ON SITE WASTE WATER DISPOSAL

SITE INVESTIGATION, ASSESSMENT AND EVALUATION CHECKLIST.

Disclaimer: Only PARTS of AS/NZS 1547:2012 have been included to help with your design and are for your guidance ONLY. Evaluators should make themselves aware of all the potential restrictions under this Standard in order to show compliance with the NZBC clause G13/VM4 and Hawke's Bay Regional Council Rules.

1.0 Site Evaluator

1.1	Name:	Registration No.
	Company	Address
	Phone:	First point of contact:
	Cell:	
	Fax:	
	E-mail	

2.0 Site Information

2.1	Location Address:	
	Owner:	Owners Address:
	Phone:	Fax:
	Mobile:	E-mail
2.2	**<u>Legal Description</u>** Lot No: ....Dp: ....BLK: .... Valuation No: .... (as per your rate demand) Total site area: ....(ha)	
2.3	Shape, Contour and layout of site is accurately described in design and shown on site plan? **Yes** ☐ Flat site **Yes** ☐ **No** ☐ Gentle slope **Yes** ☐ **No** ☐ Moderate to steep **Yes** ☐ **No** ☐ Steep **Yes** ☐ **No** ☐	
2.4	Are photographs of site attached? **Yes** ☐ **No** ☐	
2.5	Illustration of soil structure attached? **Yes** ☐ **No** ☐	

3.0 Hydraulic Loading Information

3.1	Number of bedrooms	Number of persons	Design flow allowance per person (Refer: NZS 1547)
3.2	Waste Disposal Unit Installed **Yes** ☐ **No** ☐		
3.3	Water saving devices installed **Yes** ☐ **No** ☐		
3.4	Potable water supply ☐ Rain water ☐ Bore water ☐ Reticulated ☐ **(Tick supply used)**		
3.5	Distances from system to bore or well in metres: .... Shown on Site Plan **Yes** ☐ **No** ☐		

4.0 Site Assessment

4.1	Has the reserve field been identified on the site plans **Yes** ☐ **No** ☐ **If no, please explain.**
4.2	Does the topography of the site suit the system design **Yes** ☐ **No** ☐
4.3	Are there any drainage flow paths that have to be considered **Yes** ☐ **No** ☐
4.4	Has surface water run- off been taken into account **Yes** ☐ **No** ☐
4.5	Are there cut off drains / Collector drains required **Yes** ☐ **No** ☐
4.6	Is the winter high water table known **Yes** ☐ **No** ☐ Height of water table: .... (if known) How close will this be to bed floor approx mm.
4.7	Are there site constraints with boundary or water course distances from the proposed field **Yes** ☐ **No** ☐ **(please explain) ....**

5.0 Sub-Soil Investigation.

5.1	How was the soil profile determined? Bore holes ☐ Dug Test Holes ☐ Earlier Site Excavation ☐ Soil pit ☐ Other ☐ (please specify): ....
5.2	Have the soil tests been assessed by a third party **Yes** ☐ **No** ☐
5.3	Has the soil structure profile been completed **Yes** ☐ **No** ☐ Have photographs been supplied **Yes** ☐ **No** ☐ 900 GROUND LEVEL
5.4	Has a percolation test been carried out **Yes** ☐ **No** ☐ If YES please specify the method: *(As described and shown by AS/NZS 1547:2012)*

5.5	Are the percolation test results attached **Yes** ☐ **No** ☐
5.6	Do the tests match the DLR expectations from the tables and soil categorization **Yes** ☐ **No** ☐
5.7	**Tick the appropriate soil type:** 1. Gravel, coarse sand, rapid draining **Yes** ☐ **No** ☐ 2. Coarse to medium sandy loams, free draining **Yes** ☐ **No** ☐ 3. Medium-fine-loams, moderately good drainage **Yes** ☐ **No** ☐ 4. Clay loam, loam and silt loam, imperfect drainage **Yes** ☐ **No** ☐ 5. Light clays slow drainage **Yes** ☐ **No** ☐ 6. Medium to heavy clays very poor draining **Yes** ☐ **No** ☐

