Design Guidelines and Standards

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Introduction

Guidance on sand mounds is limited to brief mentions in some current State guidelines:

- NSW Environment and Health Protection Guidelines (Silver Book) mentions Recirculating Aerobic Sand Filter Devices (RASFD), amended soil systems, sand mounds and sand filters
- Water NSW Designing and Installing On-Site Wastewater Systems (amended soil mounds and sand mounds)

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Introduction

Australian/New Zealand Standard AS/NZS 1547:2012 Appendix N:

- Incorporates a design based on the Wisconsin Mound System
- Provides limited guidance on design and construction

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Australian/New Zealand Standard AS/NZS 1547:2012

- Promotes a Wisconsin Mound type mound design as a Land Application System alternative (Table K1) for relatively flat sites with site and soil restrictions

Covers:

- Design sizing and application rates
- Recommended design loading rates for different soil types
- Construction and installation
- Commissioning and reporting

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Australian/New Zealand Standard AS/NZS 1547:2012

General:

- Mounds generally used on relatively flat slopes (up to 15%) that have site and soil restrictions:
  - Slowly permeable soils
  - Permeable layer (300-600 mm) overlying a limiting layer such as rock or hardpan
  - Permeable soils with high water table (300-600 mm) BGL
- Mound constructed directly on natural ground surface, which is ploughed beforehand
- Primary treated effluent is dosed to the mound where it is further treated in the sand fill of the mound

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Australian/New Zealand Standard AS/NZS 1547:2012

Limitations due to site, soil and climatic factors:

- Large amount of imported material needed on steeper slopes
- Risk of toe seepage on steeper slopes
- Maximum practical slope 15%
- Designed to overcome shallow soil limitations
- Designed to overcome problems of low permeability soils and shallow water tables
- Can take up a lot of space if constructed on relatively steep slopes

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Australian/New Zealand Standard AS/NZS 1547:2012

Design sizing:
- Designed according to the loading rate for sand fill, on the underlying soil basal area
- Where ground slopes, design on the vertical or horizontal linear loading rate of the soil beneath the toe area of the mound
- Size of the basal area calculated using the design loading rate of the soil (see Table N1)
- On slopes the system is extended along the contour to control the linear loading rate

Australian/New Zealand Standard AS/NZS 1547:2012

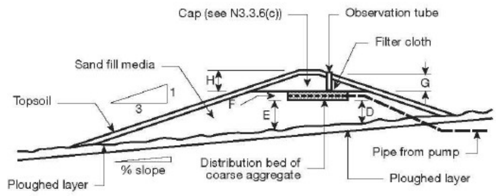
Loading rates:
- Dose loaded at not more than 40mm/day (40 L/m^2/day) (Reduced from 50mm/d in 2000?)
- Avoid hydraulic or organic overload to maintain free flow from distribution media to sand fill
- Where flow of effluent in the soil beneath is primarily horizontal (limiting layer not present), linear loading rate shall not exceed 50 L/m/day
- Where flow of effluent in the soil beneath is primarily vertical (freely draining soils), linear loading rate shall not exceed 125 L/m/day

Australian/New Zealand Standard AS/NZS 1547:2012

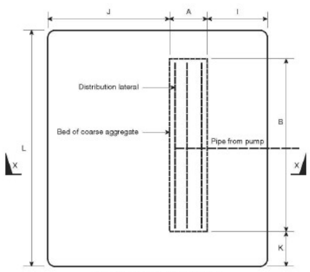
Construction:
- Pay attention to detail in ground surface preparation and mound construction
- Protect area from vehicular compaction
- Clear shrubs and trees, remove stumps
- Mark out perimeter in correct orientation
- Plough ~20cm deep or roughen surface with backhoe teeth with soil relatively dry
- Best to blend soil and mound sand in basal layer (for gradational change in K_{sat})

Australian/New Zealand Standard AS/NZS 1547:2012

Construction:



CROSS SECTION VIEW OF MOUND ON SLOPING LAND



PLAN VIEW OF DISTRIBUTION BED

LEGEND

Typical dimensions:

A	1200 to 2000 mm	H	450 mm
B	6 to 8 times A	I	Determined by ground slope and 1 in 3 mound face slope
D	600 mm	J	2000 mm minimum on sloping ground (equals I on flat ground)
E	600 mm on flat ground, > 600 mm on sloping ground	K	Determined by height of finished mound and 1 in 3 mound face slope
F	225 mm	L	B + 2K
G	300 mm		

Australian/New Zealand Standard AS/NZS 1547:2012

Construction:
- Built up of sand fill media with distribution bed of select aggregate containing effluent distribution system covered with fabric and topsoil
- Delivery pipe from dosing chamber should drain after dosing. Backfill and compact soil around pipe
- Sand fill media:
- Medium sand, grain size 0.25-1.0 mm with UC <4
- <3% fines (0.074 mm), free of clay, limestone and organics
- Place carefully to avoid compaction of soil
- Build to elevation of top of distribution bed

Australian/New Zealand Standard AS/NZS 1547:2012

Construction:

- Form distribution bed with level base and shape sides
- Fill with graded river run aggregate (20-60mm, non-crushed, rounded) and levelled at minimum depth of 150mm
- Assemble distribution network on aggregate
- Pressure and timer dosed drilled pipe
- Distribution laterals can be LPED lines
- Manifold should drain between doses
- Laterals should be laid level

Australian/New Zealand Standard AS/NZS 1547:2012

Construction:

- Pre-commission test distribution system
- Finish off distribution bed to 225mm depth
- Place filter cloth over aggregate
- Place silty loam topsoil cap to 300mm depth reducing to sides
- Place further 150mm good quality topsoil over whole mound
- Plant grass or turf and shallow rooting ground cover or shrubs around base
- Inspect, check, commission and hand over

Water NSW Designing and Installing On-Site Wastewater Systems

Chapter 9 Sand Mounds:

- Design based on Wisconsin mound (after Converse and Tyler, 2000)
- Discusses some design limitations of AS/NZS1547:2012 and provides additional guidance on design, construction and operation and maintenance
- Supporting video: https://www.youtube.com/watch?v=kSopFeo0PC4
- Checklists for installation and operation

For additional design details consult:

- Converse, J. C. and Tyler, E. J. 2000. Wisconsin Mound Soil Absorption System: Siting, Design and Construction Manual. Small Scale Waste Management Project, Soil Science Department, University of Wisconsin - Madison
- Crites, R. and Tchobanoglous, G. 1998. Small and Decentralised Wastewater Management Systems, McGraw-Hill, Boston
- Siegrist, R. I. 2017. Decentralized Water Reclamation Engineering, A Curriculum Workbook. Springer
- USEPA 2002. Onsite Wastewater Treatment Systems Manual. Office of Water, U.S. Environment Protection Agency. EPA/625/R-00/008