

Improved Landfill Management

Landfill Design and Construction

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Design and construction

WA utilises EPA Victoria Publication 788.3 Siting, Design, Operation and Rehabilitation of Landfills (Best Practice Environmental Management)

- Assessment of landfill, siting, design and its effect on the environment
 - Construction quality assurance systems
 - Landfill operation and management
 - Landfill rehabilitation and aftercare
- Covers; liners, leachate, landfill gas, covers etc

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Siting - visual impact?



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Types of landfill

- Trench fill - suitable for small rural sites
 - Area fill - preferred
 - Valley fill - avoid
 - Mound - avoid
 - Bioreactor
-
- Prefer former extractive industry sites; quarries, mines

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Trench fill

- Small rural site



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Trench fill

- Uncontrolled access
- Trench filled, compacted and covered intermittently



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Area fill landfill



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Valley fill landfill - Hawaii



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Small rural landfill

- Uncontrolled access
- Occasional compaction and cover placement
- Exposed to illegal dumping of tyres etc.



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C&D waste deposited in unlined cell



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Bioreactor landfill – Woodlawn, NSW



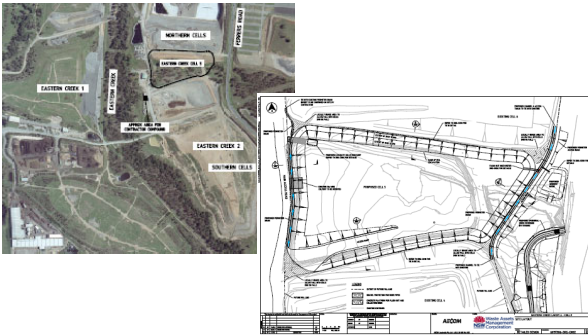
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Swanbank landfill, QLD – former coalmine



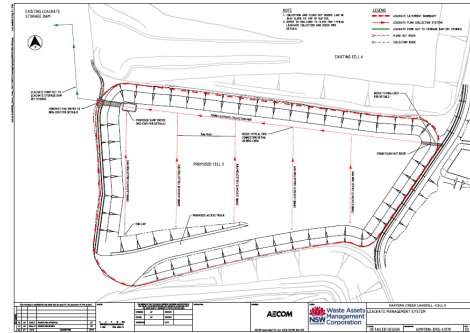
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Cell location and concept drawings



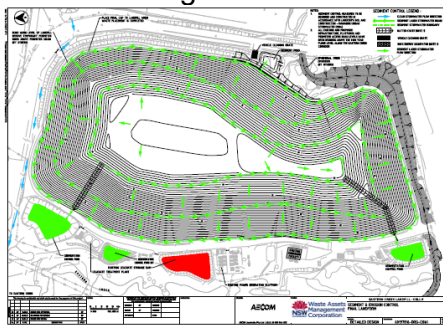
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Leachate management system



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Final landform and stormwater management detail



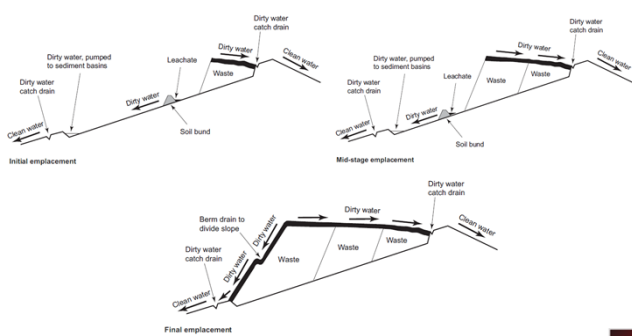
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Run-on/stormwater diversion around site



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Keeping clean and dirty water separate



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Indicative liner designs

Type	Liner performance	Indicative liner designs
2	Uses best available technology to control seepage to an amount not exceeding 10 L/ha/day.	<p>Protection geotextile</p> <p>Separation/filter geotextile</p> <p>Drainage layer</p> <p>Low-permeability clay</p> <p>Geomembrane</p> <p>Sub-base</p>
3	Uses commonly available technology to control seepage to an amount not exceeding 1000 L/ha/day.	<p>Separation/filter geotextile</p> <p>Separation geotextile</p> <p>Drainage layer</p> <p>Low-permeability clay</p> <p>Sub-base</p>

Type 2 = WA Class II
Type 3 = WA Class I

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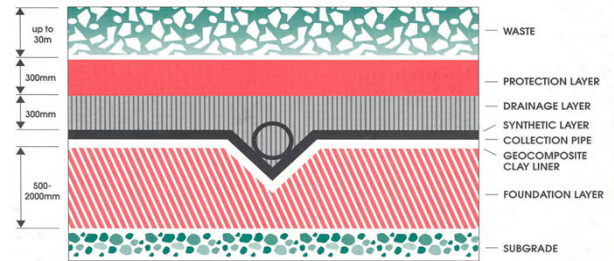
Liners