6.0 Site Evaluation

6.1	Are there any environmental constraints **Yes** ☐ **No** ☐ If YES please specify
6.2	Are there any Hawkes Bay Regional Council or Central Hawkes Bay District Council Constraints *(please check this prior to building consent application as this could materially affect the work on site)* **Yes** ☐ **No** ☐ If YES please specify HBRC discharge permit number: ....
6.3	Type of sewer treatment system best suited to this ground type including the minimum septic tank size, make and model
6.4	Type of disposal system considered best use for this site
6.5	Minimum disposal area recommended (for trenches and beds see 6.8 below and table 4.2A1 NZS1547 Area= square meters
6.6	Minimum size of reserve area (see HBRC and CHBDC requirements) Area: .... M^2
6.7	Minimum septic tank size required from AS/NZS 1547
6.8	Trench and bed calculations from NZS 1547 2000

Calculations (*Trenches and beds only example)*

Length of drain = Q÷ (SUM of DLR $\times W$)

Example:
Q= Litres per day used = number of bedrooms
$\times 2\ people\ per\ bedroom \times litres\ used\ per\ person\ per\ day.$
(Therefore 3 bedrooms = 6 people)

6 people x 180litres p.p per day =1080litres used
(180 litres is an example, consult NZS 1547 for minimum allowances to be used, or local and regional councils for minimum and maximum daily discharges)

Length of drain (Q) = 1080
Assume type 2 massive soil: 15x (trench width proposed) 0.6m

Therefore Q (Length of drain) = 1080÷ $9 = 120lm\ OF\ DRAIN\ @0.6M\ WIDE$
This equals 72m^2 of drainage.

7.0 General Comments

7.1	AS/NZS 1547:2012 "On site domestic waste water management" can be used for guidance in the on site assessment and soil evaluation. This standard can provide options for 'on site' waste water treatment and land application systems. The 2000 version is still the version automatically acceptable to G13/VM4.
7.2	AS/NZS 1546: 1998 "Septic tanks" has been adopted by the Central Hawkes Bay District Council. Unless a manufacturer has built their tanks to comply with this standard, and has had an engineer verify that the tanks comply with the same, then those tanks are unlikely to be permitted for used in Central Hawkes Bay as an alternative solution to G13/VM4.
7.3	Where it is necessary to make contact with the Hawkes Bay Regional Council in relation to an on sight waste water disposal design 06 835 9200 www.hbrc.govt.nz
7.4	Please be aware that although 'holding tanks' may be permitted under the building code and regional council rules, the discharge from them will not be accepted into the Central Hawkes Bay oxidation ponds from septic tanks cleaners. Please take this into consideration when designing your system.
Applicants Name	
Signature	
Date	

Important notes

1. Further attached are the tables required for ETA / ETS, mound and irrigation systems and field size calculations.

2. Please show reserve areas required including sizes as required by AS/NZS:1547

3. If the reserve area is to be less than 100% this must be justified by your design.

4. All site plans must show datum heights and overland flow path directions for any surface or shallow sub surface irrigation and drip-line systems.

5. All systems must show cross sectional drawings of how the system will be installed, whether they are standard trenches or AWTP systems.

6. All systems that require signage, fencing and planting in any form must be indicated on the drawings. Who does this work is between the applicant and designer, however, a code compliance certificate may not be issued unless all components are completed.

7. Anything other than full compliance with AS/NZS 1547 must be applied for as an alternative solution to the New Zealand building code clause G13/VM4.

8. If the total domestic waste water flow design allowances are to be reduced from the standard quantities, then itemization of the water reduction fixtures within the dwelling will be required to be shown as part of the application, not just generic reference.

9. Please use AS/NZS 1547 in conjunction with this form to supply an accurate design. The tables supplied are a guide only. Other site constraints may indicate alternative systems are required, or that a specialist waste water engineer be employed.

