Underground Pumped Hydro Energy Storage Project (UPHES SRG)
Stakeholder Reference Group

MINUTES: Meeting 3

Date	27/01/2022	
Time	4.00pm – 4.45pm	
Venue	Online due to COVID-19 precautions	
Independent Chair	Abigail Goldberg	Chair and Director, GoldbergBlaise
Invitees	Mr Ray Robinson Mr Trevor Jame	Myuna CCC Mandalong CCC & Mandalong MCA
Observers	Mr Tim Couchman	ARENA
In attendance	Mr Matthew Fellowes	Banpu Energy Australia
Apologies	Ms Robyn Charlton Mr Glenn Bunny Mr Peter Leven Mr James Marshall Mr Ryan Skinner Mr James McDonough Mr Anthony Margetts	Newstan-Awaba CCC & Lake Macquarie Sustainable Neighbourhoods Alliance Lake Macquarie City Council Awabakal & GuriNgai Pty. Ltd Banpu Energy Australia NSW Emerging Energy Program DPIE - Energy, Resources and Industry DPIE - Mine Safety

Agenda item		**Action**
1.0	**Welcome** The Chair welcomed participants and advised apologies.	
	Declaration of interests No new interests were advised.	Participants to update the Chair either inter-session or at meetings should any issues of conflict of interest, perceived or actual, arise.
2.0	**Overview of project progress** An update of project progress was provided by Matt Fellowes, who addressed: • Delays due to Covid-19 workplace health and safety requirements, however large scale permeameter testing has now been completed. • Preliminary results of the large scale permeameter test program • Current research activities. Participants raised questions in relation to: • Whether gases would be exhausted to atmosphere or retained within the mine? Noted that this is still to be quantified as part of the numerical modelling. Also noted that if the gas is methane, a re-use protocol may be considered. • Behavior of fines migration and implications? Noted that the velocity of water may be quite high, resulting in turbulence in	

	parts of the goaf, particularly at the edges. Pumps and turbines can be designed to handle high sediment load, albeit with increased capital cost. Options exist to manage sediment, albeit adding capital and maintenance cost. The PPt presentation is attached to the Minutes and will be posted online with the Minutes once these are finalised.	
3.0	**Other business** No other business was raised.	
4.0	**Roadmap for meetings going forward** The roadmap for meetings going forward is currently: **Meeting 4** (April 2022): • Summary of conclusion of Stage 1 Research Program – Technical Viability. • Timeline and program of activities for the next Stages.	
5.0	**Next meeting** It was agreed that the next meeting would be **4 – 5pm** on **Thursday, 14 April 2022.** This meeting may be online or face-to-face, depending on health and safety considerations at the time regarding COVID-19. The Chair closed the meeting with thanks to participants at 4:45pm.	An Agenda and venue for the April meeting will be advised ahead of time.

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Underground Pumped Hydro Energy Storage (UPHES) Stakeholder Reference Group Meeting 3 – 27 January 2022

Project Proudly Funded by:

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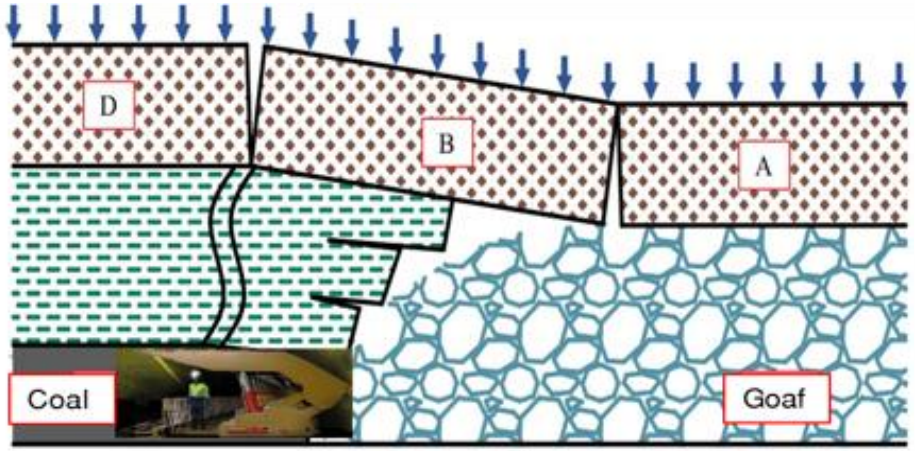
Presentation content

