



GOLDER

Climate Change Decision Making – Case Studies

IAIA WAB

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Question – how to respond to stakeholder concerns for long term climate change effects?

Planning and Permitting

Examples - Planning

BACK RIVER PROJECT, SABINA GOLD & SILVER CORPORATION

- Climate change modelling used to inform the initial planning of the tailings storage facilities and waste rock storage areas
- Introduction of an ongoing monitoring program that will determine whether freezing conditions are occurring during Operations and Closure
- Outlined additional mitigation strategies to be included as part of an adaptation management plan to overcome uncertainties of a changing climate



Question – how to incorporate climate change in design?

Design

Examples - Design

COVER THICKNESS

Provided description of future projected climate (i.e. monthly mean temperature and precipitation)

- **Baker Lake Whale Tale**
Results used to help inform cover design thickness, to account for changes in permafrost layers as climate changes
- **Cluff Lake Mine Site, Areva**
Provided climate change support services to incorporate climate projections into the updated ground water modelling design



Question – how to account for current climate extremes and long term changes?

Climate Change Vulnerability Assessments

Examples - Operations

SUDBURY INTEGRATED NICKEL OPERATIONS, GLENCORE

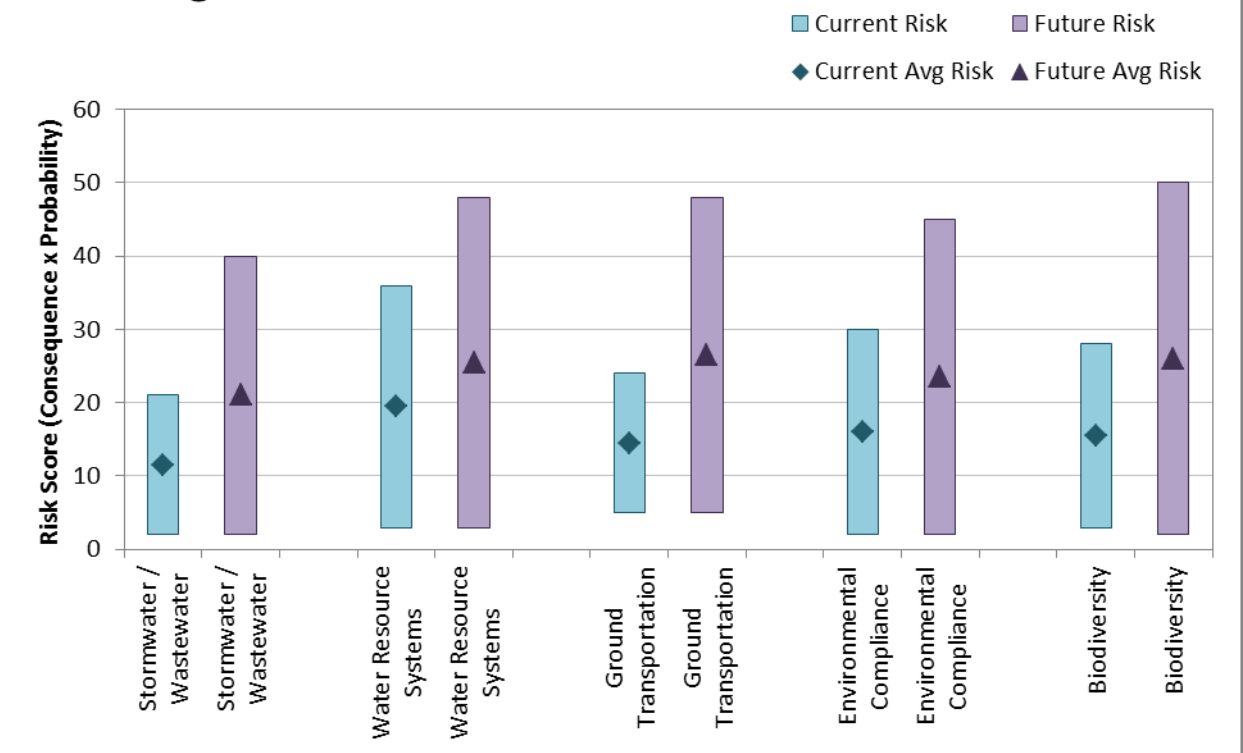
- Understand weather variability and long term climate change impacts on facilities
- Identify potential risks such as flooding, disruption to transportation, operations and worker health & safety, and how to adapt to each
- Analyze future water supplies, dam safety, flood control and requirements for water management
- Incorporate the assessment into the existing Risk Register and part of the Continuous Improvement Programs