10. Please use the blank calculations sheet attached to show calculations for systems other than trenches and beds.

11. It is not acceptable to leave questions on this form blank. If the information is not known then justification for why not must be supplied. *eg: Winter high water table*

12. Hawkes Bay Regional Council also has rules regarding the disposal of on-site wastewater. It is highly recommended that you check these guidelines as well. You cannot proceed with work even under a building consent if it would contravene other legislation!!

Calculation sheet for ETA/ETS, mounds, sub-surface and surface irrigation systems

Type of system best suited: ....

Type of soil (category): ....

Dlr or dir from tables (mm/d): ....

Number of bedrooms: ....

Occupants: (minimum of 2 per bedroom): ....

Total litres per day: ....

Size of field required m^2: ....

Size of reserve area required (see AS/NZS:1547): ....

Water saving devices (see notes in tables): ....

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Cross sectional construction details of field & site plan (including all slopes and overland flow paths with locations of water tank overflows, construction details of cut off drains and any other elements that may affect the system. Also show any signage, planting, marking, & all setbacks for both EAA and Reserve field).

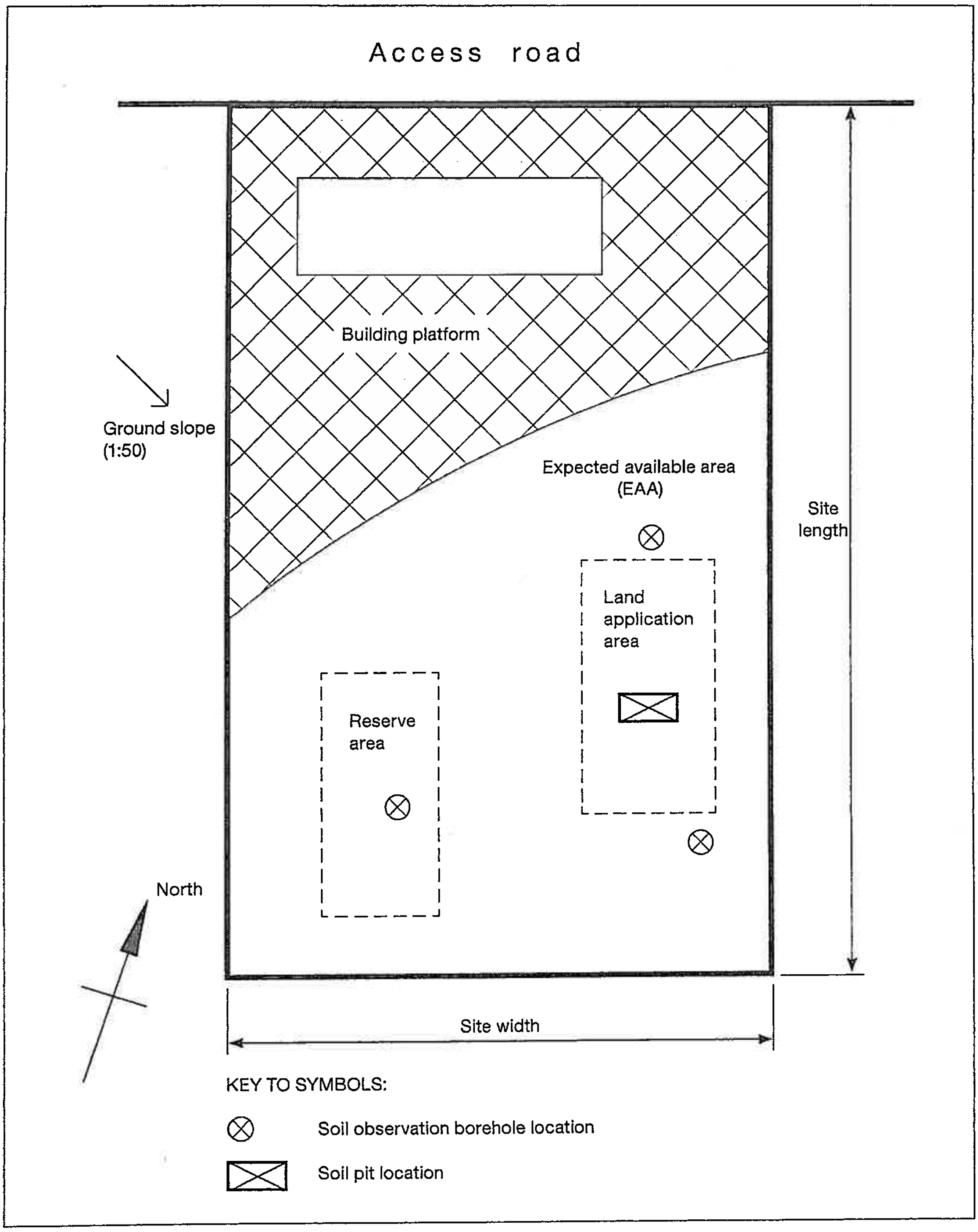


FIGURE D1 SITE PLAN – INDIVIDUAL LOT – EXAMPLE

TABLE H3
TYPICAL DOMESTIC WASTEWATER DESIGN FLOW ALLOWANCES – DOMESTIC WASTEWATER FROM HOUSEHOLDS – NEW ZEALAND

Source	Typical wastewater design flows (L/person/day) (see Note 1)	
	On-site roof water tank supply	Reticulated community or a bore-water supply
Households with standard fixtures (including automatic washing machine)	180	200
Households with standard water reduction fixtures (see Note 2)	145	165
Households with full water-reduction facilities (see Note 3)	120	145
Households (blackwater only) (see Notes 4 and 5)	60	
Households (greywater only) (see Notes 4 and 6)	90	120

NOTES:

1 These flows should be used for design purposes unless past experience demonstrates lower actual flows.

2 Standard water reduction fixtures include dual flush water closets, shower-flow restrictors, aerator faucets (taps), and water-conserving automatic washing machines.

3 Full water-reduction fixtures include the combined use of reduced flush 6/3 litre water closets, shower-flow restrictors, aerator faucets, front-load washing machines and flow/pressure control valves on all water-use outlets (9 L/min maximum). Baths should also be discouraged.

