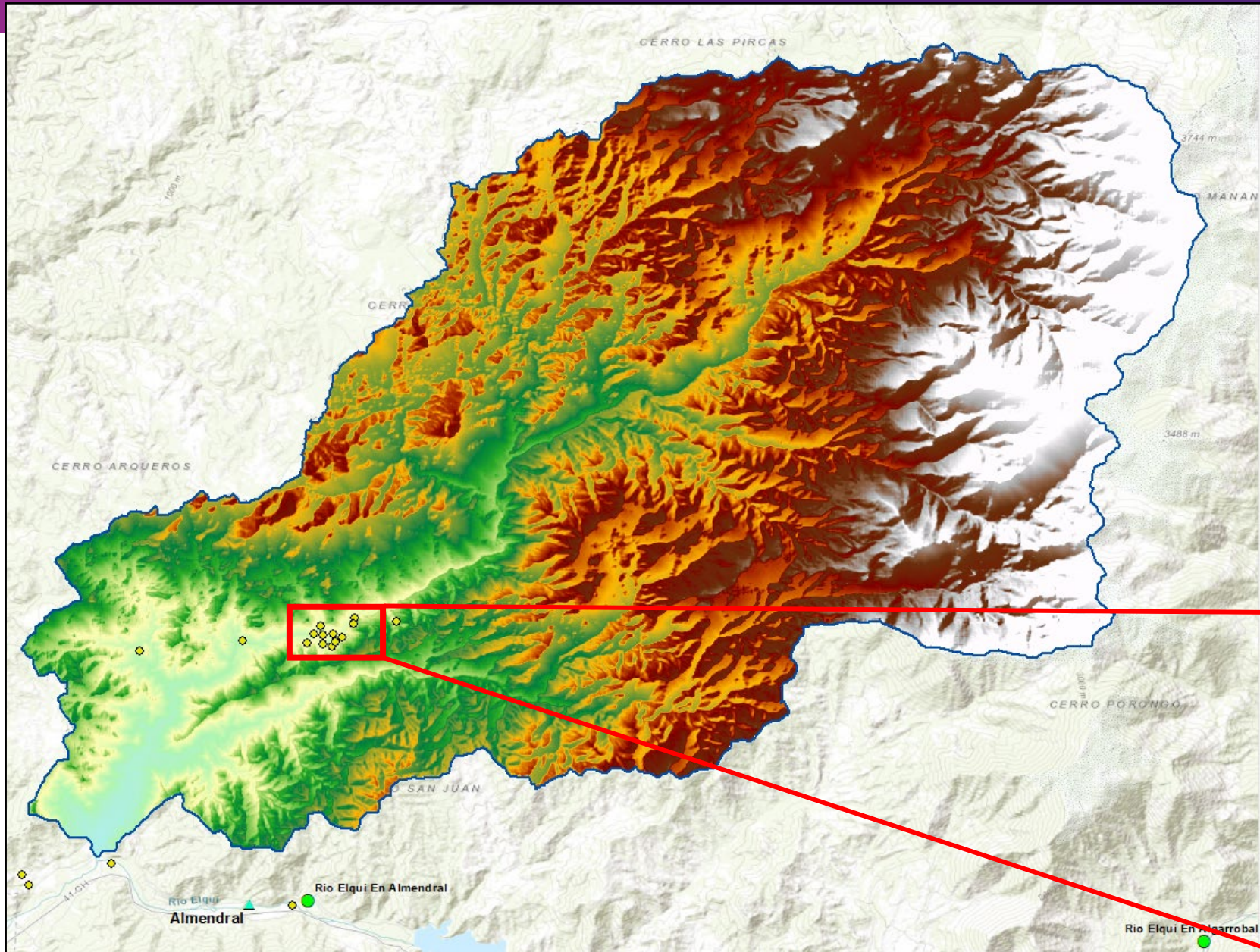
Preoccupation with Failure

Reluctance to Simplify

Commitment to Resilience

Deference to Expertise

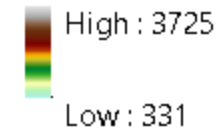




## Conventions

- Catchment area = 2036 km<sup>2</sup>
- Streamflow gauge
- Rainfall gauge
- Tailing Storage Facilities (14)

DEM [m.a.s.l.]



