Harrison Bush

Steep learning curve

→ Practical lessons from steep wall liner construction

2026 Australian Landfill and Transfer Station Conference

Acknowledgement & respect

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



Agenda

- How steep is steep?
- Design considerations
- Typical arrangements
- Constructability challenges
- Closing remarks

An emerging problem



Quarry infills



Steep-sided cells



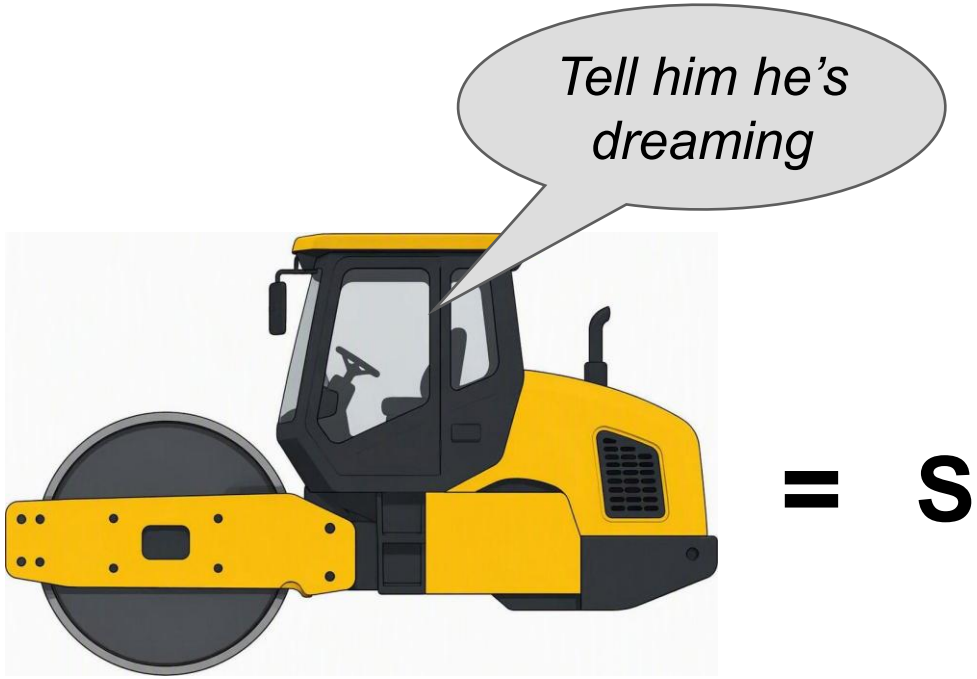
Valleys & piggybacks

Chasing airspace into constrained landforms – same performance requirements, much harder to prepare, access, line and verify.

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How steep is steep?

- 1 in 2?
- Short and steep vs long and shallow
- Incremental construction is required
- Where geosynthetics are no longer self supporting
- Need to design beyond the guidelines



= Steep?

A steep-wall liner is one that requires specialised construction, access, restraint or staging because conventional liner construction methods are no longer practical

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What drives the design



Grade & height



Geology & surface finish



Groundwater



Filling rate & waste type

Regulatory requirements



Constructability

Get in early: weigh the options with constructability as an input – not a check.

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Typical arrangements



1 Progressive clay berm

- ~200 mm compacted lifts, trimmed to profile
- Raised progressively with the waste



2 Shingleback liner

- Geosynthetics shingled up with each lift
- Anchored into the berm as it rises



3 Geosynthetic only steep-wall liner

- Where clay can’t stand without losing airspace
- Site-specific anchorage & surface prep

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Access, safety & sequencing

6–8 m

working width needed for benched liner construction

- Deploy from the crest or the base?
- Sequence so plant never tracks over placed geosynthetics
- Access is a CQA issue too





If we can’t safely get to it, we can’t verify it.

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Surface preparation

Access | **Surface** | Restraint | Sequence | Verify

The liner is only as good as the surface behind it.