Vulnerability Assessment Studies

Infrastructure Component	Climate Factor				
	Temperature	Rain	Snow	Wind	Mixed Events
Stormwater, Wastewater Treatment and Collection Systems	✓	✓	✓	✓	✓
Water Resource Systems	✓	✓	✓	✓	✓
Ground Transportation	✓	✓	✓	✓	✓
Buildings and Infrastructure	✓	✓	✓	✓	✓
Environmental Compliance	✓	✓	✓	✓	✓
Biodiversity	✓	✓	✓	✓	✓
Public Infrastructure	✓	✓	✓	✓	✓

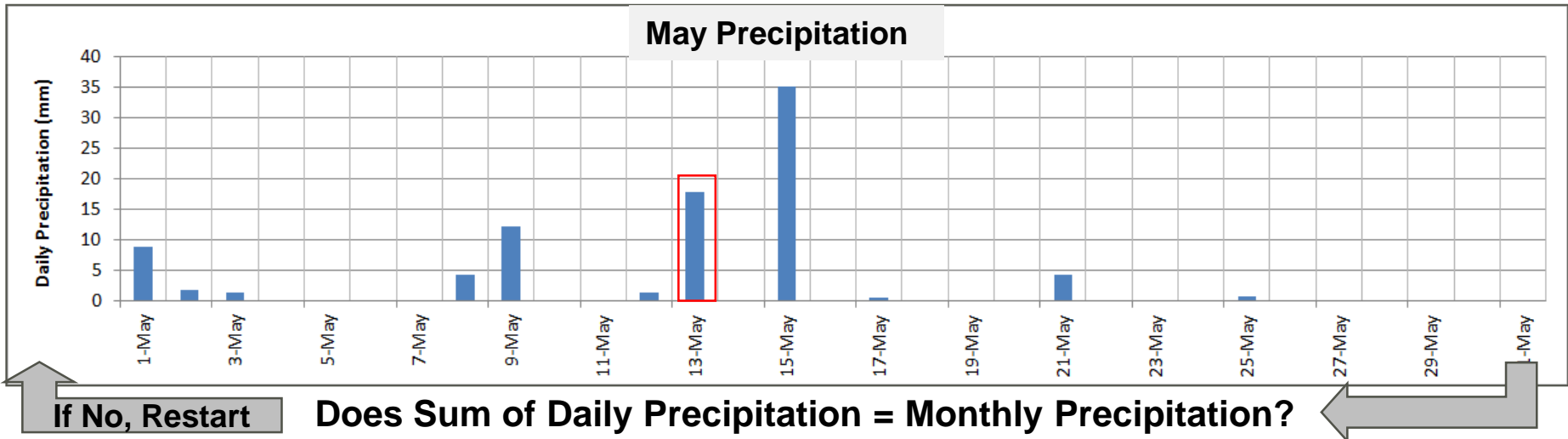
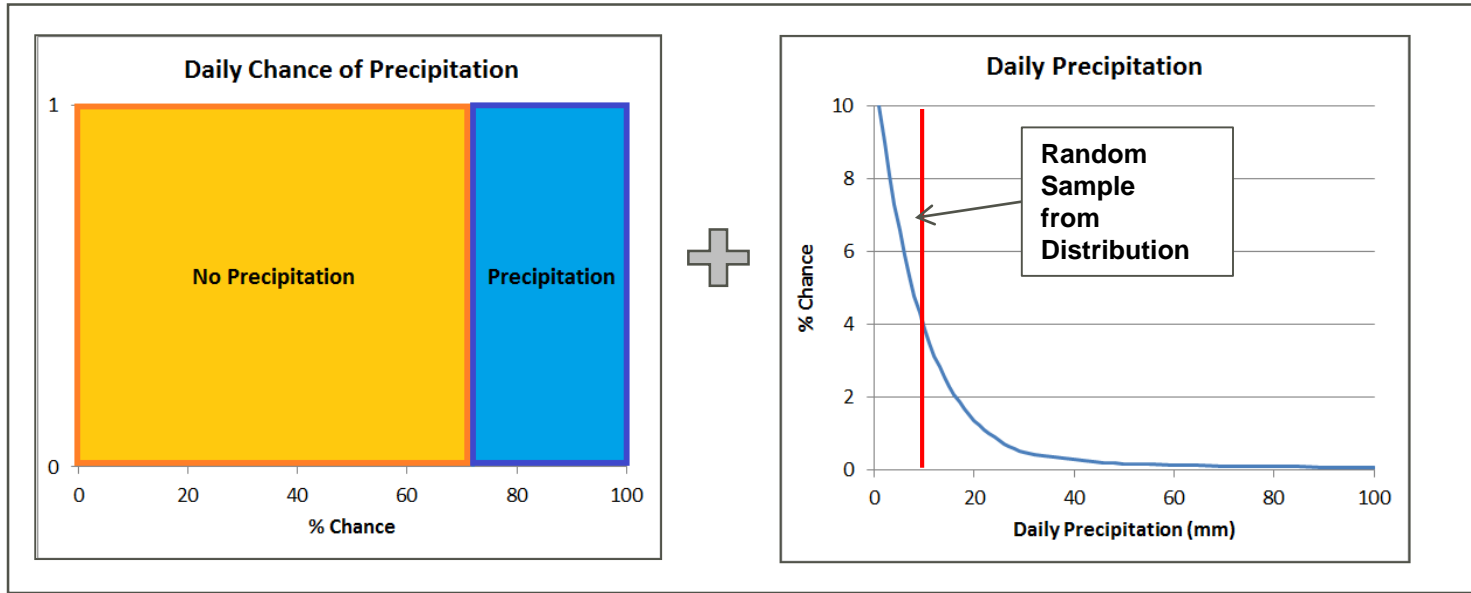
**Summary of Current and Future Risk
All Categories for Rain**