## Hydrological & Hydro-geological Modelling





# Duties

## Environment Teams

- Oversee increasingly more complex technical studies
- Rely on specialised technical advice
- Must use a range of complex tools and software (GIS)
- Require resources

Them

At organisation level, oversimplification of the perception of the duties

- “plant trees”
- “bait feral cats”
- “remove dead cattle from mine water dam”
- “relocate snake from meeting room”

Us



Sensitivity to Operations

Preoccupation with Failure

Reluctance to Simplify

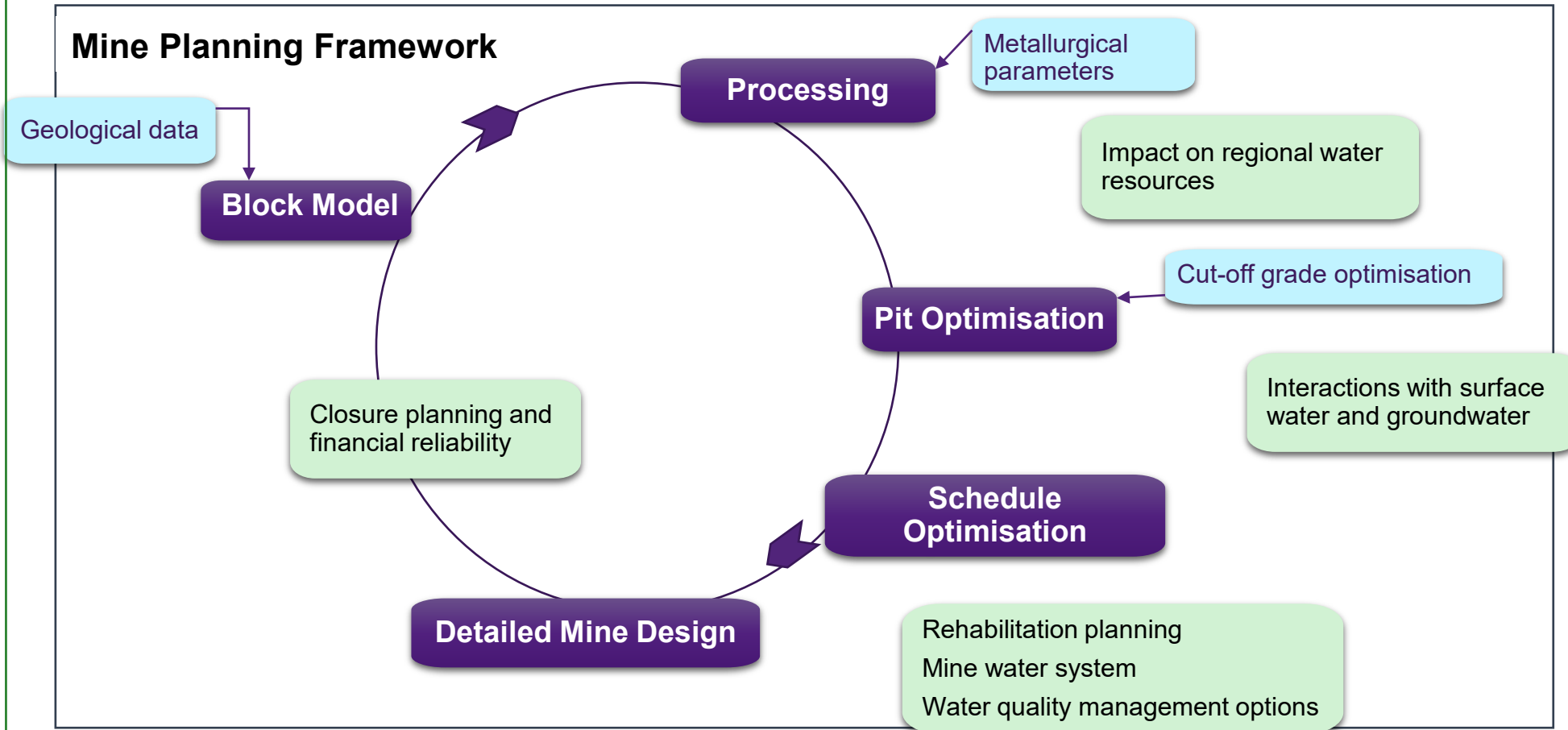
Commitment to Resilience






Deference to Expertise

## International and Regional Context

Regulatory frameworks, climate predictions, water resources, energy systems, communities

