TRANSFORMING THE FLOWSHEET FOR TAILINGS

Workshop Report

Metplant 2026, Adelaide

22 March 2026

Workshop participants at Metplant 2026.

Contents

1. Executive summary

PURPOSE AND CONTEXT

CEEC International convened this workshop on the topic Transforming the Flowsheet for Tailings: Innovation for a Sustainable Future, in order to test the proposition that better tailings outcomes depend on earlier, innovative and more integrated thinking by process engineers before decisions across processing, dewatering, deposition, storage and closure. The workshop is the first industry consultation aspart of CEEC's Global Tailings Initiative and was designed as an interactive technical session rather than a conventional conference presentation.

The workshop combined short technical presentations, a structured tailings game, group flowsheet design exercises and live polling. Participants were asked to work through contrasting archetype scenarios and then revisit their initial assumptions as new information was introduced on clay behaviour, water chemistry, particle size distribution, dewatering physics, storage strategies and closure implications.

PARTICIPATION

The workshop brought together participants from mining companies, technology suppliers, consultants and research institutions, with strong representation from process and metallurgy backgrounds and additional participation from tailings and geotechnical, technology and equipment, and consulting disciplines. This mix supported cross-disciplinary dialogue and practical problem solving.

KEY CROSS-CUTTING INSIGHTS AND FINDINGS

1. **Tailings performance is strongly shaped by upstream decisions.** The workshop consistently linked tailings outcomes to comminution, recovery, particle size distribution management, water conditioning and stream separation, not just to storage facility design.
2. **Clay and fines behaviour remains a central technical constraint.** Participants repeatedly highlighted clay and fines behaviour, along with water chemistry and dispersion, as underappreciated drivers of dewatering performance, storage behaviour and closure risk.
3. **A common language is needed across disciplines.** Discussion highlighted the need for process engineers, tailings and geotechnical specialists, technology providers and operators to adopt clearer, and specifically, shared terminology when describing tailings characteristics, clay behaviour, water quality, dewatering performance and closure requirements.
4. **There is no single preferred tailings technology.** The breakout scenarios showed that viable solutions vary by ore, water chemistry, climate, topography, seismic setting, operating constraints and closure intent.
5. **Industry still defaults toward conventional solutions.** Early polling and group exercises showed that thickened tailings remains the instinctive default, even where upstream redesign, size separation or hybrid approaches may unlock better outcomes.
6. **CEEC is well placed to convene the next stage of work.** The strongest support in the final polling was for CEEC and the Global Tailings Initiative to produce a practical decision framework, case examples

and continued cross-disciplinary dialogue.

NEXT STEPS

- Document and share the findings of this workshop across CEEC's networks, sponsors and stakeholders.
- Convene a discussion forum, perhaps via LinkedIn
- Translate the workshop logic into a practical decision framework linking ore, water, particle size, climate, topography and closure requirements to feasible dewatering, deposition and storage pathways.
- Develop a casebook of working examples covering hybrid flowsheets, split-stream concepts, sand production strategies and other intermediate solutions.
- Prioritise follow-on dialogue and applied research on clay mineralogy, water chemistry, dispersion behaviour, water recovery mechanisms, operability and risk assurance.

CLOSING REFLECTION

The workshop reinforced that better tailings outcomes will not be achieved by focusing on storage in isolation. Earlier flowsheet decisions, stronger cross-disciplinary understanding, and more practical pathways between conventional and filtered solutions will be critical to improving safety, water recovery, closure performance and project economics.

2. Introduction

Tailings management is under increasing scrutiny from regulators, communities, investors and operators. At the same time, declining ore grades, finer-grained orebodies and the growing volumes of fine and clay-rich material, permitting challenges, closure liabilities and water constraints are increasing the pressure on minerals processing flowsheets and storage strategies.

In this context, CEEC convened a dedicated workshop in Adelaide in parallel with Metplant 2026 to examine tailings as an integrated flowsheet issue. The workshop brought together mineral processing engineers and other technical specialists to explore how ore characteristics, water chemistry, particle size management, dewatering and storage choices interact, and to identify practical pathways toward safer, more efficient and more adaptable tailings systems.

3. Disclaimer

This report captures the discussion, themes and outputs generated during the workshop. It should not be interpreted as a formal benchmark, ranking or endorsement of any technology, supplier, service provider or methodology. The workshop was conducted under the Chatham House Rule to support open, technically grounded discussion. References to concepts discussed during the day reflect the findings of participant exploration and should not be interpreted as CEEC policy positions or definitive technical prescriptions.

4. CEEC's Mission and Role in the Industry

CEEC International is a global not-for-profit organisation dedicated to accelerating the adoption of eco-efficient minerals and metals production practices. CEEC provides an independent platform that connects industry leaders, researchers, operators and technology providers to advance practical improvements in energy, water, emissions and tailings.

Within that role, the Global Tailings Initiative creates space for technically grounded, cross-disciplinary dialogue on the upstream and downstream choices that shape tailings outcomes. CEEC does not promote specific vendors or commercial solutions. Its value lies in convening diverse perspectives, surfacing practical insights and helping the sector translate technical understanding into better decisions.

5. Purpose of the Workshop – Transforming the flowsheet for tailings

The purpose of the workshop was to unlock ideas during free dialogue. Viable, cost-effective and safe strategies for tailings generation and management that improve cost, safety, water consumption and physical footprint were explored. The session especially challenged a common framing in industry practice: that tailings solutions collapse toward two bookends - wet thickened tailings on one side and filtered dry stack on the other.

Participants were encouraged to examine the broader decision space between those endpoints, including size separation, stream management, water conditioning, staged dewatering, hybrid arrangements, sand production, co-disposal concepts and closure-led design choices. The central premise was that better tailings outcomes depend on earlier and better-integrated decisions across the full flowsheet.

> **Workshop focus areas:** tailings characterisation; clays and water; flowsheet selection; particle size management; dewatering; tailings placement; and size separation.