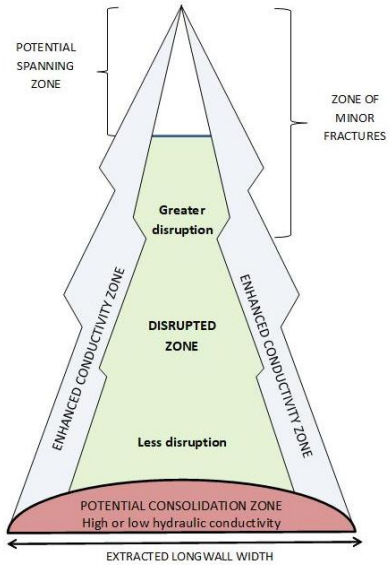
Overview of project progress

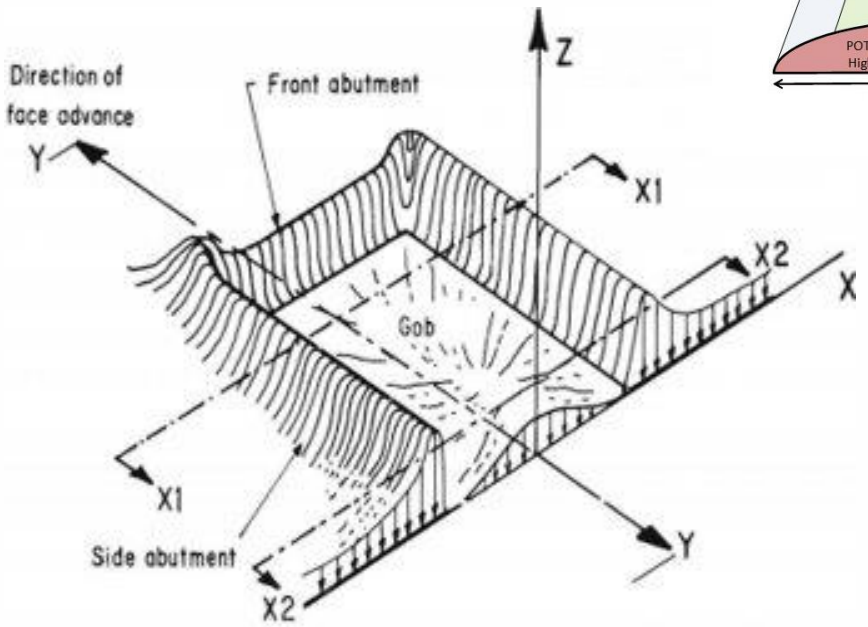
- Re-cap of flow modelling mechanics
- Large scale permeameter test program
- Current research activities