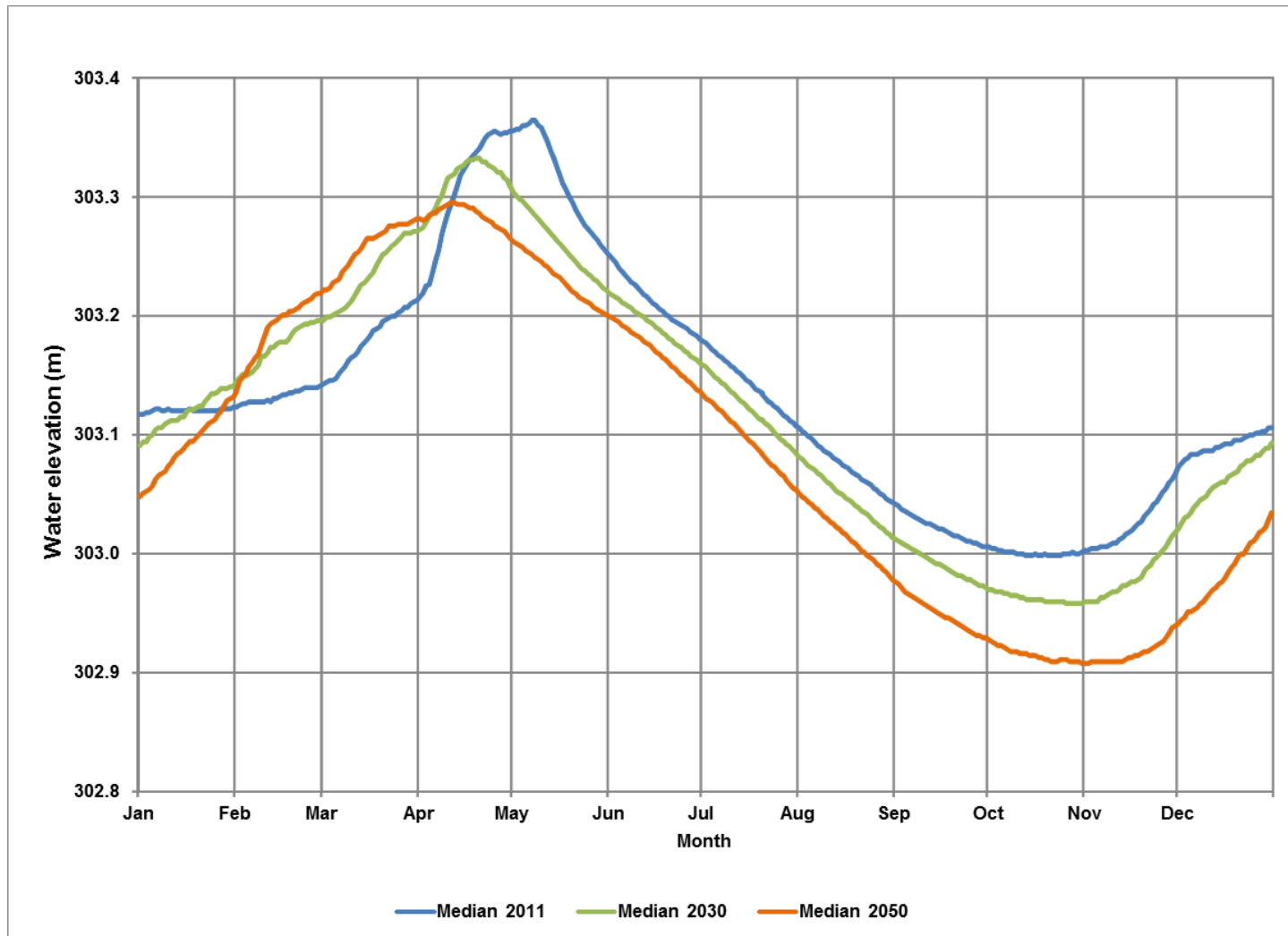
$$R = C \times P$$

R = Risk
C = Consequence
P = Probability

Generating Climate (Precipitation)



Water Management



Question – how to return disturbed areas to resilient natural landforms?