6. Workshop Structure and Methodology

Workshop design and format

The workshop agenda combined technical context-setting with iterative group problem solving. After welcome remarks and introduction of the tailings game, participants moved through three technical blocks: classifying tailings, the physics of dewatering, and storage, closure and landforms. Between and after the technical presentations, each table developed a workable tailings flowsheet for a scenario, tested conventional and unconventional solutions, and then adjusted its design in response to a wild card or changed constraint.

Rather than treating tailings storage as a downstream issue to be solved after the plant flowsheet is fixed, the workshop repeatedly pushed participants to move upstream and revisit comminution, recovery, size separation, water conditioning, deposition and storage as one integrated system. The structure also supported cross-disciplinary learning, consistent with the workshop hypothesis that outcomes improve when disciplines build at least a working understanding of each other's technical drivers.

Agenda	
Time	**Session**
8:30 AM	Registration and welcome coffee
9:00 AM	Welcome
9:15 AM	Tailings game introduction - Andrew Vietti
9:30 AM	Tailings game - Round 1

10:30 AM	Coffee break
10:45 AM	Technical session - Matt Pyle
12:00 PM	Lunch
1:00 PM	Technical session - Campbell Haines
1:30 PM	Tailings game - Round 2
2:00 PM	Coffee break
2:15 PM	Group presentation and discussion
3:00 PM	Closing remarks

7. Facilitators and Participants

Facilitators and Presenters

The workshop was guided by facilitators and presenters with experience spanning tailings management, mineral processing, slurry transport, flowsheet design and industry collaboration. Together, they brought perspectives from technical consulting, operations, innovation and industry leadership, helping to frame discussion across upstream processing, dewatering, storage and closure.

Name	Role	Organisation
Laurie Reemeyer	Facilitator; CEEC Advocate	Resourceful Paths
Philip Bangerter	Host; CEEC Board Director	CEEC International
Andrew Vietti	Presenter	Vietti Slurrytec
Matt Pyle	Presenter	Ausenco
Campbell Haines	Presenter	Ausenco

Participant profile

The workshop brought together 32 participants from a cross-disciplinary mix of mining companies, technology and equipment providers, consultants, researchers and academia. Participants brought strong representation from process and metallurgy backgrounds, alongside expertise in tailings and geotechnical, technology and equipment, and consulting disciplines. This mix supported the workshop's objective of testing tailings decisions through multiple technical and operational lenses.

Participant	Title	Organisation
Arturo Gutierrez	Principal Process Consultant	Ausenco
Greg Williams	Technical Consultant	Ausenco
Richard Whittering	Principal Process Consultant	Ausenco
Gerson Sandoval	Lead Metallurgist	Beca

Tony Tran	Principal Innovation Tailings & Water	BHP
Wilson Bui	Project Metallurgist	BHP Olympic Dam
Tom Hilde	Principal, Global Processing and Metallurgy	BHP Resource Centre of Excellence
Alec Newman	Country Manager	Derrick
Yogesh Rega	Technical Manager	Derrick
Fran Burgess	Manager Process Qld	Ausenco Services Pty Ltd
Caroline Woywadt	Managing Director	Gebr. Pfeiffer Mining Gmbh
Danica Alburo	Metallurgist	Glencore
Stanko Nikolic	Director Of Technologies	Glencore Technology
Simon Michaux	Senior Scientist	GTK
Shaun Wait	Sales Manager - Dewatering	Jord International
Carsten Gerold	Sr. Manager Ore & Minerals Technology	Loesche
Chris Greet	Global Mineral Processing Specialist	Magotteaux
Jason Palmer	Senior Manager Filtration	Metso
Joshua Pethick	Technology Manager - Mining Filters	Metso
Sergio Calil	Manager Tailings Filtration	Metso
Peter Cooper	Sales Manager	Micronics
Virginia Lawson	Principal Consultant	Mineralis
Trent Jolly	Principal Process Engineer	Mining One Consultants
Alec Malcolm	Senior Plant Metallurgist	MMG
Kirsty Hollis	Principal Metallurgist	Oceanagold
Ben Strong	Group Manager Processing, Infrastructure and Tailings	Perseus Mining
Bernadette Currie	Principal Advisor Processing	Self Employed
Natasha Walter	Senior Technical Specialist	Sinoz Group
Kingsley Lui	Managing Principal	The Peoples Solicitors
Kevin Galvin	Director ARC Centre of Excellence	University of Newcastle
Daniel Komada	Chemical Engineering Student	University of Queensland
Jeremy Hanhiniemi	Director, Technology and Innovation	Weir

8. Key Discussion Themes

8.1 Challenging conventional thinking

The opening discussion established that many tailings decisions are still shaped by convenience, habit and organisational boundaries rather than by a whole-of-system assessment of risk and opportunity. Participants were encouraged to question whether conventional solutions are truly optimal when viewed through the combined lenses of water recovery, embankment stability, closure burden and mine life extension.

The workshop materials also emphasised that filtered tailings are not the only alternative to conventional slurry storage. Instead, participants were asked to look for a broader set of options across classification, dewatering intensity, deposition strategies, sand production, co-disposal and pre-concentration.

8.2 Classifying tailings: clays, fines and water quality

A central thread in the workshop was that process engineers and geotechnical disciplines lack a common language for describing tailings, particularly where clay-rich systems are involved. This inhibits an interdisciplinary approach to design of tailings systems.

The presentations highlighted the interaction between clay mineralogy, cation exchange characteristics, pH, ionic strength and calcium-to-sodium balance in driving dispersion and dewatering behaviour.

Participants were encouraged to move beyond broad references to difficult tailings and ask more specific questions about the fines fraction, active clay content and whether process water is dispersive. Workshop discussion also reinforced this theme, with water quality identified as one of the most underestimated factors affecting tailings behaviour.

8.3 Dewatering physics and the value of stream separation

The dewatering discussion focused on a practical proposition: it often does not make technical sense to dewater coarse and fine particles together. Coarse particles occupy capacity and create wear, while fine and clay-rich fractions require more dewatering effort and can blind filter media or retain water within networked structures.