Re-cap of flow modelling mechanics

UPHES hydro-geology re-cap

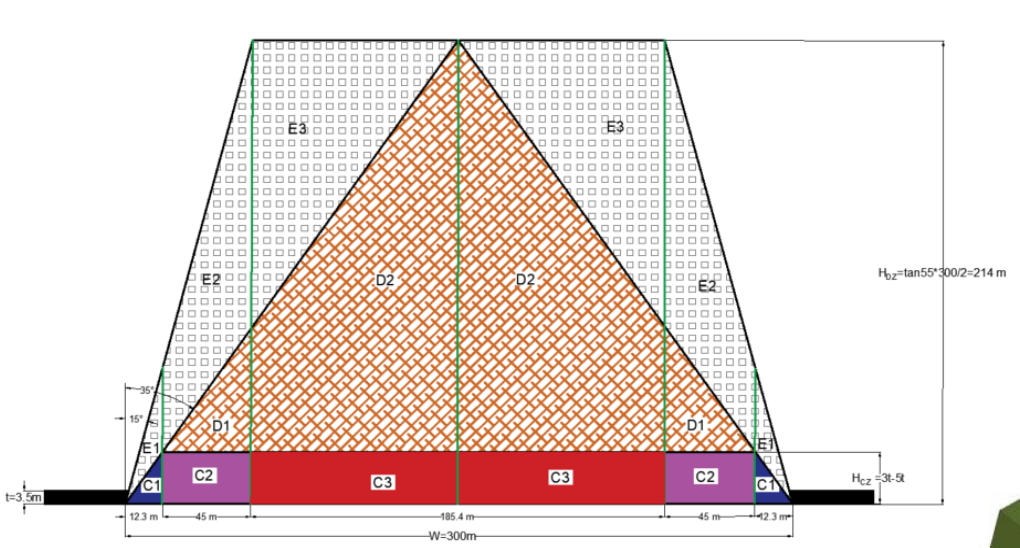




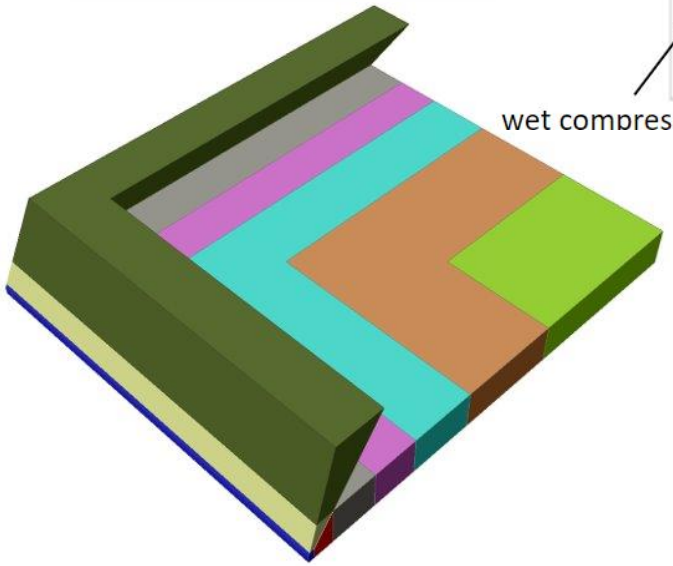


- Mine subsidence and goaf load profiles will vary from mine to mine
- The goaf load profile and hence flow mechanics within any goaf is complex & difficult to verify
- The research has been designed to determine the changes to the rock matrix within the goaf such that the 'hydro-geology flow' behaviour within a given 'goaf reservoir' can be assessed using 3D numerical modelling

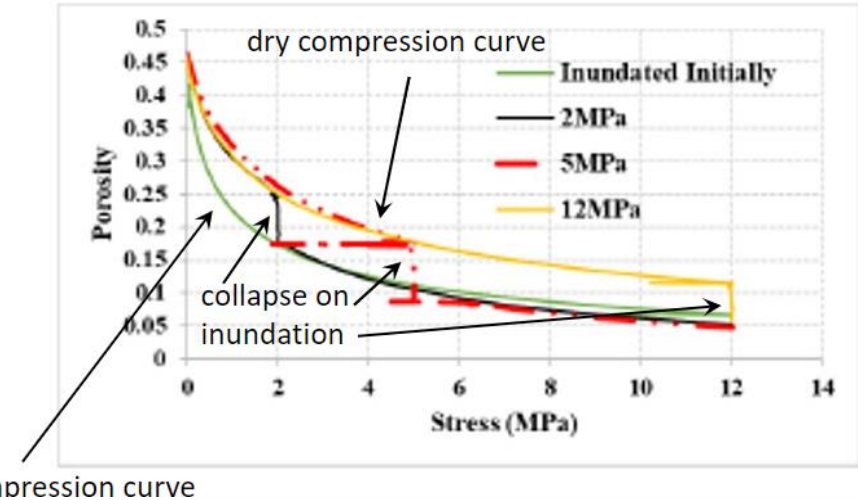
Porosity and permeability distribution



2D model



3D model construct visualisation



Consolidation behavior

Porosity and permeability can be changed in each zone.

