



Using Geotubes for improving the safety & reducing the footprint of tailings storage facilities

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Tailings Storage Facilities - Current Situation

3,500 large active TSFs (at least 20% extreme & 40% high+)

10,000+ tailings storage facilities

100,000+ active, abandoned, closed

Only **5%** dry stacks

200 failures over the last 50 years

2,000 casualties

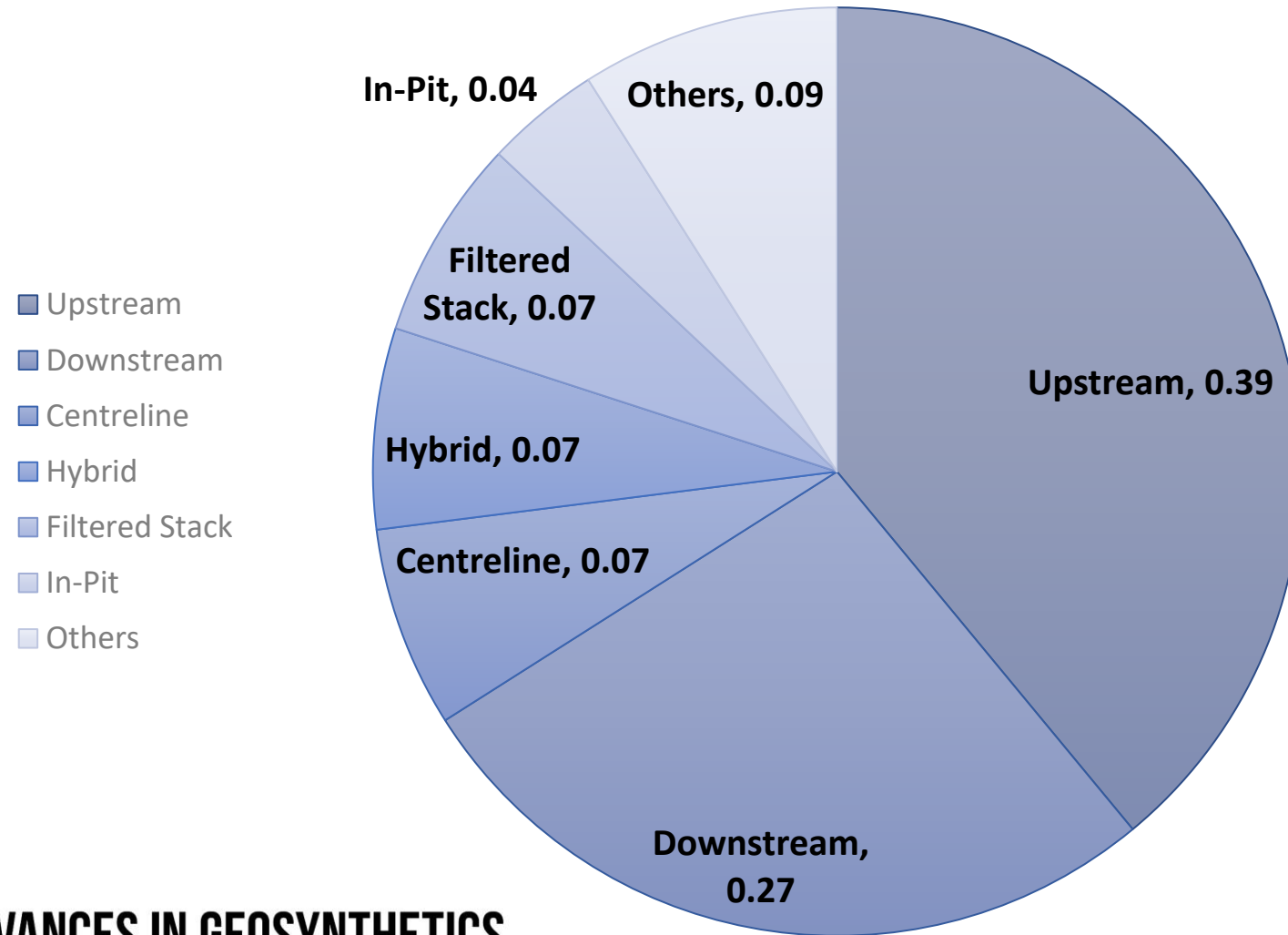
20,000 km of rivers and streams polluted