4 Additionally, water reduction may be achieved by treatment of greywater and recycling for water closet flushing (reclaimed water cycling). However, when designing the water treatment unit and the land application area, it needs to be borne in mind that effluent derived from recycled wastewater will be likely to have a higher level of nutrients and salts than non-recycled water, and that there is no certainty on the exact extent of reuse or that the reuse system will remain in place in the long term. Therefore any reduction in the size of the land application system should be conservative and subject to the approval of the relevant regulatory authority.

5 Flow allowances only apply where the blackwater from toilets is to be treated and discharged to land disposal. Blackwater flows constitute 10% to 30% of the total per person daily flow allowances, typically in New Zealand in the order of 25%. Where water-reducing fixtures are already in place, blackwater flows from toilets are likely to be a lower proportion of the total daily water usage, in the order of 15% to 18% of the total water usage.

6 Flow allowances only apply where the greywater is to be treated and discharged to land disposal, where solids from kitchen and toilet waste flows are excluded from the wastewater stream (no food waste disposal unit).

TABLE H4
TYPICAL DOMESTIC WASTEWATER DESIGN FLOW ALLOWANCES – DOMESTIC WASTEWATER FROM COMMERCIAL PREMISES – NEW ZEALAND

Source	Typical wastewater design flows (L/person/day)	
	On-site roof water tank supply	**Reticulated community or a bore-water supply**
Motels/hotels		
– guests, resident staff	220	
– non-resident staff	30	
– reception rooms	20 – 30	
– bar trade (per customer)	20	
– restaurant (per diner)	25 – 30	
Tearooms/lunch bars (per customer)		
– without restroom facilities	10	15
– with restroom facilities	15	25
Community halls		
– banqueting	20	30
– meetings	10	15
School (pupils plus staff)	15 – 30	
Rural factories, shopping centres	30	50
Camping grounds		
– fully serviced	100	130
– recreation areas	50	65

NOTE: These flows should be used for design purposes unless past experience demonstrates lower actual flows. Design flows should be based on the maximum figure in the range unless justification for lower values can be provided by way of actual water use data. Although guidance is provided for flow allowances for non-household activities, this Standard does not provide specific requirements for commercial loads, for example in commercial kitchens and laundries (see 1.9 definition of domestic wastewater).