This led participants toward size separation, bimodal or split streams, coarser grind strategies and more tailored combinations of primary and secondary dewatering technologies. In the live polling, upstream flowsheet design ranked first and particle size distribution management ranked second as the levers with the biggest impact on outcomes but least use in practice.

8.4 Storage, closure and landform implications

The discussion extended the analysis downstream into storage and closure. Participants examined how placement strategy, embankment concept, drainage design and closure objectives materially affect cost, permitting, rehabilitation complexity and long-term liability.

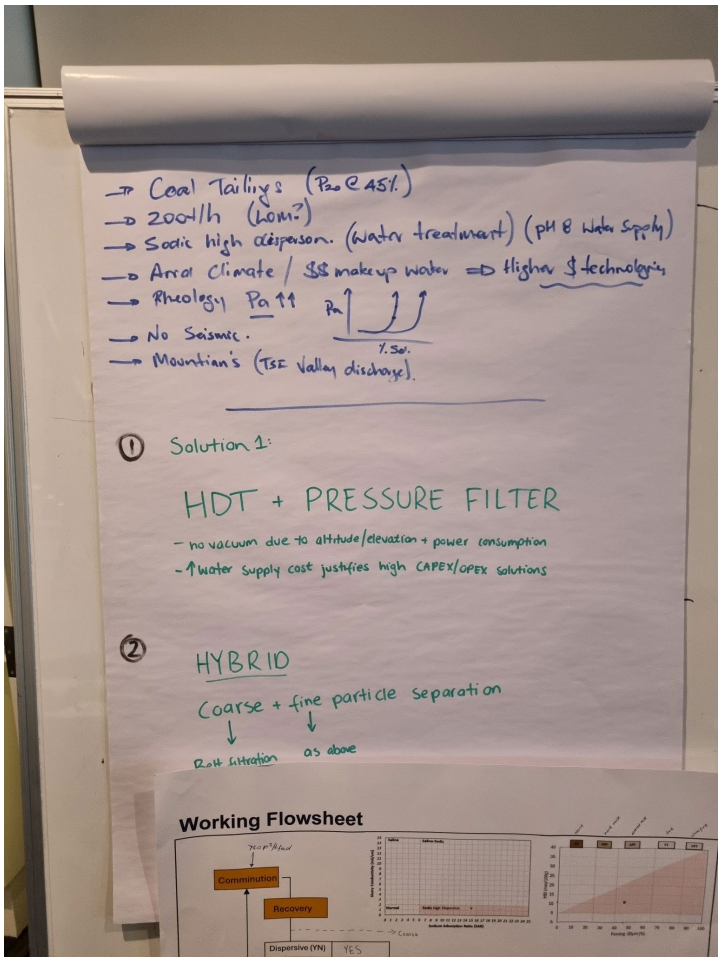
The examples contrasted conventional approaches with next-generation concepts that combine sensing, sorting, screening, coarse rejection and selective deposition. These examples illustrated how stronger separation of coarse and fine fractions may reduce the wet tailings inventory, improve drainage and create

additional options for co-disposal, sand embankment construction, valley discharge concepts or staged closure.

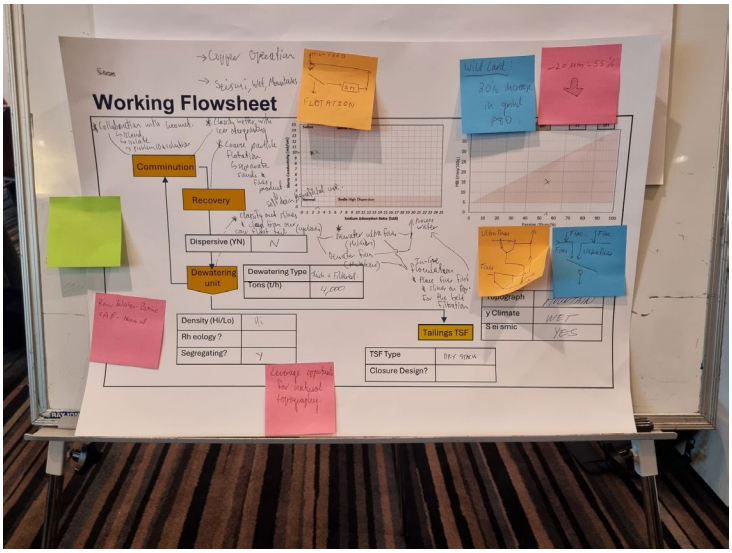
8.5 Breakout activity and worksheet themes

The breakout activity involved applied problem solving towards a hypothetic tailings design case. Groups worked through a unique problem statement covering a range of site conditions, including arid and wet climates, mountainous and flat topography, dispersive and non-dispersive systems, and both seismic and non-seismic settings. The resulting flowsheets varied significantly, reinforcing that there is no universal answer and that the right solution depends on the interaction between ore, water, climate, topography, operating constraints and closure intent.

Several groups moved toward hybrid or split-stream solutions, including high-density thickening plus pressure filtration, coarse and fine particle separation, cyclone or screen-based sand production, and use of coarse fractions for embankment or drainage support.

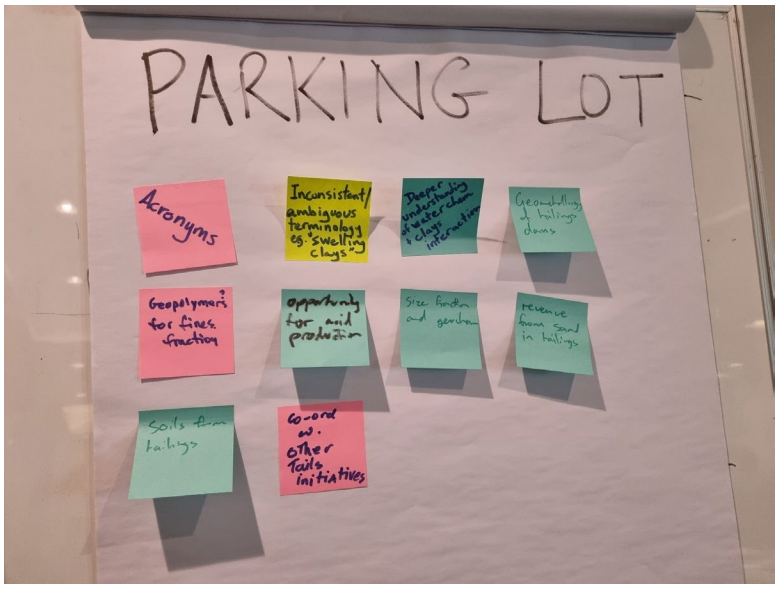


Whiteboard notes from one breakout scenario.