72,000 ha of water storage polluted

Underground water polluted and ecosystem destroyed

100 Billions tonnes of waste rock and tailings produced annually

Tailings Storage Facilities - Type

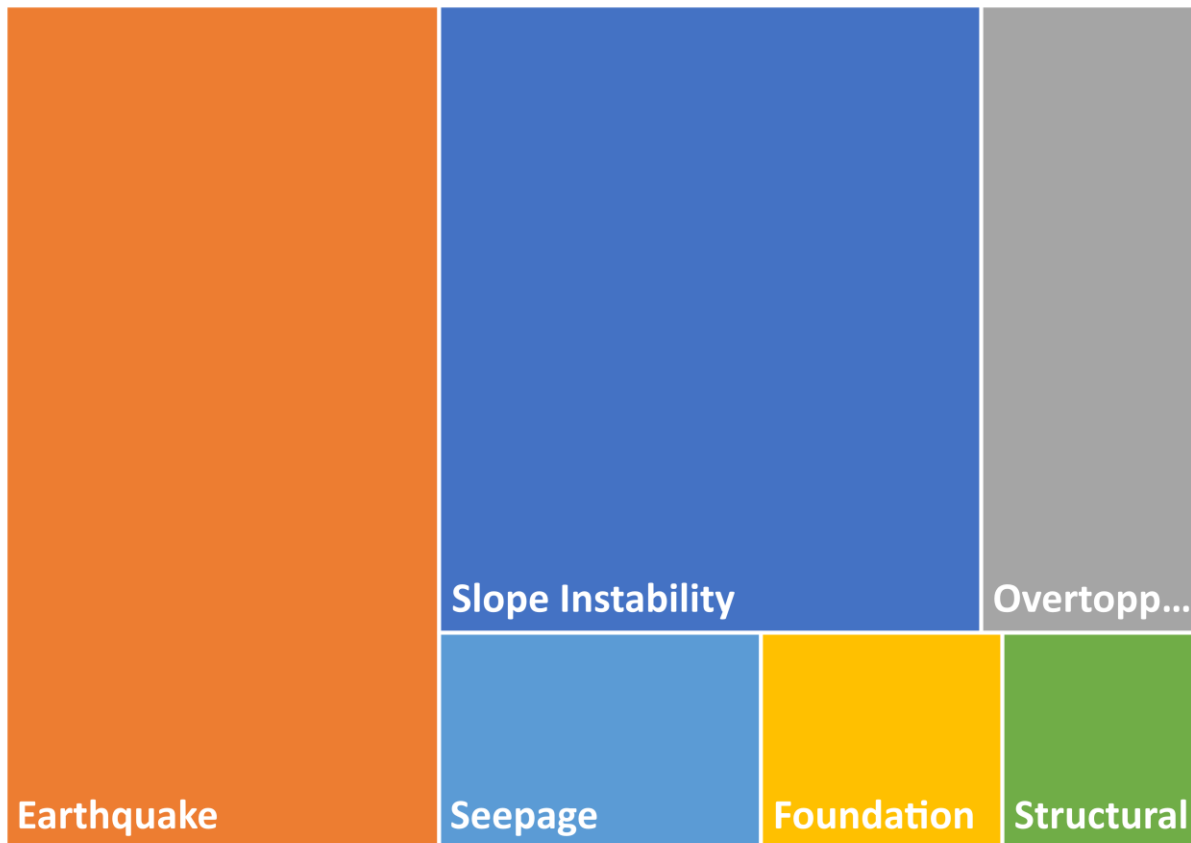


Source Global tailings Portal

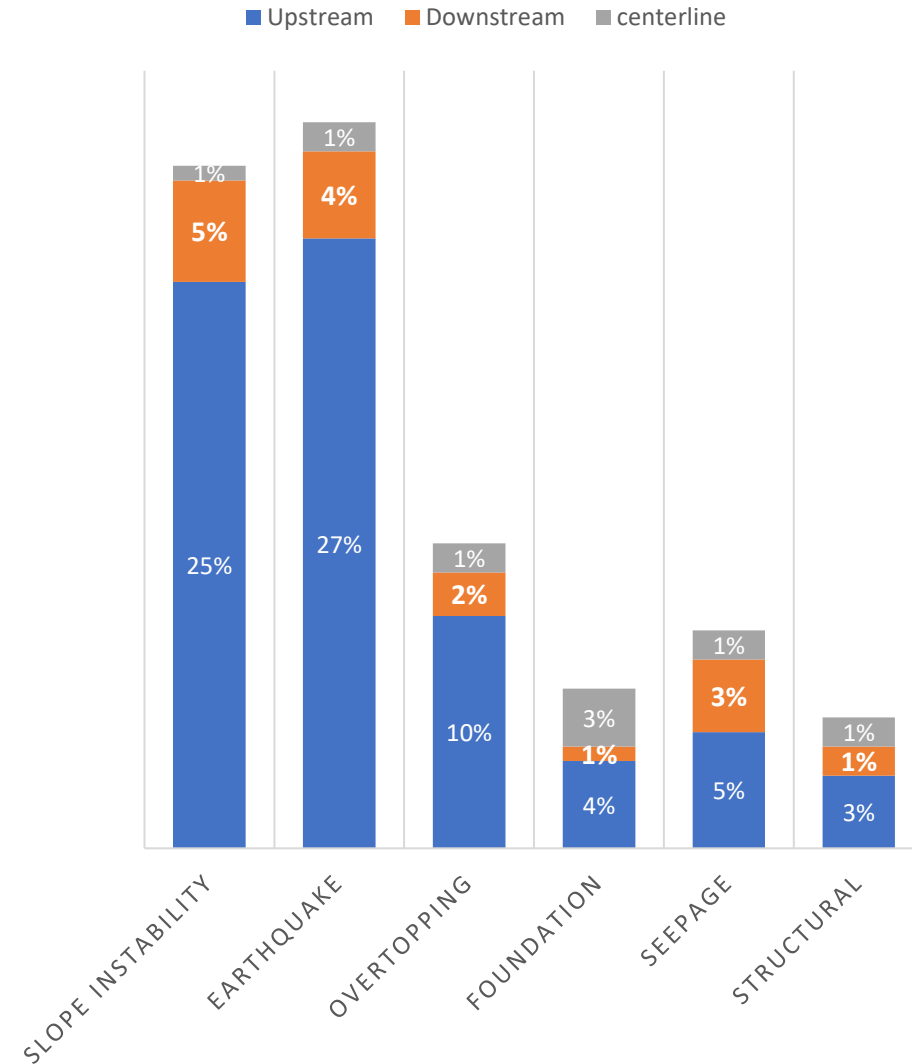
Tailings Storage Facilities - SWOT by types

Storage Type	Upstream	Downstream	Filtered Stack
