



Minimising the Water Loss Associated with
Mine Tailings Disposal
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Tailings
Management



Water
Management



Geotechnical
Engineering



Slurry
Transport



Waste
Management



Laboratory
Testing

Tailings and Water Management Scheme

- Selection of a scheme for tailings disposal is a difficult and complex process, if the best option is to be found;
- The method of disposal must be decided, ranging:-
 - Unthickened tailings ex. the plant;
 - Thickened tailings (slurry);
 - Filtered Tailings (cake)

Selection Criteria

- The criteria that will be used in the evaluation are many and varied, but the principal ones are:-
 - Practicality and simplicity;
 - Minimisation of risks, performance and environmental damages;
 - Cost;
 - Availability and cost of water.
- There are many sub-criteria buried within these headings but too many to go into, here.
- **The main focus of this presentation is water.**

Concentrator



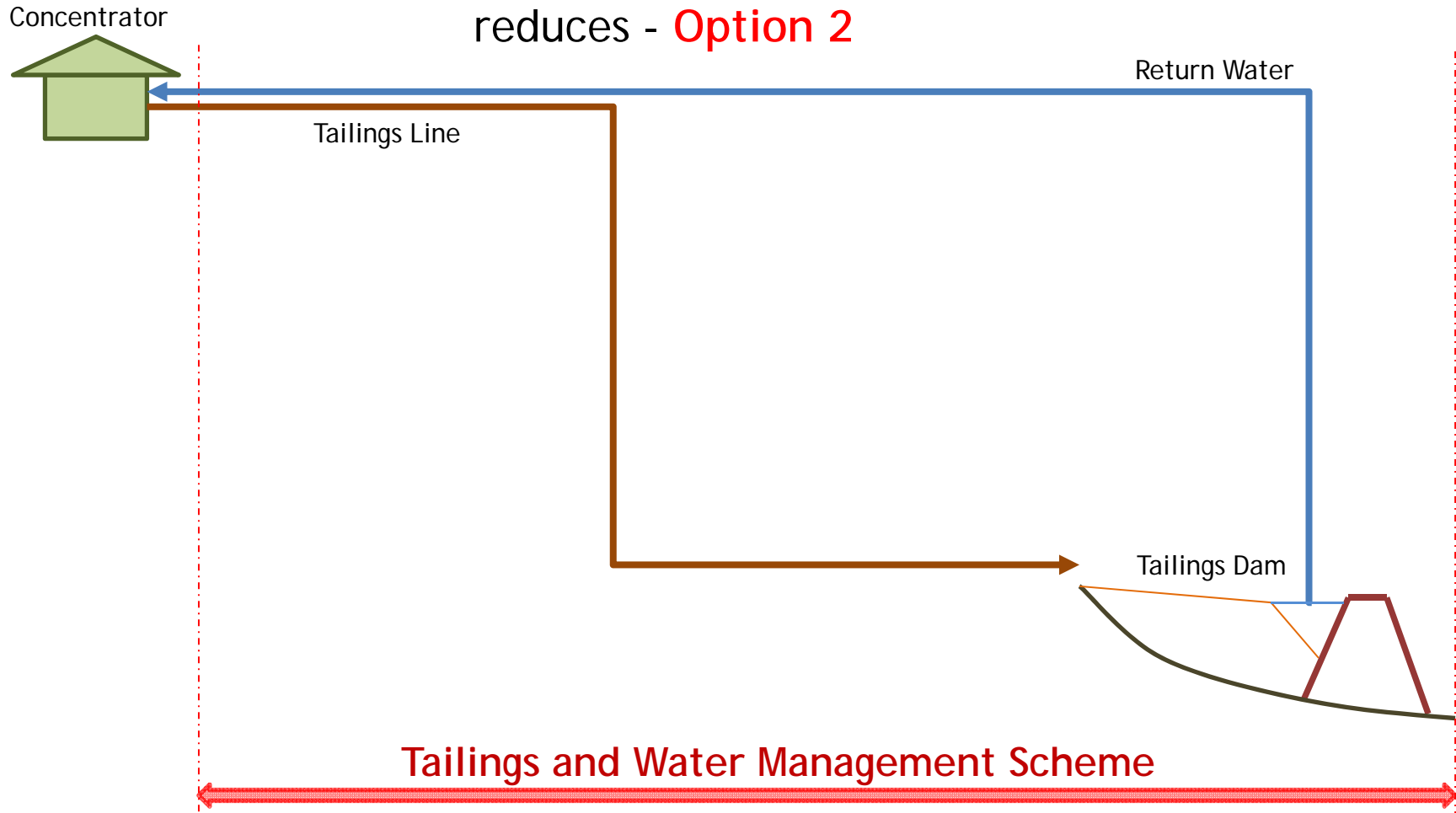
Tailings Line

Simplest scheme - Slurry Discharge
to a Dam - No Return Water -
Option 1

Tailings Dam

Tailings and Water Management Scheme

Add Return Water Pumping - water usage reduces - **Option 2**

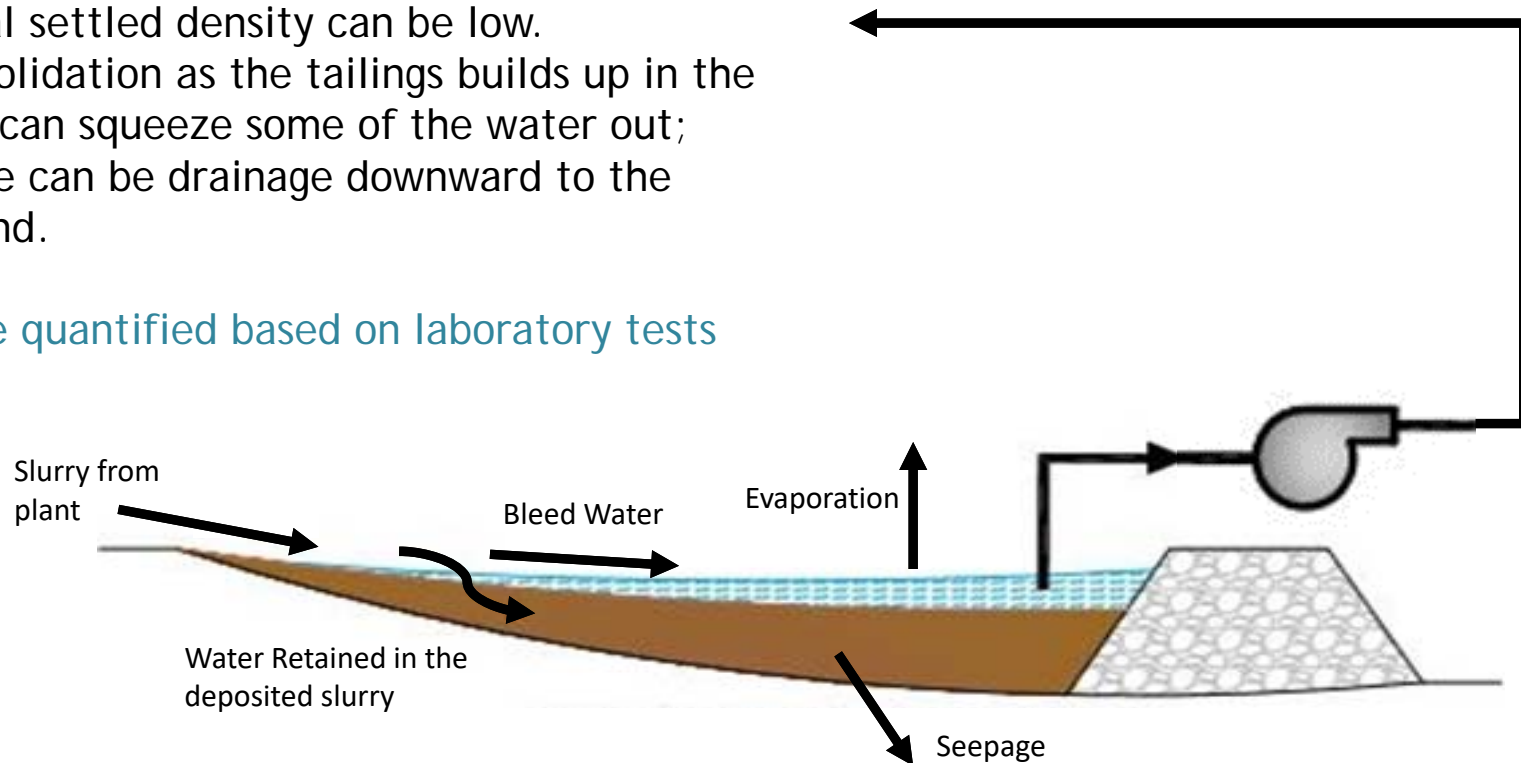


Is the water initially retained in the deposited slurry all lost?