Closure

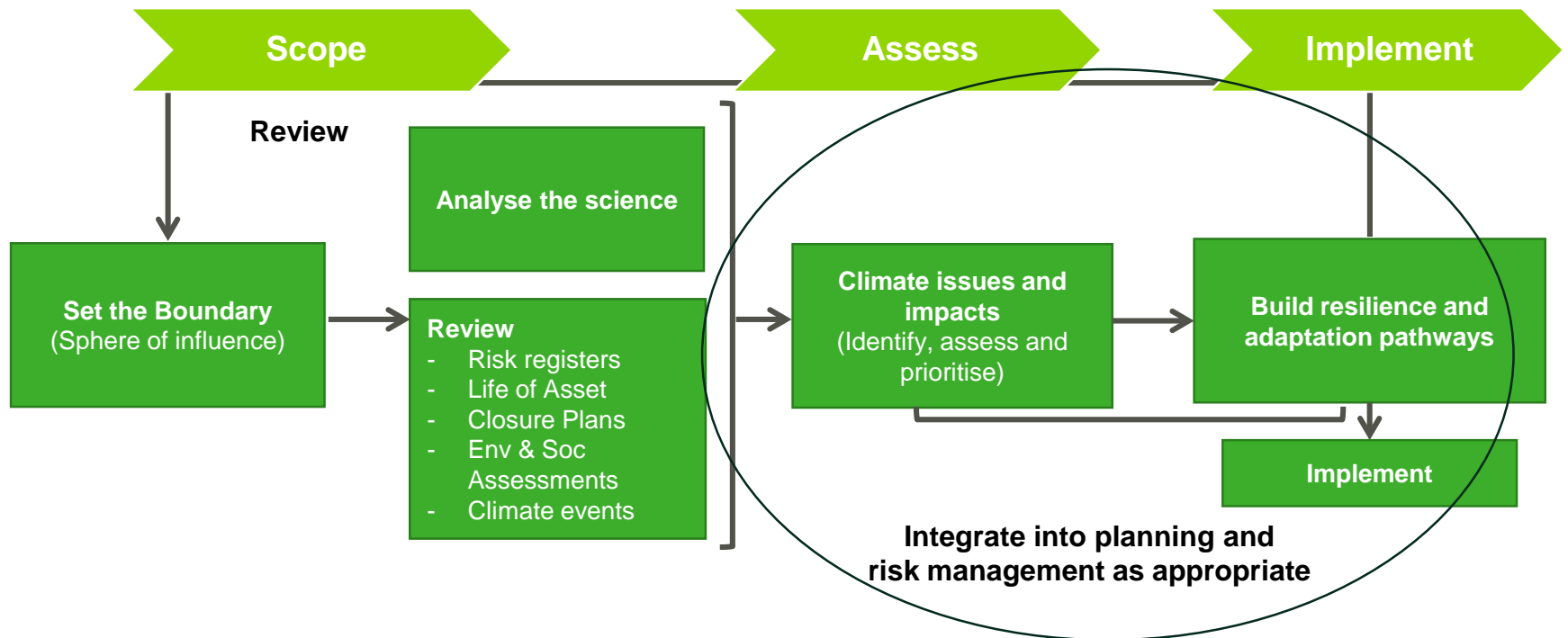
Examples - Closure

MINE SITE NORTHERN ONTARIO

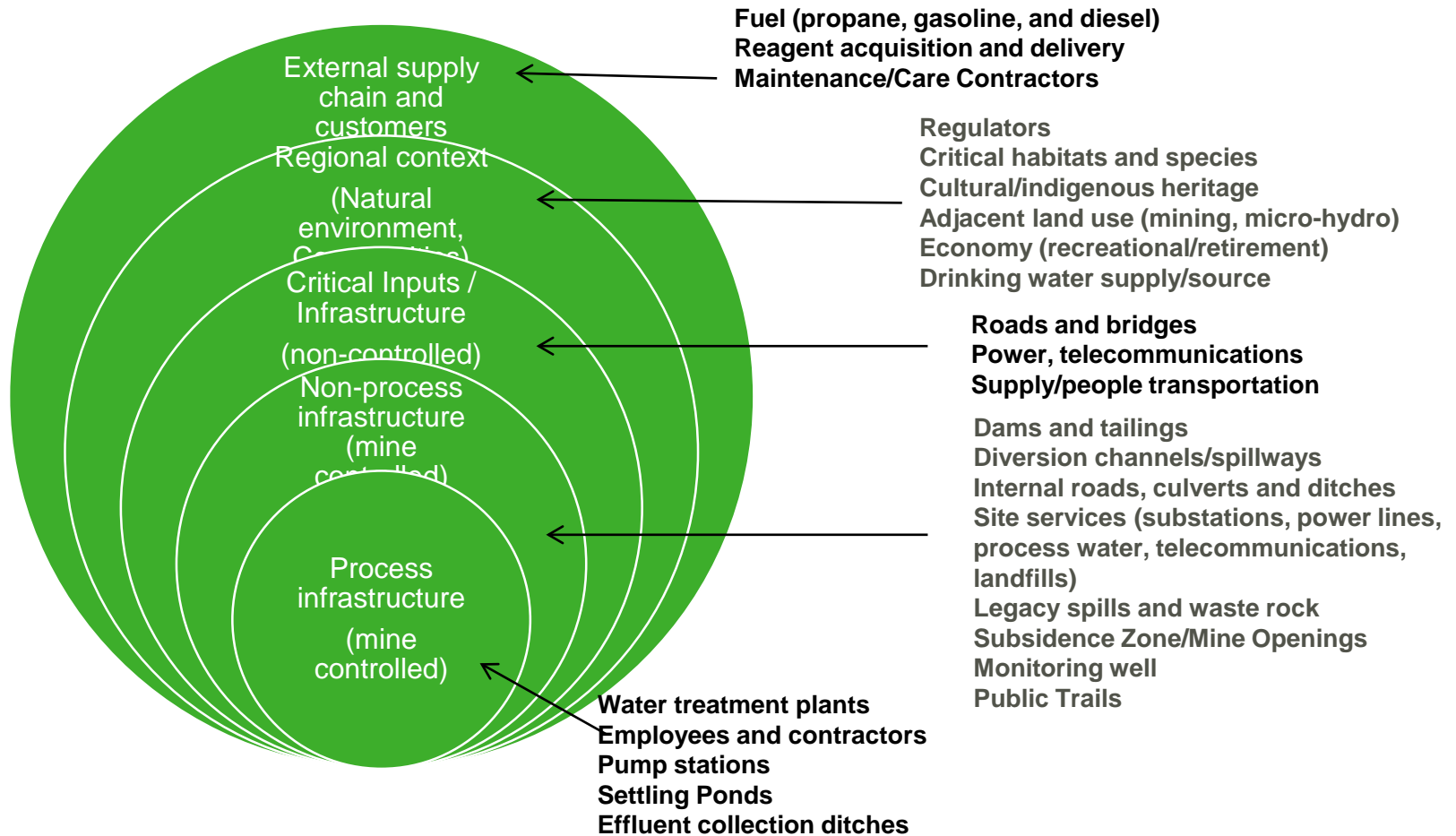
- Climate change projections used to support the climate risk assessment of the dams and water management structures for the various Tailings Management Areas (TMAs)
- Evaluate the impacts of climate change on the various TMAs by projecting how critical climate variables will change in the future and how this will affect the closure of the facility
- The key design parameters in the original closure reports were exceeded by the revised parameters under future climate conditions