Large scale permeameter test program

Permeameter Construction

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Step 1: Build a 1m high base pyramid of rocks on a base frame and then fit permeameter “tank shell”

Permeameter Construction

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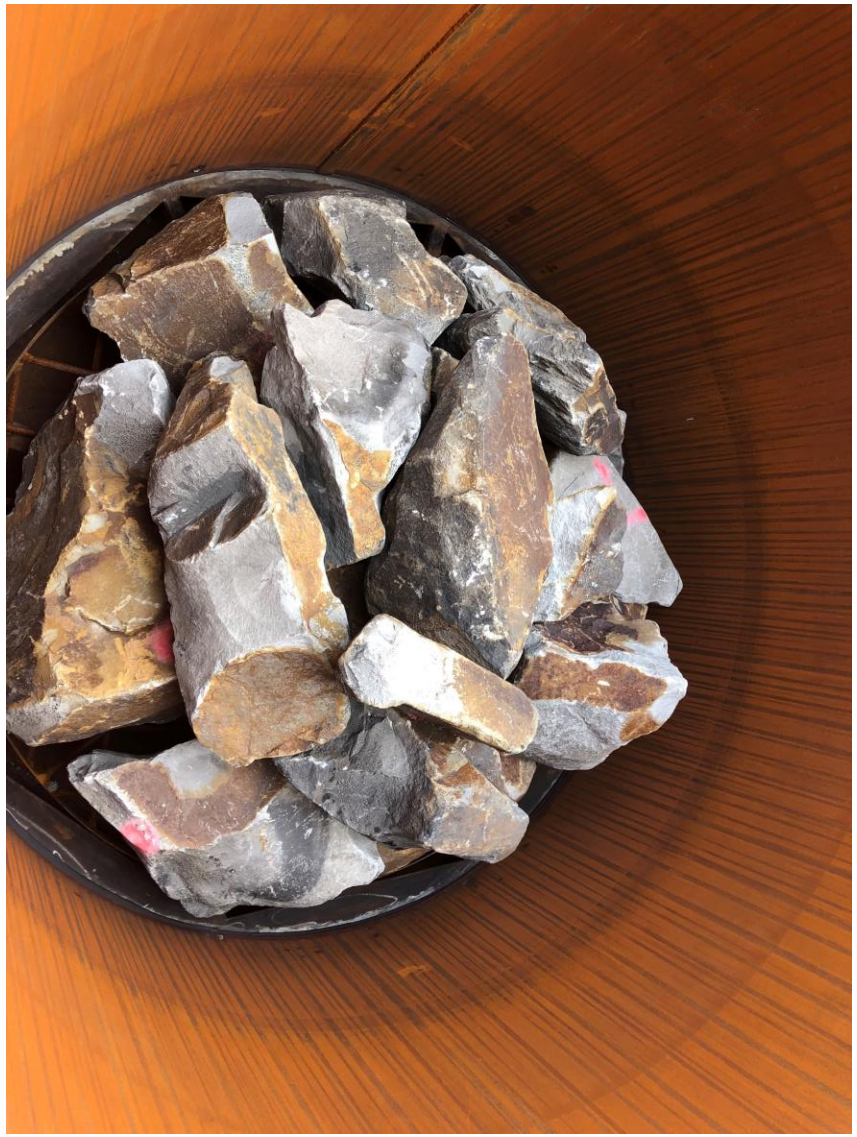
Step 1: Looking inside the tank and down onto the 1m pyramid of rocks in the first test sample – "no fines"