Strength	Low CAPEX	Lower risk	High dry density
Weakness	Embankment	Large footprint	Mechanical and dust
Opportunity	Remote stable area	Abundance of construction material area	Water recovery
Threat	Extreme consequence category in case of failure	High consequence category in case of failure	Dust, slope stability

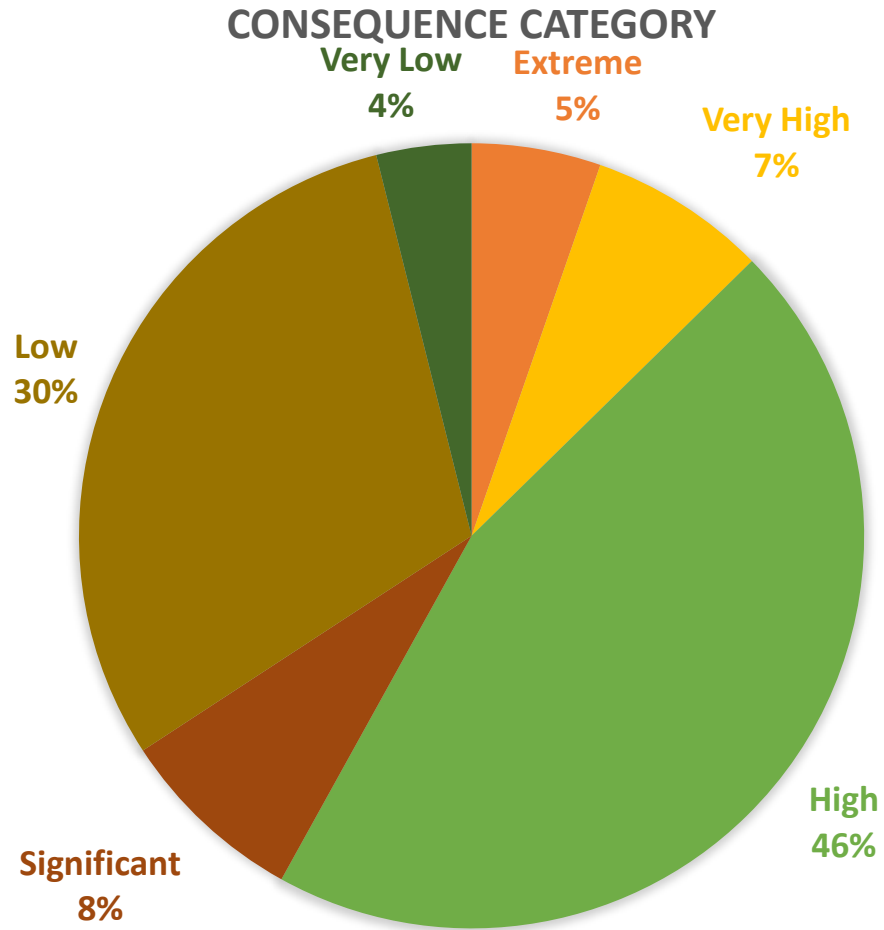
Tailings Storage Facilities - failure by types