Not necessarily:-

- Can be lost to evaporation;
- Initial settled density can be low. Consolidation as the tailings builds up in the dam can squeeze some of the water out;
- There can be drainage downward to the ground.

All to be quantified based on laboratory tests

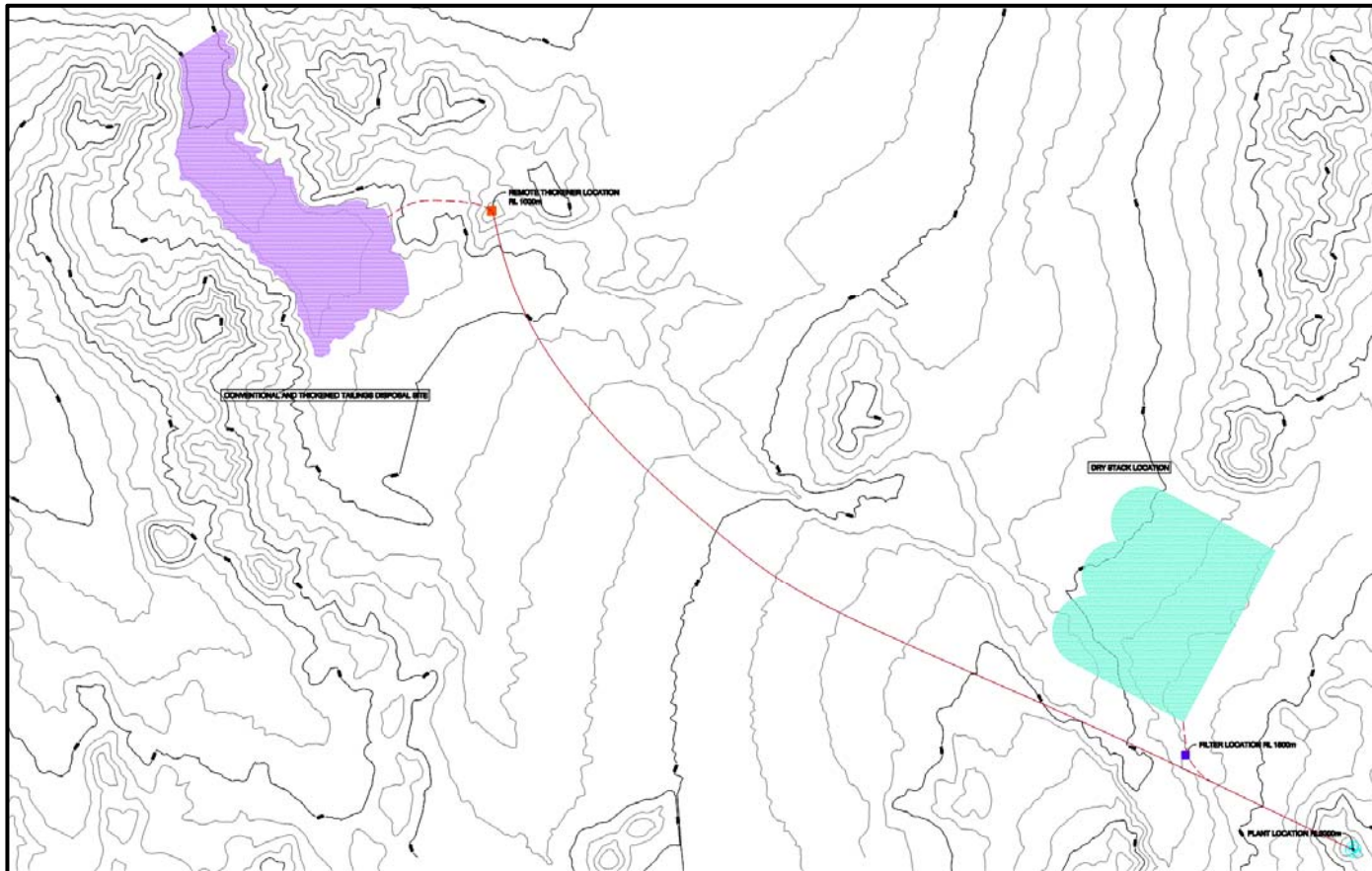


Dewatering

- If we intervene and prevent some of the water from going to the dam in the first place we can reduce losses, options are:-
 - Thickening:-
 - Conventional,
 - High Rate;
 - High Density;
 - Paste.
 - Filtration:-
 - Belt and Disc Filters;
 - Filter Presses.
- **Water recovery increases progressively as you work thorough the list, but so does the cost, in CAPEX and OPEX.**

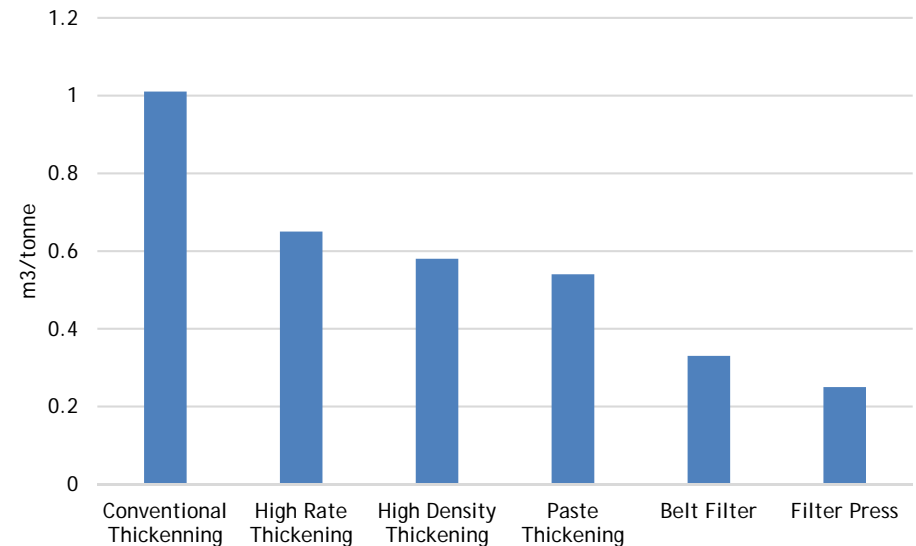


Example Site Layout



Water Recovery Water Lost per Tonne of Solids

- Thickening:-
 - Conventional: 1.01 m³/tonne,
 - High Rate: 0.65 m³/tonne,
 - High Density: 0.58 m³/tonne,
 - Paste: 0.54 m³/tonne.
- Filtration:-
 - Belt and Disc Filters: 0.33 m³/tonne,
 - Filter Presses: 0.25 m³/tonne,
- In the case of no thickening and no return water (Option 1), water lost is 3 m³/tonne,
- In the case of no thickening but with return water (Option 2), water lost is 1.26 m³/tonne.



Summary of Reviewed Options

Options	1	2	3	4	5	6
	No Thickening No Return Water	No Thickening with Return Water	High Rate Thickening	High Density Thickening	Paste Thickening	Filter Press
Dewatering	None	None	High Rate	High Density	Paste	Filter Press
Return Water	None	Yes	Yes	Yes	Yes	Yes
Underflow Solids Concentration (%)	25	25	59	64	67	80
Water loss (m ³ /tonne)	3.0	1.26	0.65	0.58	0.54	0.25