Permeameter Construction

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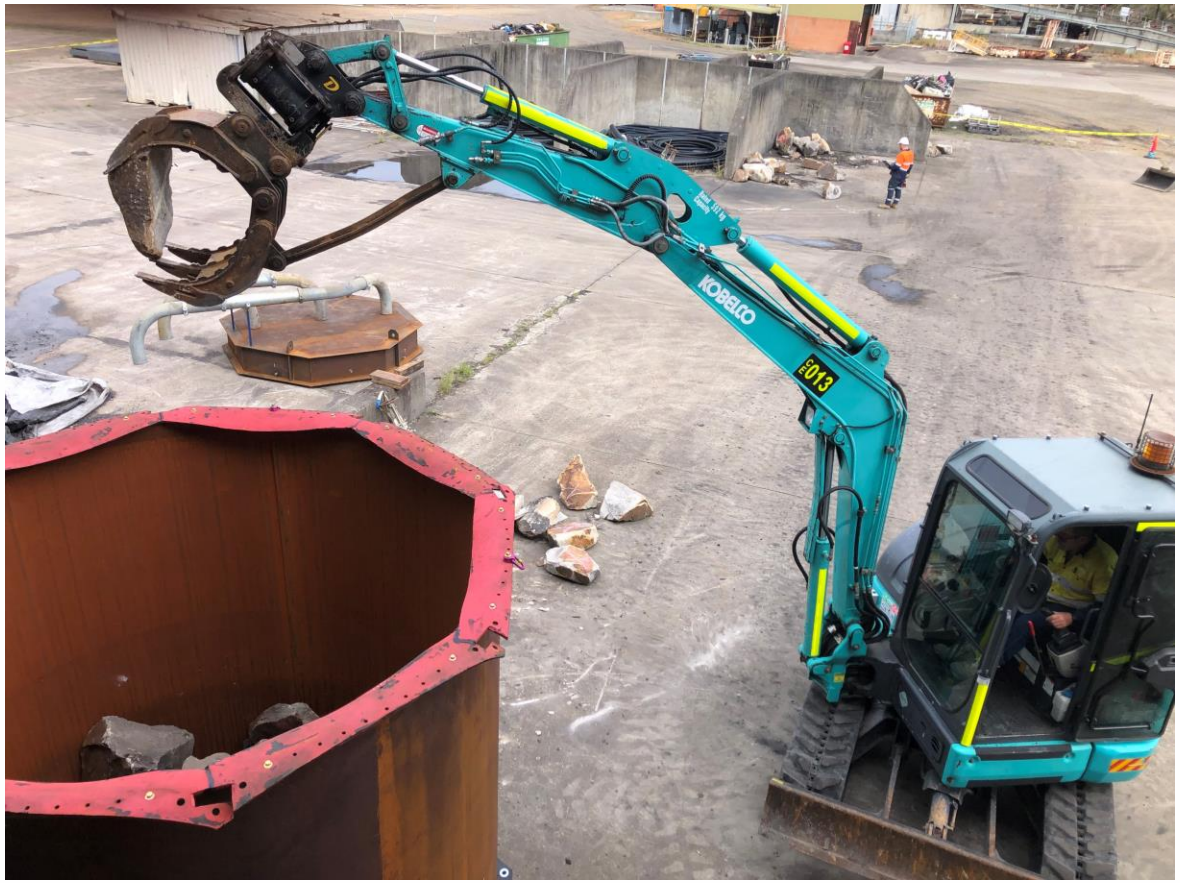
Step 2: Fill tank to a “recipe” based on size and shape of individual rocks using a 5 tonne excavator – Test 1 "no fines"



Permeameter Construction

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Step 3: Fit permeameter lid to tank using 40T Franner crane