TABLE J1
ALL-WASTE SEPTIC TANK OPERATIONAL CAPACITIES

Population equivalent (persons)	**Number of bedrooms**	**Design flow** (L/day)	**Tank capacity** (L)
1 – 5	1 – 3	1000	3000
6 – 7	4	1000 – 1400	3500
8	5	1400 – 1600	4000
9 – 10	6	1600 – 2000	4500

TABLE J2
GREYWATER SEPTIC TANK OPERATIONAL CAPACITIES

Population equivalent (persons)	**Number of bedrooms**	**Design flow** (L/day)	**Tank capacity** (L)
1 – 5	1 – 3	600	1800
6 – 7	4	600 – 840	2100
8	5	840 – 960	2400
9 – 10	6	960 – 1200	2700

TABLE J3
BLACKWATER SEPTIC TANK OPERATIONAL CAPACITIES

Population equivalent (persons)	**Number of bedrooms**	**Design flow** (L/day)	**Tank capacity** (L)
1 – 5	1 – 3	300	1500
6 – 7	4	300 – 420	1800
8	5	420 – 480	2100
9 – 10	6	480 – 600	2500

TABLE L1
RECOMMENDED DESIGN LOADING RATES FOR TRENCHES AND BEDS

Soil category	Soil texture	Structure	Indicative permeability (K_{sat})(m/d)	Design loading rate (DLR) (mm/d)			
				Trenches and beds			ETA/ETS beds and trenches
				Primary treated effluent		Secondary treated effluent	
				Conservative rate	Maximum rate		
1	Gravels and sands	Structureless (massive)	> 3.0	20 (see Note 1)	35 (see Note 1)	50 (see Note 1)	(see Note 4)
2	Sandy loams	Weakly structured	> 3.0	20 (see Note 1)	30 (see Note 1)	50 (see Note 1)	
		Massive	1.4 – 3.0	15	25	50	
3	Loams	High/ moderate structured	1.5 – 3.0	15	25	50	
		Weakly structured or massive	0.5 – 1.5	10	15	30	
4	Clay loams	High/ moderate structured	0.5 – 1.5	10	15	30	12
		Weakly structured	0.12 – 0.5	6	10	20	8
		Massive	0.06 – 0.12	4	5	10	5
5	Light clays	Strongly structured	0.12 – 0.5	5	8	12	8
		Moderately structured	0.06 – 0.12		5	10	5 (see Notes 2, 3, & 5)
		Weakly structured or massive	< 0.06			8	
6	Medium to heavy clays	Strongly structured	0.06 – 0.5	(see Notes 2 & 3)			
		Moderately structured	< 0.06				
		Weakly structured or massive	< 0.06				

NOTES:

1 The treatment capacity of the soil and not the hydraulic capacity of the soil or the growth of the clogging layer govern the effluent loading rate in Category 1 and weakly structured Category 2 soils. Land application systems in these soils require design by a suitably qualified and experienced person, and distribution techniques to help achieve even distribution of effluent over the full design surface (see L6.2 and Figure L4 for recommended discharge method by discharge control trench). These soils have low nutrient retention capacities, often allowing accession of nutrients to groundwater.

2 To enable use of such soils for on-site wastewater land application systems, special design requirements and distribution techniques or soil modification procedures will be necessary. For any system designed for these soils, the effluent absorption rate shall be based upon soil permeability testing. Specialist soils advice and special design techniques will be required for clay dominated soils having dispersive (sodic) or shrink/swell behaviour. Such soils shall be treated as Category 6 soils. In most situations, the design will need to rely on more processes than just absorption by the soil.

3 If K_{sat} < 0.06 m/d, a full water balance for the land application can be used to calculate trench/bed size (see Appendix Q).