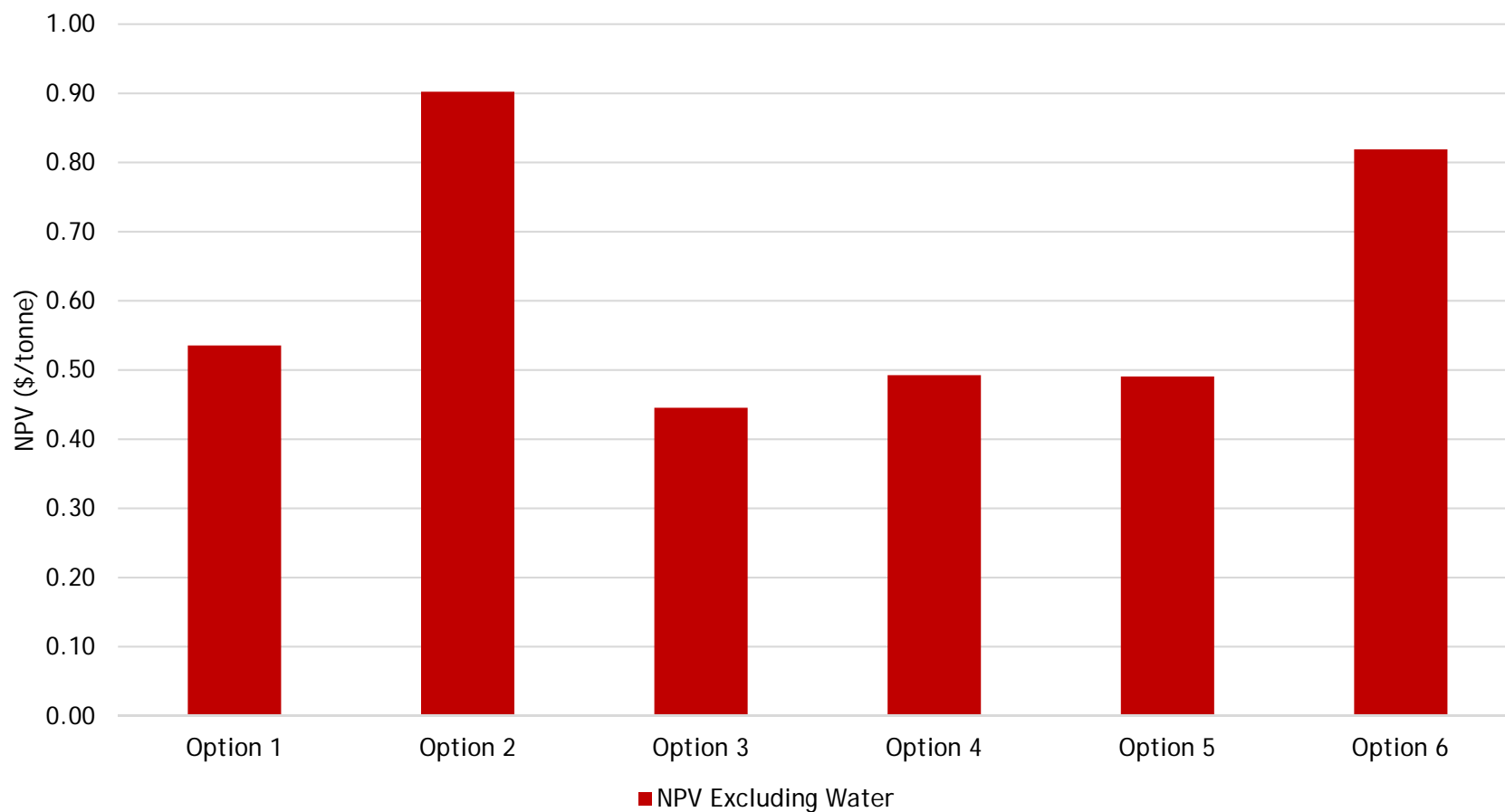
Summary of Options Costs

Options	1	2	3	4	5	6
	No Thickening No Return Water	No Thickening with Return Water	High Rate Thickening	High Density Thickening	Paste Thickening	Filter Press
Start-up CAPEX (\$/tonne)	0.31	0.40	0.32	0.29	0.27	0.42
LOM CAPEX (\$/tonne)	1.10	1.19	0.47	0.43	0.36	0.71
LOM OPEX (\$/tpa)	0.01	0.80	0.23	0.45	0.54	1.12
TOTAL PD\$ (\$/tonne)	1.11	1.99	0.70	0.88	0.90	1.83
TOTAL NPV (\$/tonne)	0.54	0.90	0.45	0.49	0.49	0.82