### Mine Planning Framework



-  Sensitivity to Operations
-  Preoccupation with Failure
-  Reluctance to Simplify
-  Commitment to Resilience
-  Deference to Expertise



# “Green Tape”

Mindset that environmental teams are “blockers” but there are plenty of opportunities for them to act as “enablers”

- Unlock value in strategic mine planning
- Integration of knowledge through management of large data sets
- Technical skills that can support other functions

Opportunity to be a leader in the field of environmental management

- Technical work of high standard

## From Haslam & Jetten

whether or not an organisation becomes and HRO depends on whether groups  
*“work with, for, or against each other”*



Sensitivity to Operations



Preoccupation with Failure



Reluctance to Simplify



Commitment to Resilience



Deference to Expertise

# Mental models of crises

## Theodore, the first Queensland town to be totally evacuated, reflects on flood disaster 10 years on

ABC Capricornia / By Rachel McGhee and Erin Semmler

Posted Mon 28 Dec 2020 at 10:52am, updated Tue 29 Dec 2020 at 6:30am



## Queensland Floods Commission of Inquiry

### 13 Mining

Prolonged rainfall over Queensland's mining regions during the 2010/2011 wet season severely affected the industry. Huge volumes of water poured into pits and leaked into underground areas. Following years of drought, some mines had been designed to catch as much runoff as possible.<sup>1</sup> Storage facilities and dams became so full that operators were forced to pump excess water into pits.<sup>2</sup> Access to equipment, storage facilities and monitoring sites was cut.<sup>3</sup> Gigantic mining equipment was swamped by floodwaters.

Eighty-five per cent of Queensland coal mines had to either restrict production or close entirely.<sup>4</sup> In May 2011, Queensland's coal mining sector had recovered to only 75 per cent of its pre-flood output.<sup>5</sup> The economic repercussions of these events were a loss of \$5.7 billion<sup>6</sup> (2.2 per cent)<sup>7</sup> in Queensland's gross state product for the financial year ending June 2011, and a reduction in royalties received by the Queensland Government.

Mindfulness of environmental issues require new mental models to visualise and respond to severe consequences

# Towards greater environmental reliability

Industry- wide collective mind on environmental performance

- Less reactive

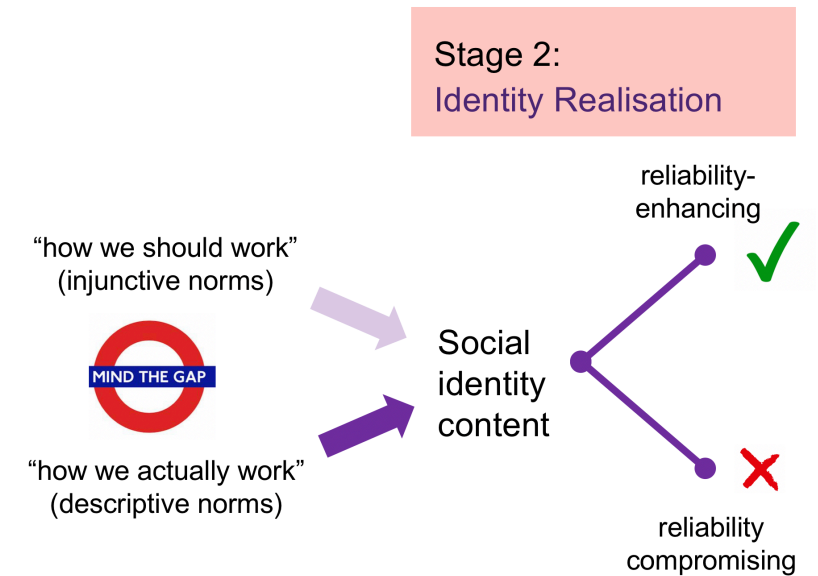
Within companies, building a shared identity more inclusive of environmental teams eg.

- Shared goals
- Integrated work platforms

Visible environmental leaders

Develop tools to support the vision

- Support, measurement and innovation, response to regulation





THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA

CREATE CHANGE

# Questions

Dr Claire Côte | Director  
Centre for Water in the Minerals Industry  
Sustainable Minerals Institute  
[c.cote@uq.edu.au](mailto:c.cote@uq.edu.au)  
07 3346 4061