Permeameter Construction

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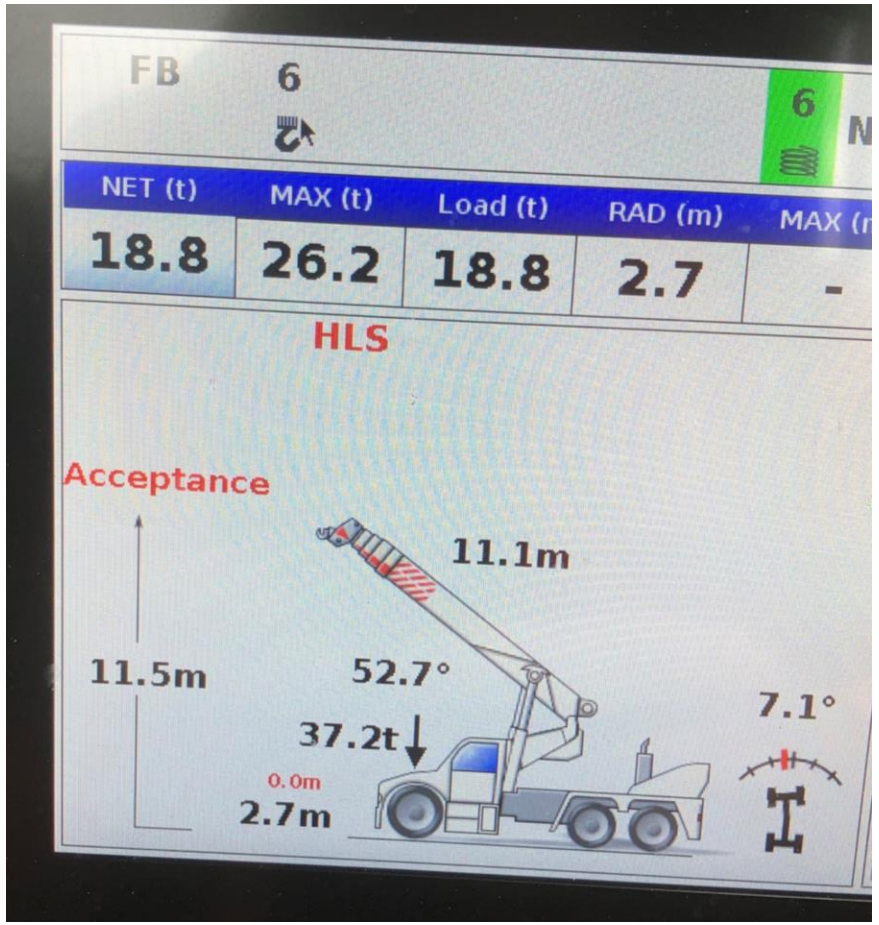
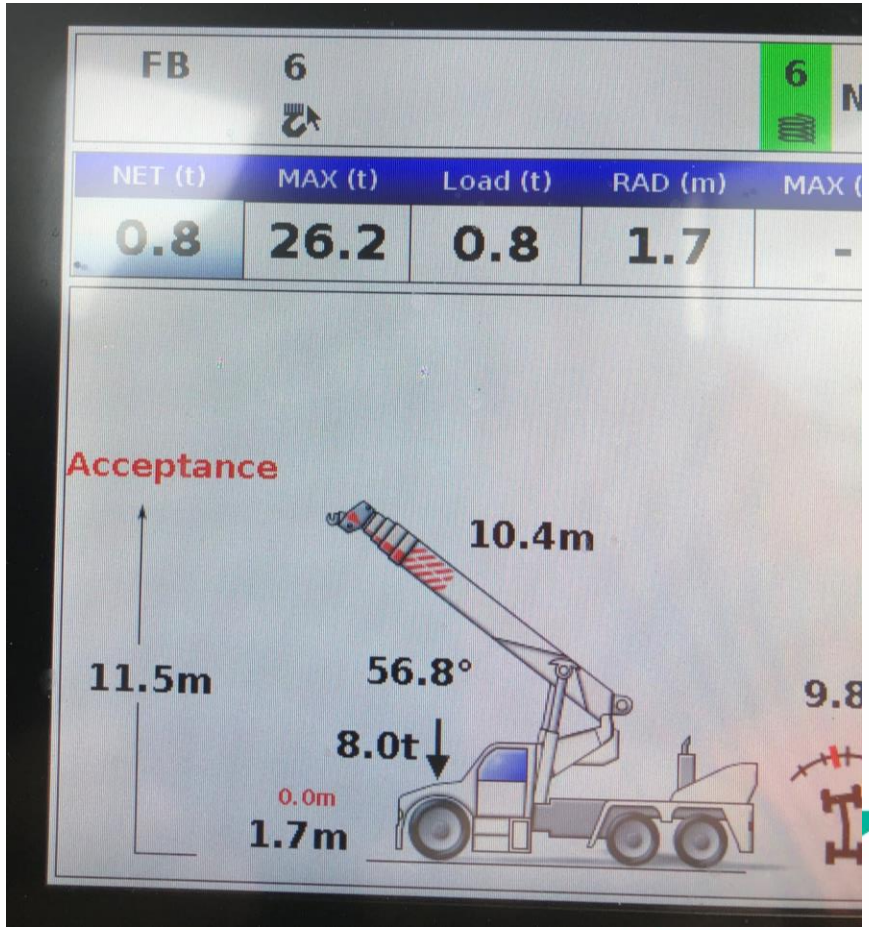
Step 4: Weigh dry filled contents using Franner crane to determine porosity (storativity) of rock sample





Permeameter Construction

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Step 5: Plumb pipework to header tank and pump and install instrumentation

Permeameter Construction

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Step 6: Install pump into the circuit

Permeameter Construction

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Step 7: Pressure and flow meters attached to data logging PC

Unloading Permeameter

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Step 8: Drain tank and disconnect pipework. Use 50T crane to lift tank and lid from the base and allow rocks to slump out. Then clear rocks using a 5T excavator and prepare equipment for the next test.