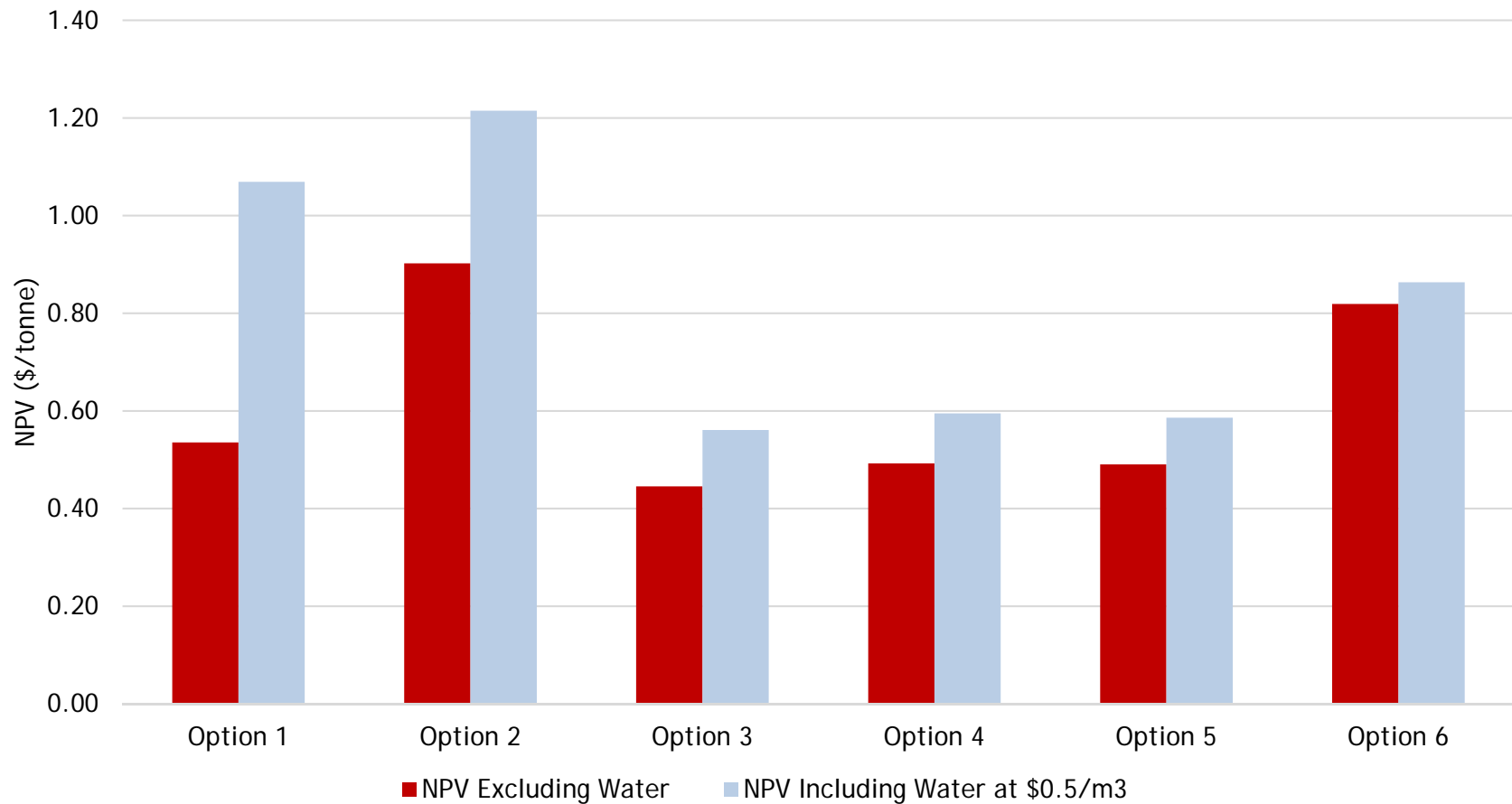
Summary of Options Costs including cost of Water

Options	1	2	3	4	5	6
	No Thickening No Return Water	No Thickening with Return Water	High Rate Thickening	High Density Thickening	Paste Thickening	Filter Press
NPV Including Water at \$0.5/m ³ (\$/tonne)	1.07	1.2	0.56	0.59	0.58	0.86
NPV Including Water at \$2/m ³ (\$/tonne)	2.67	2.15	0.91	0.90	0.87	1.0
NPV Including Water at \$5/m ³ (\$/tonne)	5.87	4.03	1.6	1.52	1.45	1.26