Annotated flowsheet showing scenario redesign and wild card response.

The parking lot captured additional themes for future work, including inconsistent terminology, water-clay interactions, geomorphology and tailings dam design, geopolymers for fines fractions, and revenue opportunities from sand in tailings.



Parking lot topics captured during the workshop.

9. Workshop Outcomes

- The immediate outcome of the workshop was a stronger shared understanding that tailings design should be addressed as an integrated flowsheet question. The worksheets show that participants actively applied new information during the day and reworked their solutions rather than defending their starting assumptions.
- A further outcome was recognition that the sector needs a more consistent common language for tailings. Participants identified that terminology is not always shared across process, tailings, geotechnical, water and closure disciplines, particularly when describing clay-rich systems, fines behaviour, water quality and

dewatering performance. Building this shared language should be treated as an enabling step for more integrated design and decision making.

- A second outcome was clearer prioritisation of the issues requiring further industry attention. The workshop discussion and group exercises pointed to a focused set of high-value topics: practical flowsheet-to-tailings decision support, stronger treatment of clay and water chemistry effects, greater confidence in water recovery mechanisms, and clearer articulation of risk, operability and assurance.
- A third outcome was community-building. The workshop brought together operators, suppliers, consultants and researchers around a common technical problem, consistent with CEEC's goal of building an interdisciplinary tailings community of practice.

Question	Result
Dominant constraint in participant scenarios	Clay & fines 48%; seismic & stability 31%; water availability 7%
What would change decisions most quickly	Social licence and permitting timelines ranked first; seismic-geotech context second; PSD and % <20 um third
Impact of clay session on participant thinking	48% yes - significantly; 40% yes - somewhat; 12% no change
Most underestimated factor affecting tailings behaviour	Water quality was the leading response
Lever with biggest impact but least used	Upstream flowsheet design ranked first; PSD management second
Most promising route to improve water recovery	Coarse grinding / particle size management ranked first
Biggest barrier to wider improvement	Operational complexity ranked first, followed by CAPEX and lack of data
Priority for the next 10 years	Tailings dewatering technologies ranked first, followed by water recovery
Priority for CEEC / GTI next	Practical decision framework ranked first; casebook of working examples second

10. Recommended Next Steps

Develop a practical decision framework: Translate the workshop logic into a practitioner-friendly framework that starts with ore, water, particle size distribution, climate, topography and closure requirements, and then guides users toward feasible dewatering, deposition and storage pathways.

Prepare a casebook of working examples: Document real or near-real examples of hybrid flowsheets, split-stream concepts, sand production strategies, controlled dispersed systems and other intermediate solutions that sit between conventional and fully filtered concepts.

Define a targeted research agenda: Prioritise applied work on clay mineralogy, water chemistry, dispersion behaviour, water recovery mechanisms, operability and risk assurance for non-conventional tailings solutions.

Convene follow-on operator roundtables: Use smaller operator-focused forums to test the emerging framework against live brownfield and greenfield problems and to identify data gaps and adoption hurdles.

Link GTI outputs with other CEEC initiatives: Connect tailings work with CEEC's broader programs on water, energy and readiness-level thinking so that future outputs reinforce each other and support integrated flowsheet decisions.

Develop the Global Tailings Initiative white paper: Use the workshop findings as a foundation for a CEEC-convened white paper that frames tailings as an integrated flowsheet issue, documents the need for a common cross-disciplinary language, and sets out practical principles for linking ore characteristics, water chemistry, particle size management, dewatering, deposition, storage and closure. The white paper will draw on technical expert input, peer review and steering committee guidance, and identify priority questions for the next phase of GTI work.

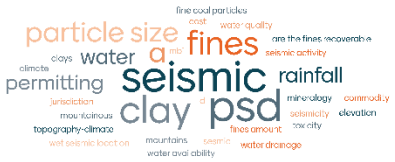
11. Closing Reflection

The workshop did not produce a single preferred tailings configuration, nor was that its purpose. Its value lay in making visible the often-fragmented decisions that shape tailings performance and in helping participants test how those decisions shift when clays, water chemistry, particle size and closure requirements are considered together.

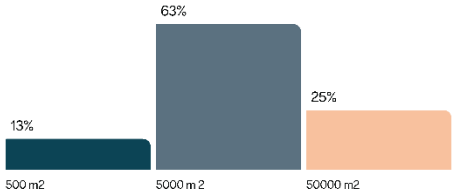
For CEEC and the Global Tailings Initiative, the strongest message was that the sector needs more practical tools for navigating the space between default conventional solutions and fully optimised future-state concepts. The workshop provided a strong foundation for that next stage of work.

Appendix A: Mentimeter Results

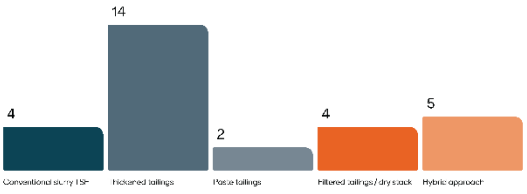
Which factor is most likely to create the biggest challenge in your scenario?



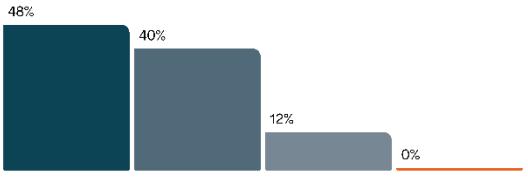
What total surface area does a small spoonful of swelling clay have?