Permeameter Construction

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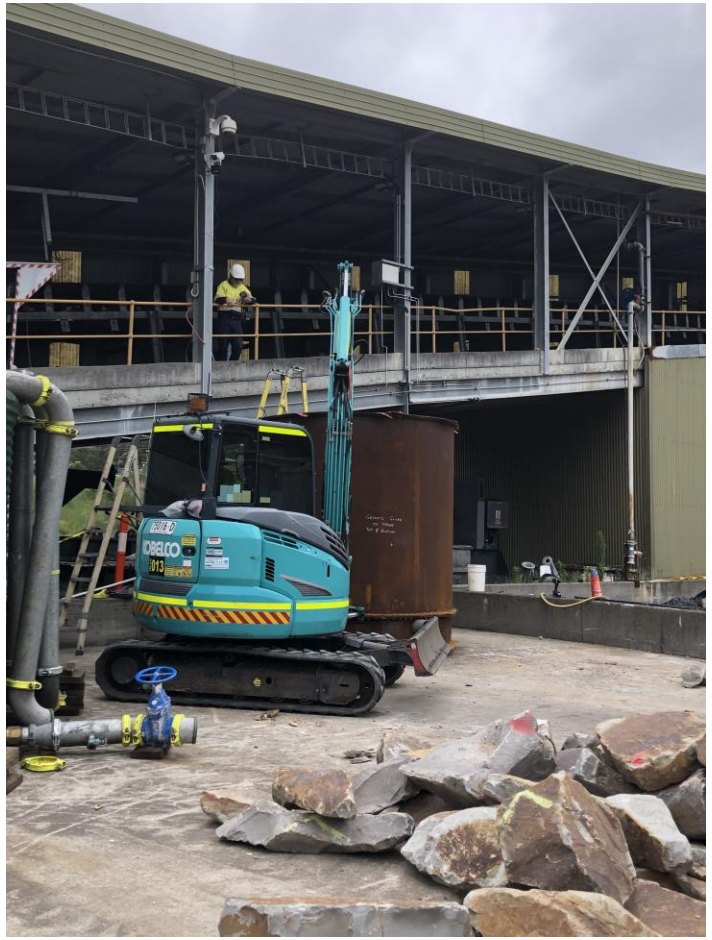
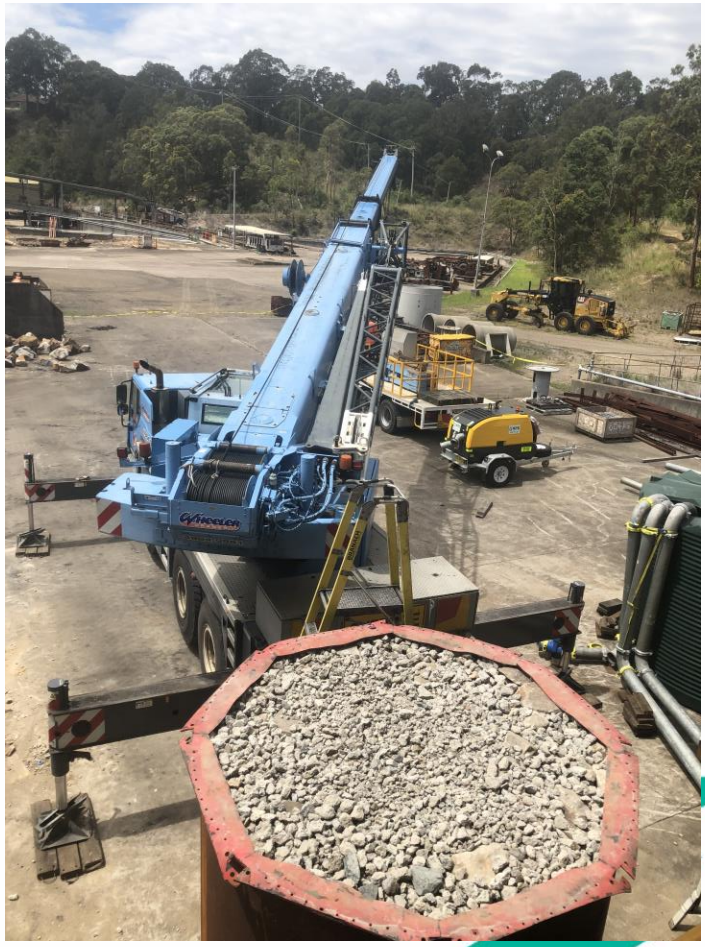
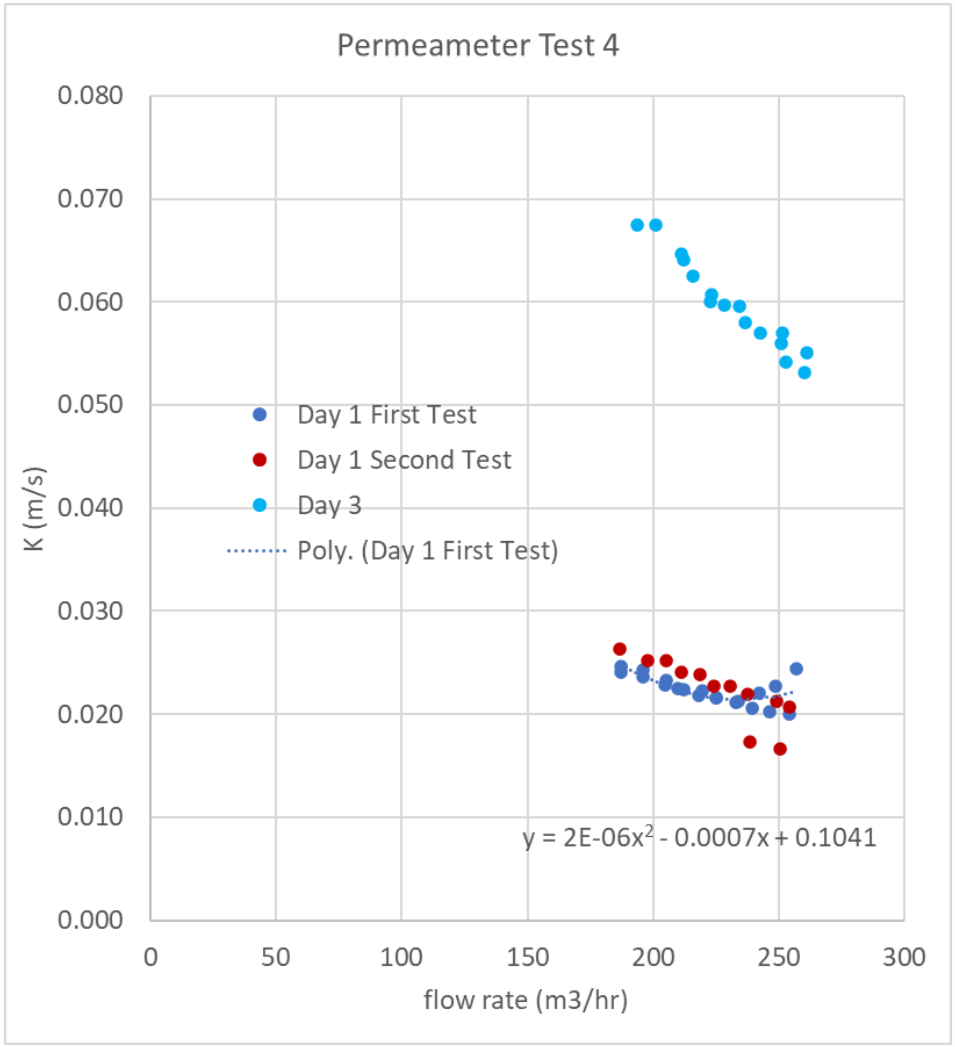
Step 9: Reload sample #2 – same as sample #1 plus 50-200mm "fines" - then fit lid and weigh sample





Test Results summary



Porosity v permeability plots

Current work - 3D Numerical Modelling

- Compile all research results and knowledge and assign input variables to each zone within the 3D Finite Element Model
- Run the model through full cycles of filling and emptying
- Run sensitivity analysis of key variables including the geometric variables
- Assess the implications of the gas within the reservoir
- Report on the hydro-geological behaviour and likely viability of using coal mine goafs (rock filled reservoir's) as part of a pumped hydro scheme

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Future Meetings Roadmap

Meeting No.	Content
Meeting 4 April 2022 (exact date TBC)	Summary of conclusion of Stage 1 Research Program – Technical Viability Timeline and program of activities for the next Stages