- Grind & fill – potentially cheaper and more stable
- Shotcrete – costly; specify the finish, not just the strength
- Cushion geotextile, geocomposite, geogrid
- Design drainage, UV & wind protection – don’t improvise







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Deployment & restraint

Access | Surface | **Restraint** | Sequence | Verify

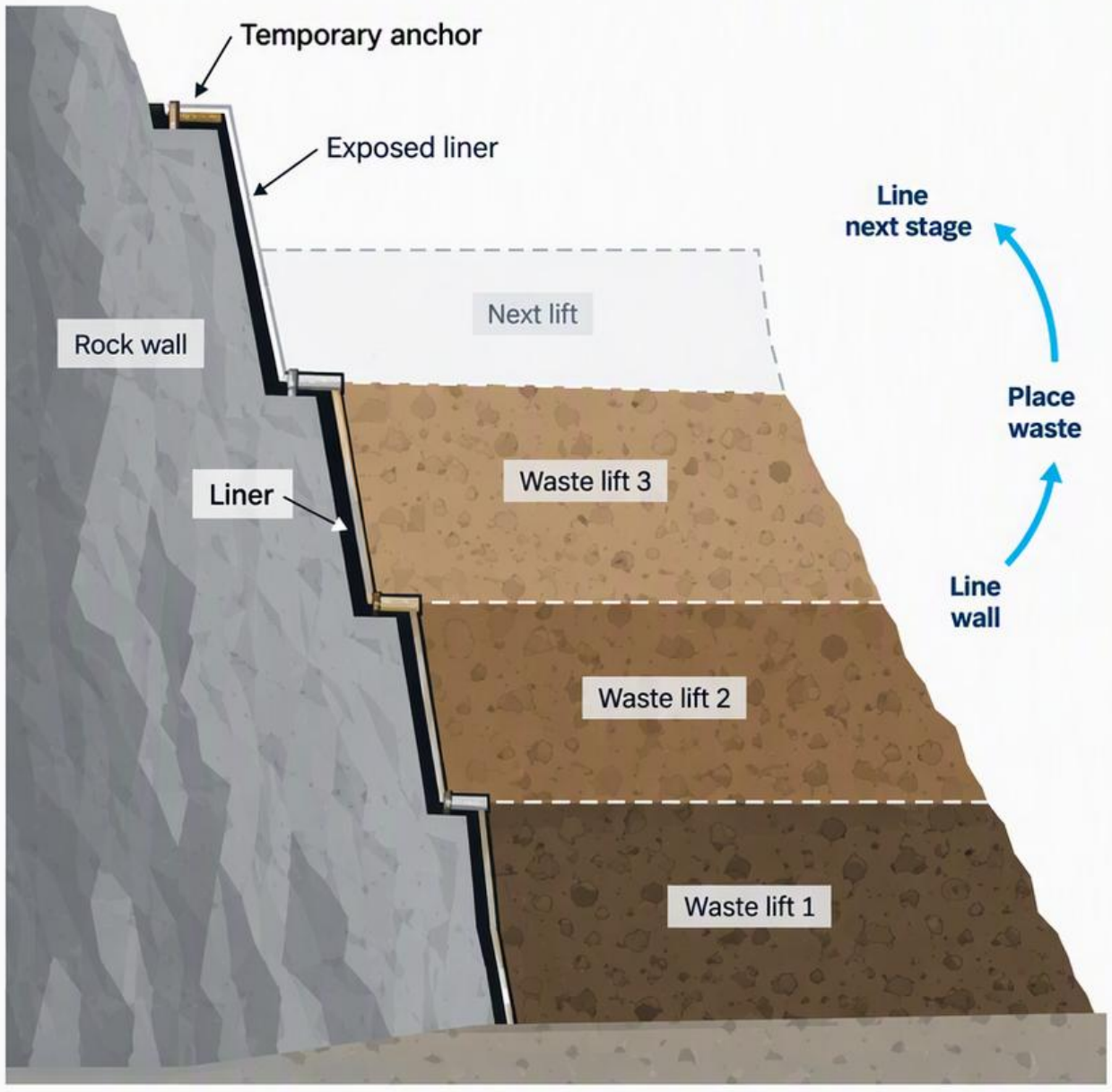
- The waste that will hold it isn’t there yet
- Anchor trenches need room to dig, compact & inspect
- High wall: intermediate benches or temporary mid-face anchorage (with calcs)
- Slip-plane geotextile reduces liner stress
- Crew reach can set the maximum lift height







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Liner & filling sequence

The liner often isn't finished until the landfill is.

- ? How long is each section exposed?
- ? Who protects it while it waits?
- ? How does the contractor get back to the wall?
- ? How is stormwater managed on a part-lined wall?

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Verifying the liner

Access | Surface | Restraint | Sequence | **Verify**







If it isn't designed in, it's very hard to retrofit.

- Destructive test methods for membrane are still available
- Conductive-layer methods must be specified in design
- Clay berms tested every lift – safe access every time

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Key takeaways



Demand will grow

More airspace in more constrained landforms



Plan QA/QC in design

QA verification needs to be considered in the design



Constructability drives it

Collaborate with contractors on new details



Get everyone in early

Owners, designers, contractors and regulators



No two walls are the same

Whole-of-system thinking

Thank You

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