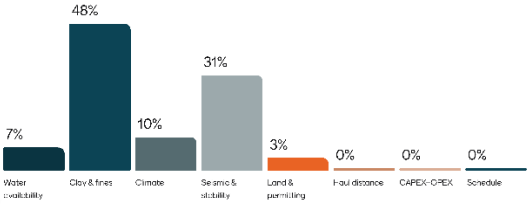
What would your instinctive "conventional" solution be?



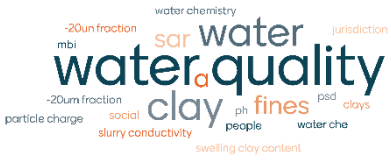
Has the new information about clays changed how you view your project scenario?



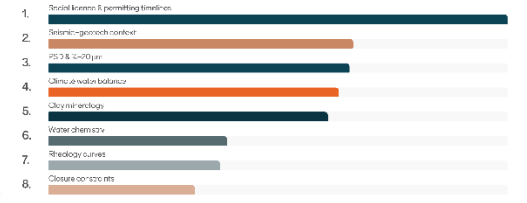
For your scenario, what's the dominant constraint?



What is the single most underestimated factor affecting tailings behaviour?



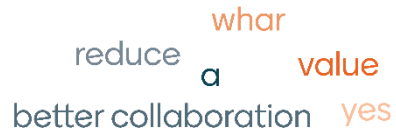
What info would most change your decision quickly?



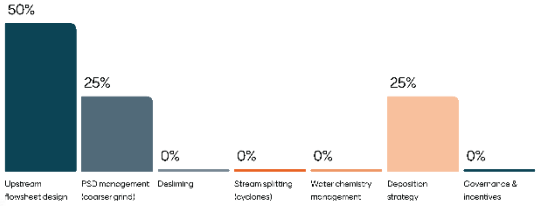
What's the most misunderstood factor about "difficult" tailings?

What do you think is happening here? What are the potential mechanisms that explain this?

Do you think this has industrial relevancy? How might we rethink dewatering?

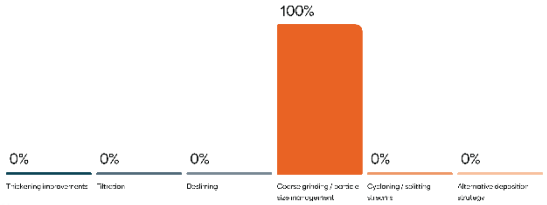


Which lever has the biggest impact on tailings outcomes, but is least used?

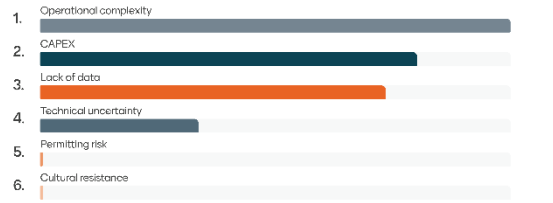


What's your best "unconventional" option for your scenario now?

Which approach seems most promising for improving water recovery in your scenario?

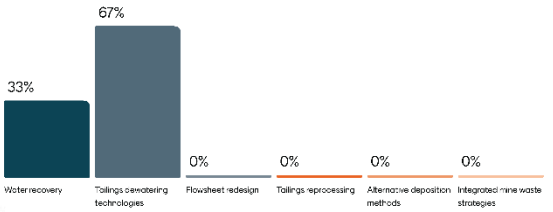


Which constraint most limits adoption of unconventional tailings solutions?

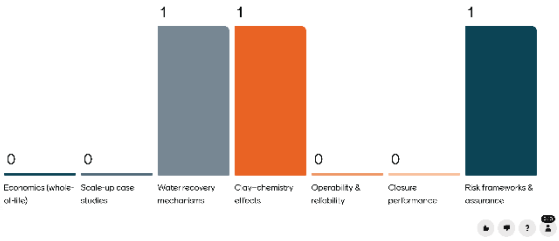


What is the biggest barrier to improving tailings outcomes industry-wide?

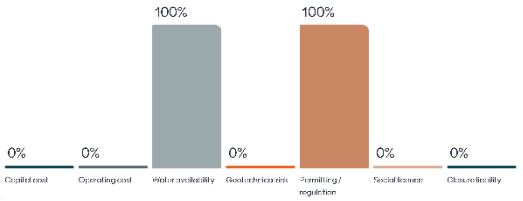
What should the industry prioritise over the next 10 years?



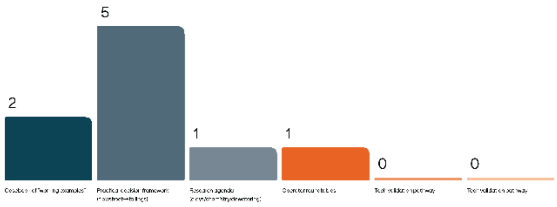
Where do we need more evidence to unlock adoption?



In your experience, what most strongly drives tailings strategy decisions?



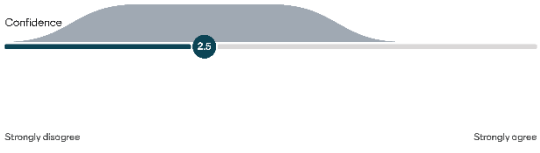
What should CEEC/GTI prioritise next?