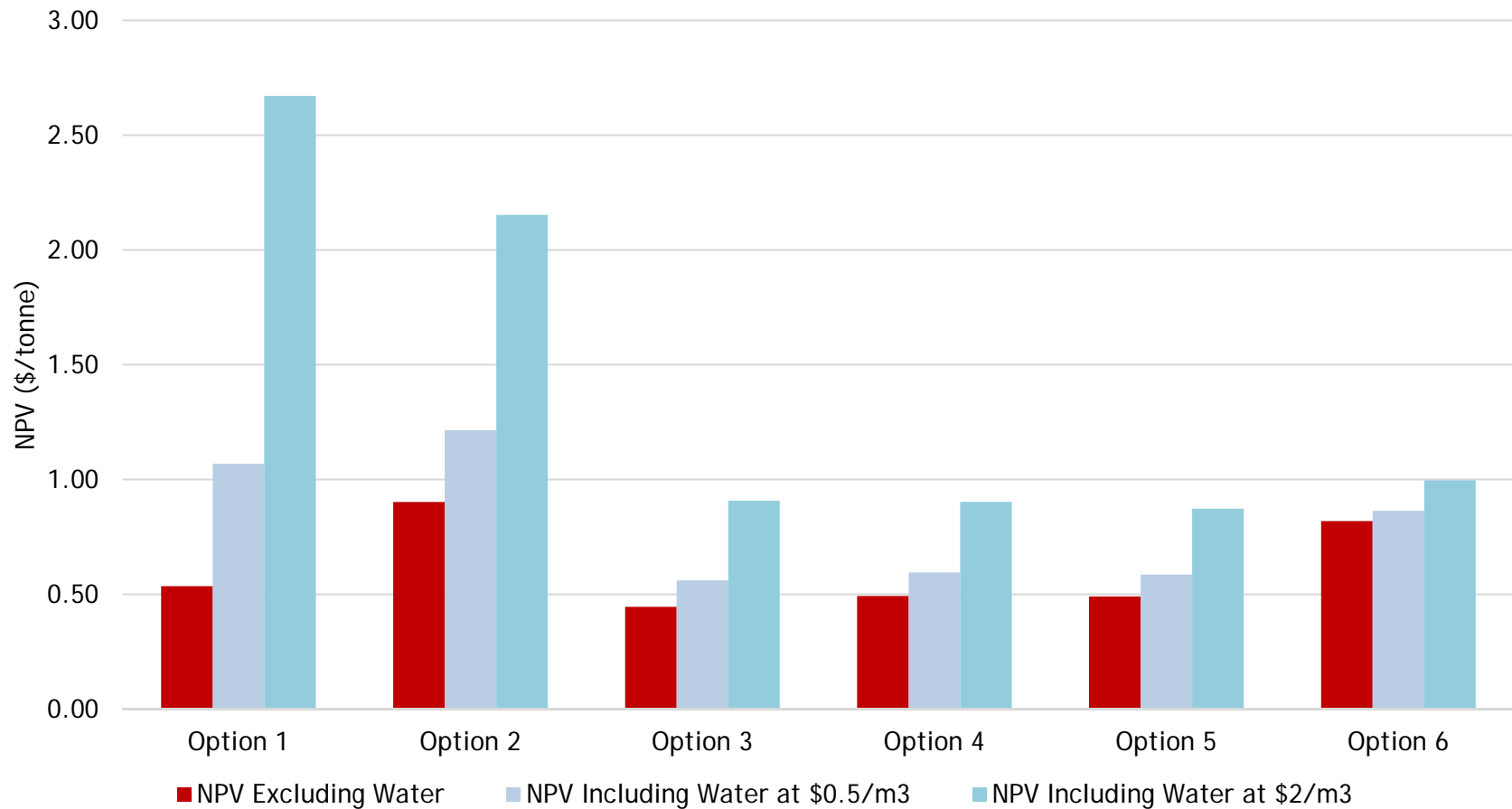
Summary of Options Costs without cost of Water