Source Global Tailings Portal



Tailings Storage Facilities - risk type



Indicative Consequences	Casualties	Cost
Very Low	<1	<\$10M
Low	>1 to < 10	\$10M-\$100M
Significant	>1 to <10	\$10M-\$100M
High	>10 to <100	\$10M-\$100M
Very High	>100 to <1,000	\$100M-\$1B
Extreme	>1,000	>\$1B

Source Global Tailings Portal

Tailings Storage Facilities - Alternative

Tailings Geotube Stack



What a tailings storage facility could look like

Tailings Storage Facilities - Alternative



Tailings Storage Facilities - Alternative



Tailings Storage Facilities - Alternative



**Low
moisture
content**

Tailings Storage Facilities - Alternative

Reduced
spillage
risk

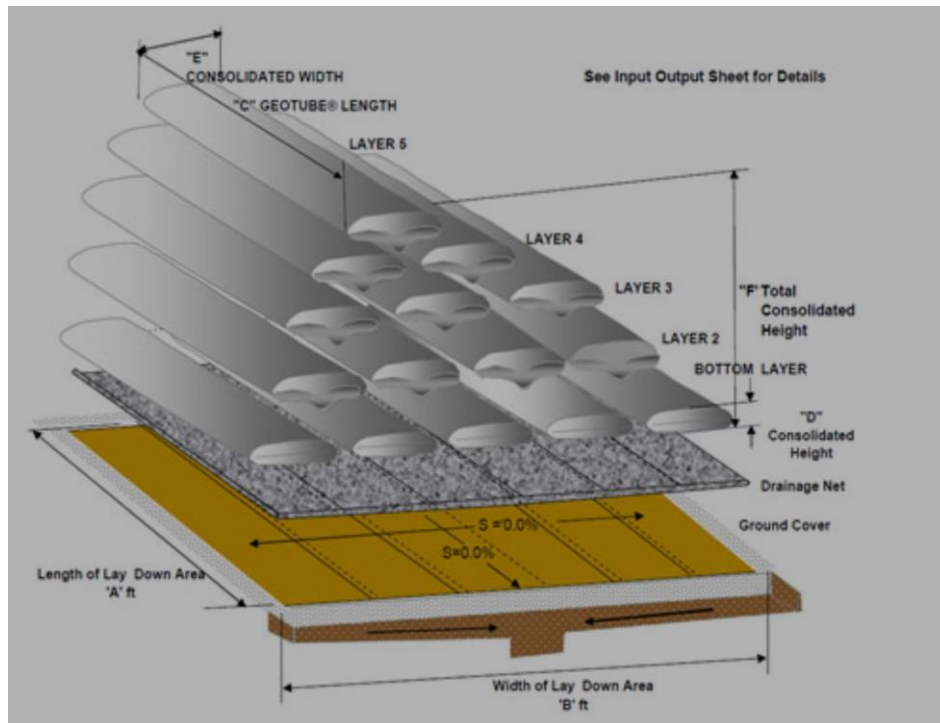


Tailings Storage Facilities - Alternative

Reduced
spillage
risk



Tailings Storage Facilities - Alternative



PRO	CON
Filtered tailings	Layout
Solid state	Operation
No dust	Logistic
Stable slope	
Reduced footprint	
High density	
No mechanical parts	
Water recovery	
Safe	

Reduced consequence categories

Embankment failure

- Compact tailings shortly after water drainage and stacking
- Geotextile provides a reinforcement
- Very low consequence in case of failure of a geotube due to the low water content and limited volume

Spillage

- Water drained early with a result similar to a mechanical filtration solution
- Water draining from the geotubes stacked on a lined platform
- Not storing storm water, therefore no overflowing risks
- Very low consequence

Tailings Storage Facilities - substantial benefits

- This solution is a good response to the current search for improved tailings management solution.
- It is safe with a reduced footprint.
- Projects are already work-in-progress
- It should be considered by the mining industry
- It needs be included in tailings management guidelines





Tailings Storage Facilities - Thanks and questions

Thank you

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