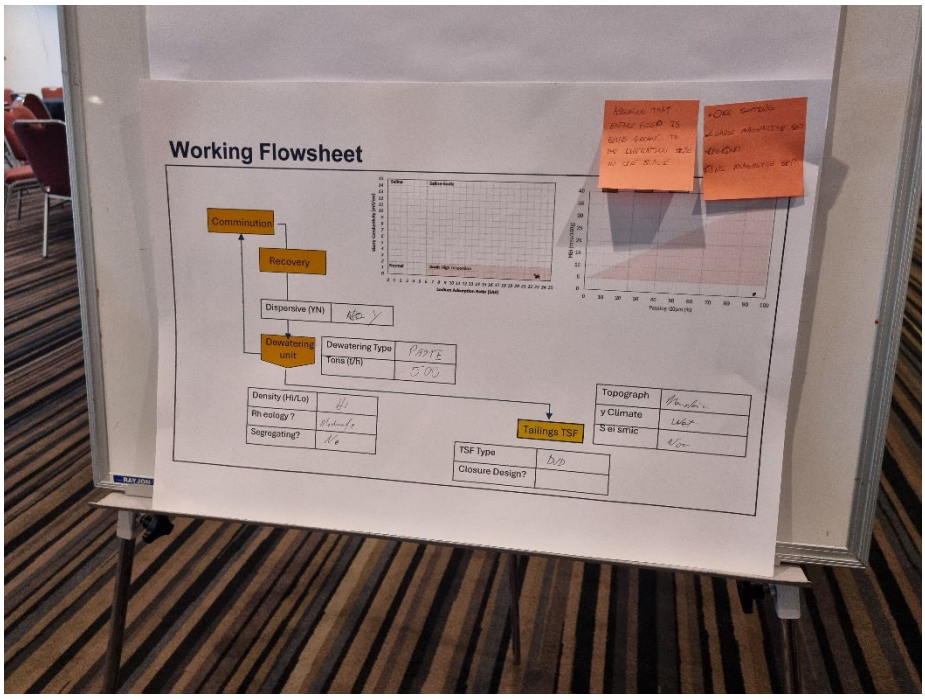
One word: What "Tailings success" looks like to you?

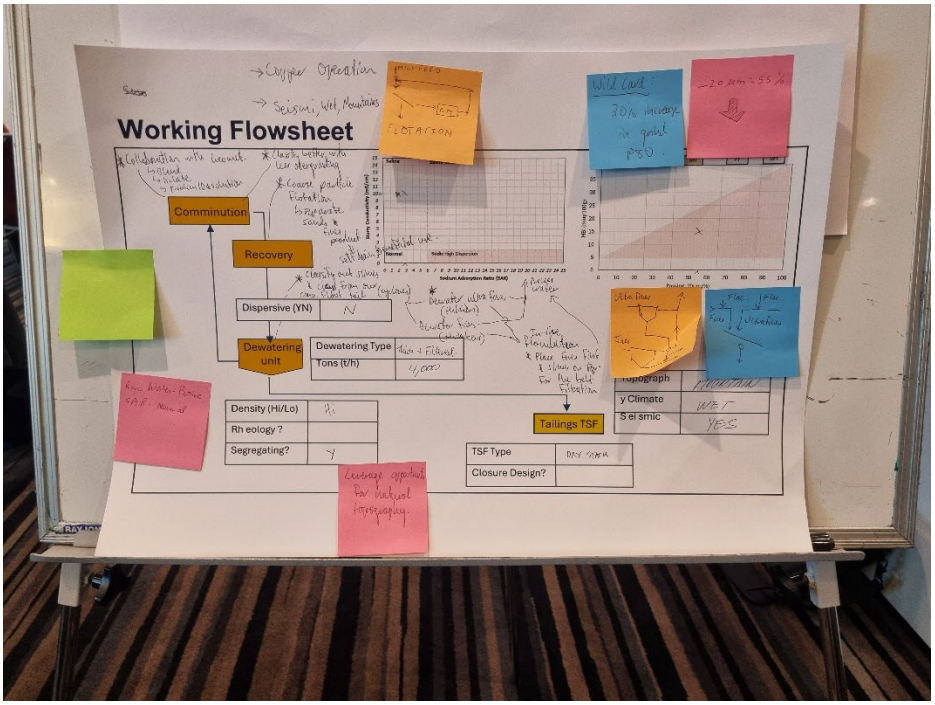
What discipline best describes your primary background?

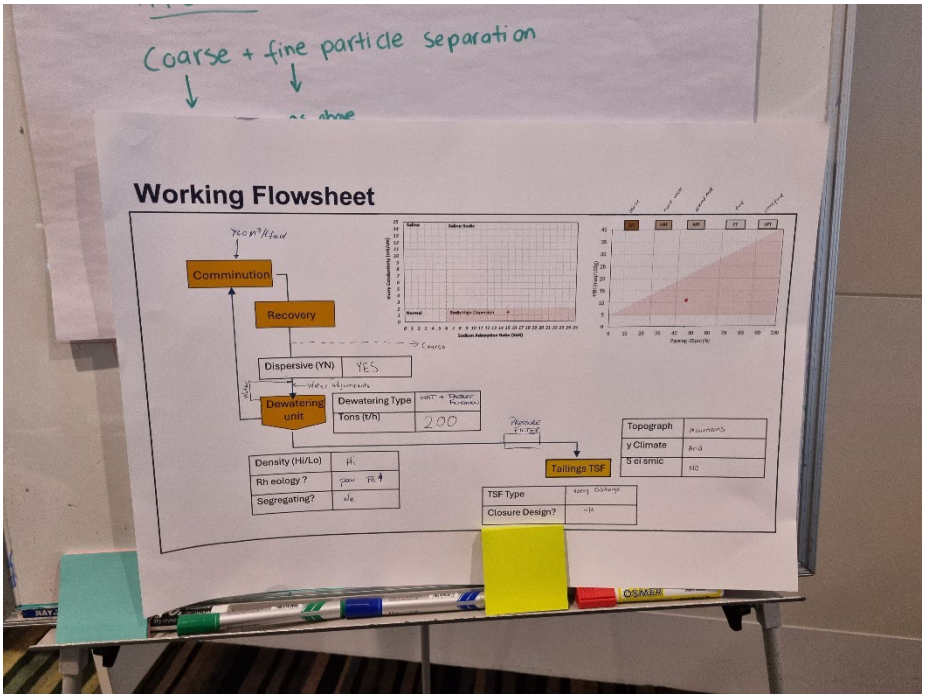
How confident are you that our industry understands what really drives tailings dewatering performance?