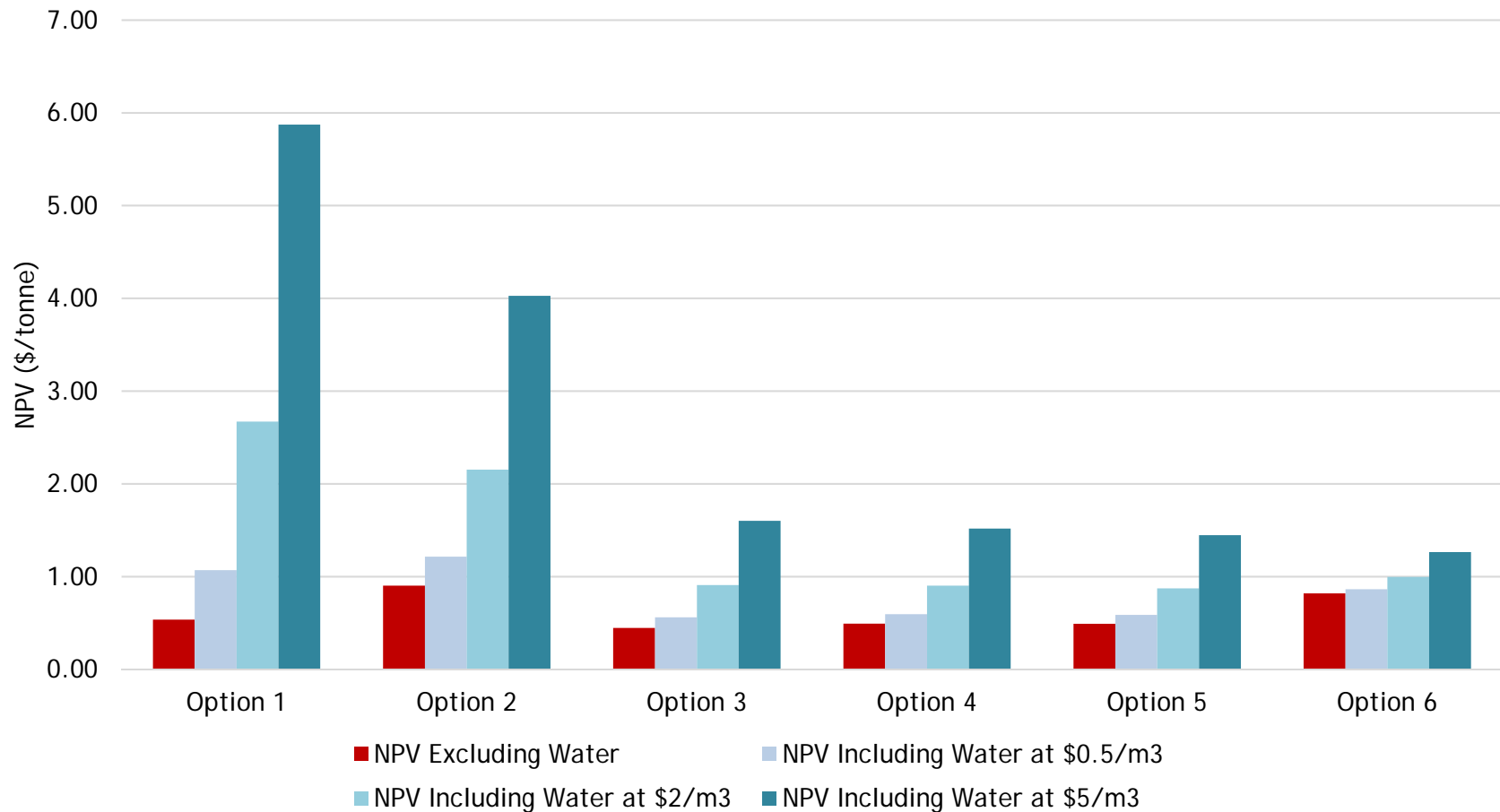
Summary of Options Costs including cost of Water



Summary of Options Costs including cost of Water



Summary of Options Costs including cost of Water



Conclusion

- You must do an Options Study for **your** project. The numbers are very site specific, depending, for example, on topography, climate, site specific constraints.
- You must do laboratory testing to get parameters for **your** tailings. This will give you: tailings dewatering characteristics, deposition characteristics, and hence density, bleed, consolidation, seepage, etc.
- You must know the cost of water.
- You must include the cost of water.

In General

- Unthickened tailings disposal, with or without water return, is not the cheapest option.
- Thickening, and thickened tailings discharge management, is the cheapest technology. Up to half the cost of filters.
- The justification for filters and dry stacking can only be very high cost of water, around \$5.00/m³, or its simple non-availability.