- Clay liner hydraulic conductivity $< 1 \times 10^{-9}$ m/s
- Geosynthetic Clay Liner (GCL)
- Composite of bentonite and geotextile
- May be reinforced or unreinforced
- Some advantages over clay but some limitations
- Geomembranes (HDPE, LDPE) limit contaminant migration, reduce water ingress and control gas migration

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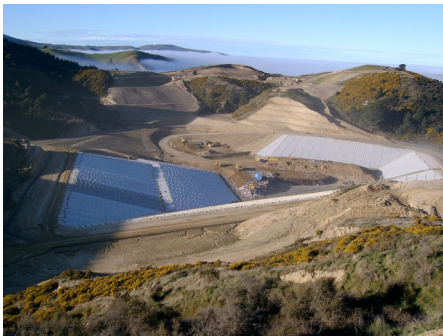
Liners

- Typical liner configuration



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Cell liner construction



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Clay lined new cell construction



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Clay lined cell with overlying drainage layer



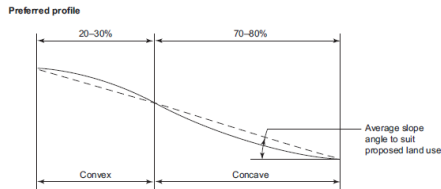
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Bund diverts stormwater from existing cell upslope



Landfill batters

- Preferred profile to minimise soil erosion if spreading distance is unconstrained

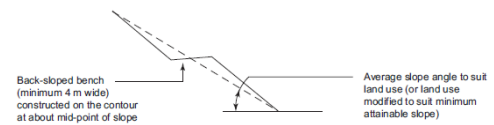


Source: Hannan 1995

Landfill batters

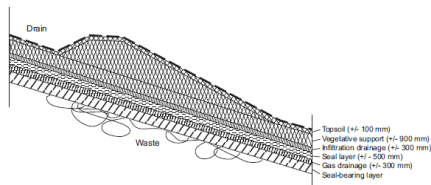
- Preferred profile to minimise soil erosion if spreading distance is constrained

Profile design when external features limit spreading distance



Source: Hannan 1995

Typical berm drain over landfill



Leachate management

- Evaporation
- Surface irrigation on capped areas subject to salinity management
- Dust suppression
- Recirculating through bioreactor landfill
- Variety of treatment options; wetlands, aeration in ponds, reverse osmosis (RO)
- Discharge to sewer, with or without pretreatment

Buttonderry landfill, NSW – leachate pond



Landfill gas

- Flammable and explosive
- Asphyxiation hazard
- Toxic to humans, flora and fauna
- Odorous
- Corrosive
- Contributes to greenhouse gas emissions
- Contributes to photochemical smog

Landfill gas risk assessment

- Quantity, rate and composition of gas generated
- Potential emission pathways from landfill
- Potential risks/hazards to all potential receptors, both on and off site
- Monitoring is an integral part of management
- Monitoring bores
- Action levels defined
- Management by flaring or capture and power generation

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Landfill gas monitoring

- Portable gas analyser
- Measures CH₄, CO₂, O₂, H₂S and CO



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Gas well enclosure on closed landfill



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Landfill gas well head



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Landfill gas power plant



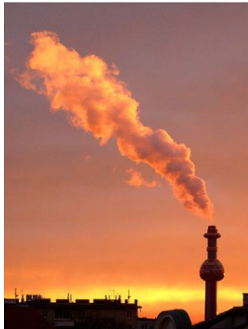
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Landfill gas generator, Maryland, USA



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Landfill gas flare



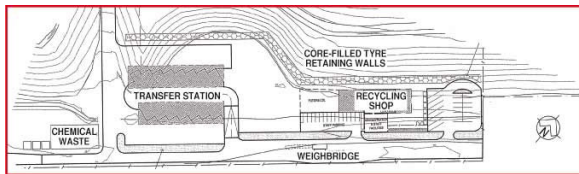
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Beneficial reuse of recycled material in construction

- Engineered tyre walls and hardstands
- Reclaimed crushed brick and concrete in haul roads and for erosion control
- Mulch for cover, rehabilitation
- Crushed glass and tyres for drainage culverts

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Engineered tyre retaining walls



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Ecoflex engineered recycled tyre wall



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Access road - recycled C&D waste



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Brick and mulch check dams



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Mulch for erosion control on batter



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