Appendix B: Photos of Working Flowsheets






Coarse + fine particle separation
Working Flowsheet
Comminution
Recovery
Dispersive (YN)
YES
Dewatering unit
Dewatering Type
Tons (t/h)
200
Density (Hi/Lo)
Rh eology ?
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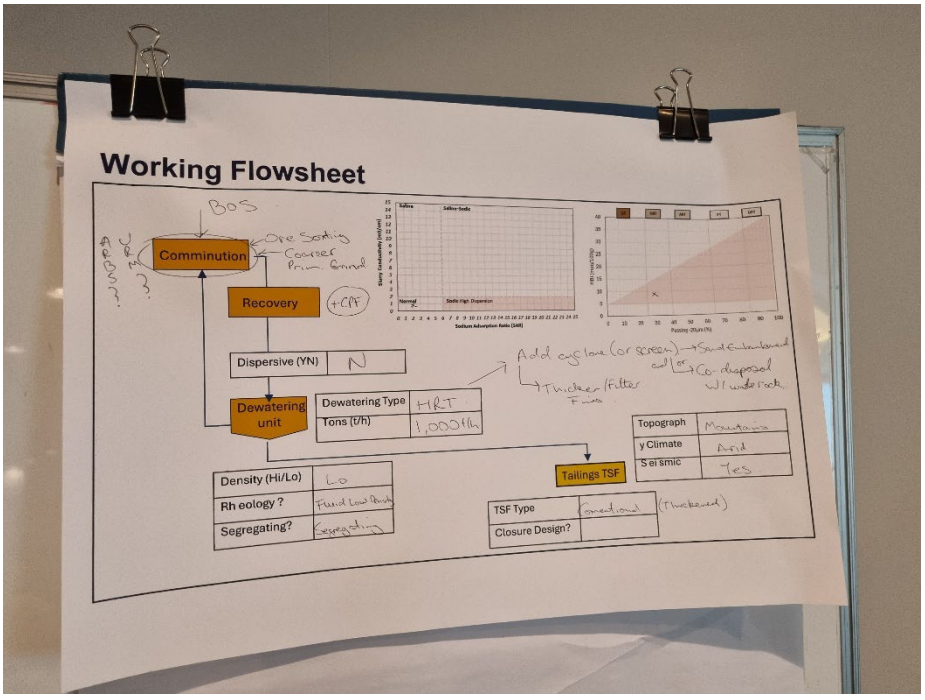
Working Flowsheet
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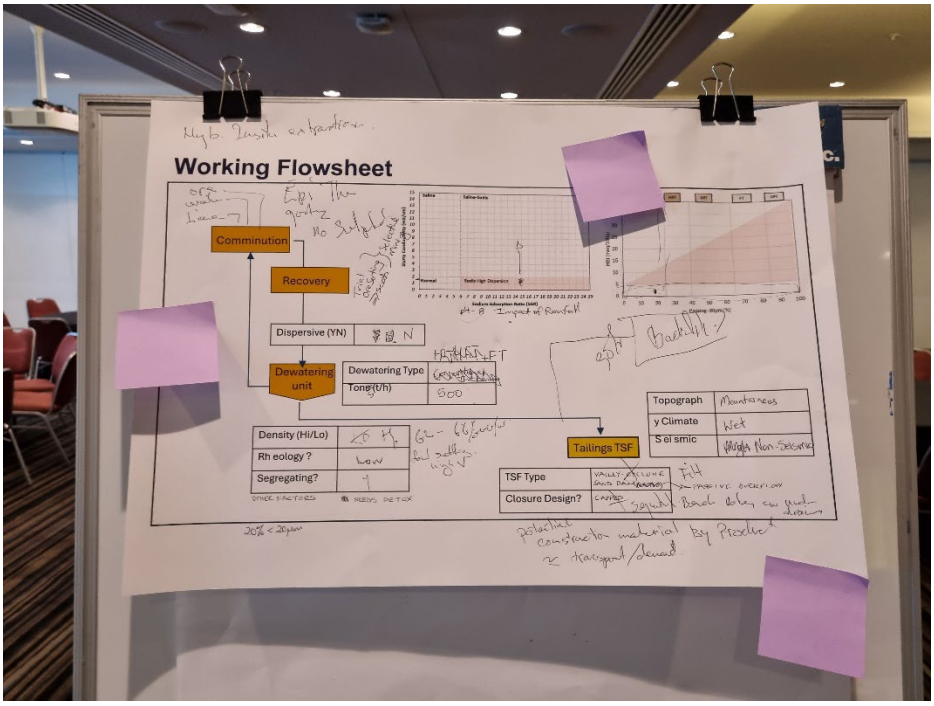
Yes