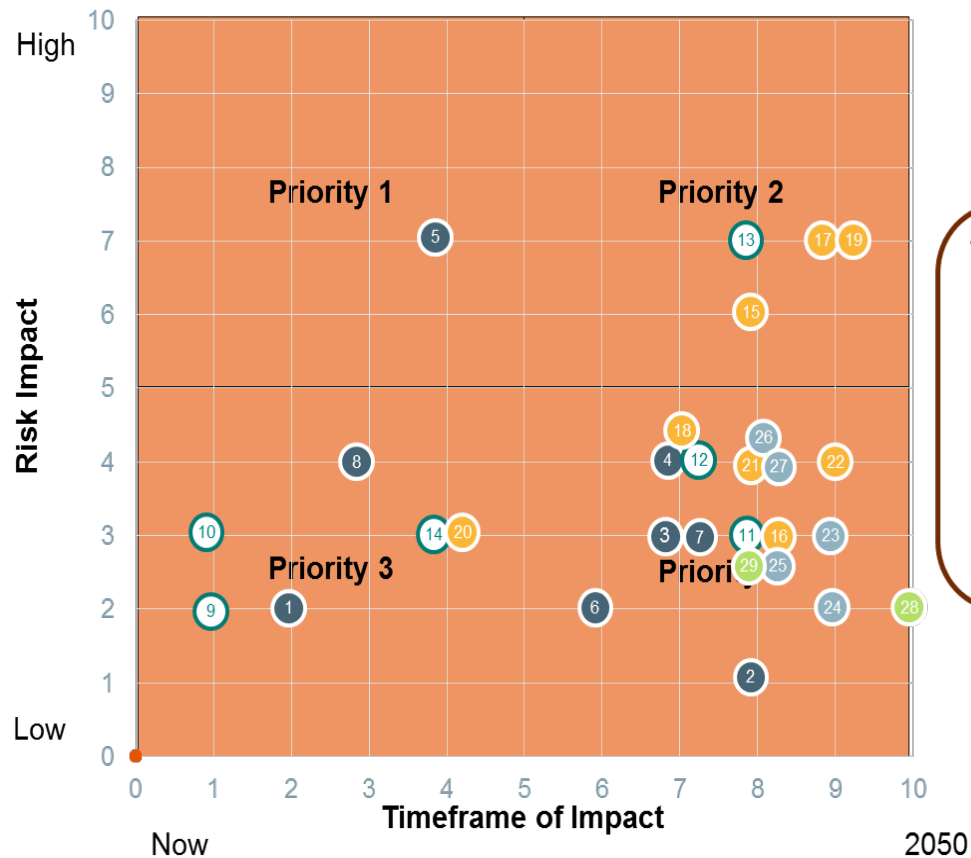
Climate Resilience Planning Process



Climate Sphere of Influence



Prioritization Matrix

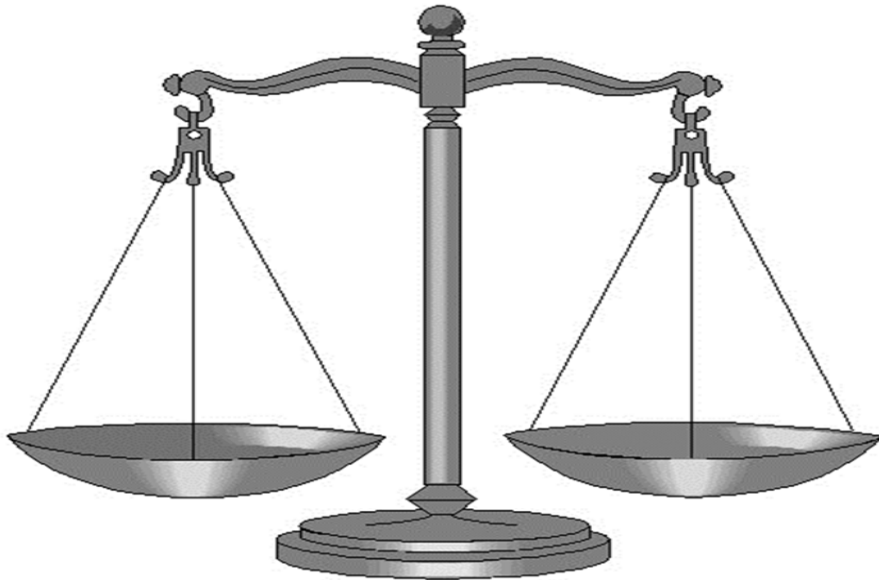


What is the significance of the climate issue?

1. How significant is the likely business impact?
2. When will the issue impact us?

Lessons Learned

PATH FORWARD



Data exists to describe the range and uncertainties of the future climate projections

Risk Assessment framework can identify climate interactions that require further assessment

Economic assessment can identify the preferred adaptation measures

Continuous improvement process can create stakeholder engagement



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Questions?

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