Working Flowsheet
Comminution
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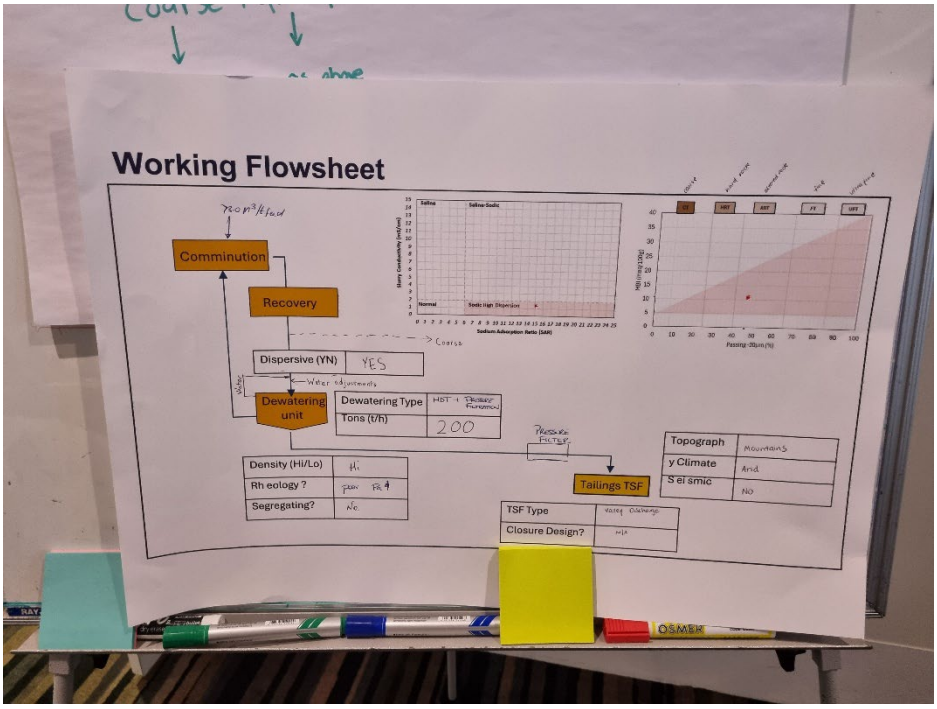
Working Flowsheet
Comminution
Recovery
Dispersive (YN)
YES
Dewatering unit
Dewatering Type
Tons (t/h)
200
Density (Hi/Lo)
Rh eology ?
Segregating?
Tailings TSF
TSF Type
Closure Design?
Topograph
Mountains
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And
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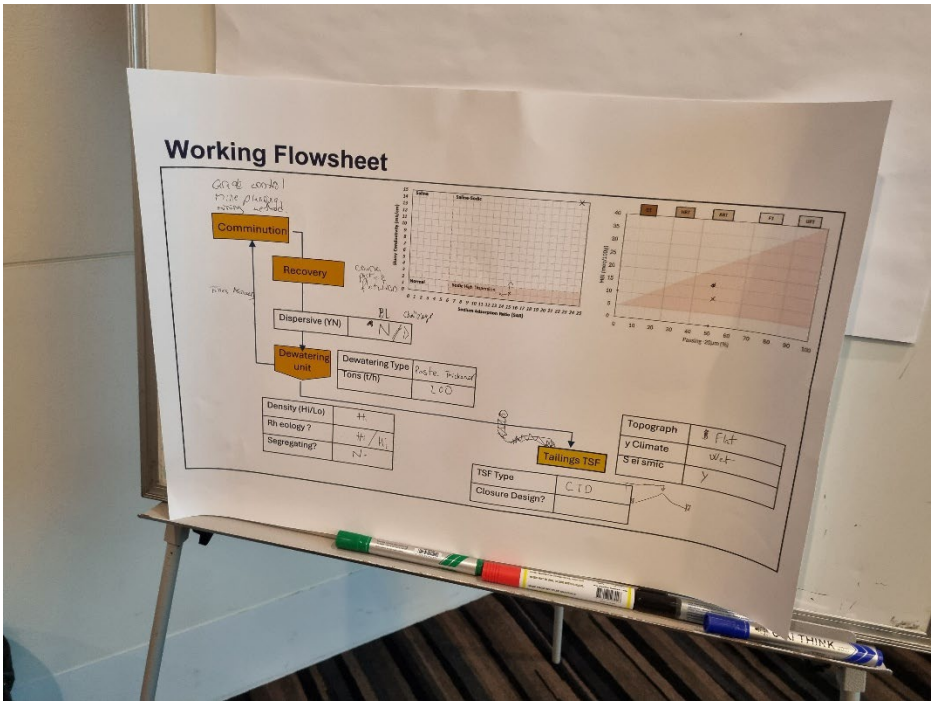
NO


Working Flowsheet
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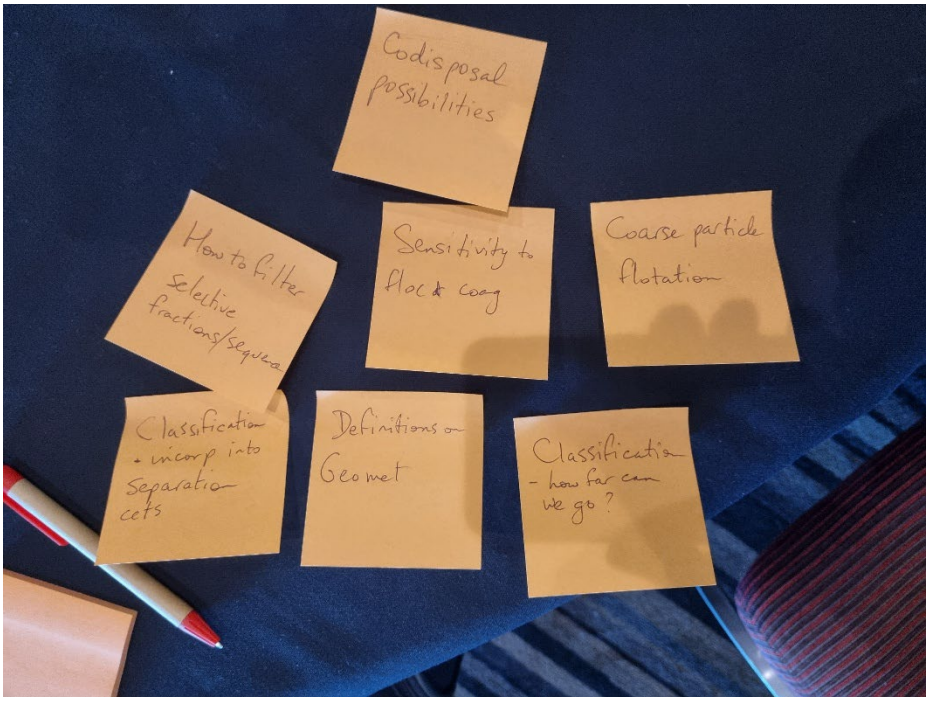
Codisposal possibilities
How to filter Selective fractions/sequen
Sensitivity to floc & coag
Coarse particle flotation
Classification + incorp into Separation cets
Definitions on Geomet
Classification - how far can we go ?