4 ETA/ETS systems are not normally used on soil Categories 1 to 3.

5 For Category 6 soils ETA/ETS systems are suitable only for use with secondary treated effluent.

TABLE L2
TYPICAL DIMENSIONS OF CONVENTIONAL TRENCHES AND BEDS

	Typical dimensions (mm)	Maximum (mm)	Minimum (mm)
Trench dimensions			
Width	300 – 450	600	200
Depth of aggregate	200 – 400	400	200
Depth of topsoil	100 – 150	150	100
Spacing between adjacent trenches (sidewall to sidewall)	–	N/A	1000
Bed dimensions			
Width	1000 – 4000	4000	1000
Depth of aggregate	300 – 600	600	300
Depth of topsoil	100 – 150	150	100
Spacing between adjacent beds (sidewall to sidewall)	–	N/A	1000

L5.3 Construction details

Typical details of construction are shown in:

Trenches	Figure L1 Conventional piped trench
	Figure L2 Self-supporting arch trench (two versions)
	Figure L3 Boxed trench
	Figure L4 Discharge control trench
Beds	Figure L5 Conventional bed
ETA/ETS trenches and beds	Figure L6 ETA/ETS bed details
	Figure L7 ETA/ETS trenches

CL5.3

In these figures:

(a) Filter cloth is placed in conventional trenches and beds to prevent soil incursion into the distribution aggregate;

(b) Brick or precast reinforced concrete trench sidewalls and the trench covers are usually at least 50 mm thick, to ensure stability of construction;

(c) The sand-fill media used in the discharge control trench for Category 1 soil (see L6.2), is the same as that used in mound construction (see N3.3);

(d) LPED lines are used to distribute effluent under manifold pressure dosing or automatic sequencing valve into either trenches or beds. (Note that LPED lines are used also in LPED shallow subsurface irrigation of primary effluent (see 5.5.3.5 and M5).

The layer of sand overlying the gravel distribution layer (see Figure L6 and L7) in both ETA/ETS trenches and beds enables effluent moisture and nutrients to rise by capillary action to the root systems of vegetation planted in the covering topsoil layer.

L10 PRE-COMMISSIONING TESTS

A pre-commissioning test shall be carried out on pump dosed systems after all on-site components, including the pump, have been installed but prior to covering the effluent distribution system in the trench or bed (see also 6.2.5.2):

(a) Fill the pump chamber to 'pump-on' level with water;

(b) Start the pump;

(c) Check perforated lines to ensure that water flows uniformly from all squirt holes; and where LPED lines are installed, check that uniform distribution is being achieved along the length of the distribution line;

(d) Record time taken to pump from 'pump-on' level to the 'pump-off' level – desirably approximately 3 minutes;

(e) Follow the pump manufacturer's recommendations for commissioning pump;

(f) Check the pumping main to ensure there are no leaks and that the air-release valve is functioning;

(g) Check that the high-water-level alarm operates; and

(h) Where automatic sequencing valves are installed, check that the valve mechanism rotates consistently at each pump cycle.

Siphon dosed systems shall be subject to pre-commissioning tests by equivalent procedures.

L11 COMMISSIONING

The on-site system shall be inspected, checked, and commissioned according to 6.2.5.

L12 MARKING

The location of underground pipes and land application fields shall be marked.

CL12

Marking tape to AS/NZS 2648.1 is suitable for underground use. The system's inspection ports and air vents can act as above-ground markers for parts of the system.

L13 REPORTING

An installation and commissioning report shall be produced to include the 'as-built' details following construction, the results of construction inspections, and the commissioning process. This report shall be provided to the property owner of the on-site system and, if required, to the regulatory authority (see 6.2.5.4).

TABLE M1
RECOMMENDED DESIGN IRRIGATION RATE (DIR) FOR IRRIGATION SYSTEMS

Soil Category (see Note 1)	Soil texture	Structure	Indicative permeability (K_{sat}) (m/d)	Design irrigation rate (DIR) (mm/day)		
				Drip irrigation	Spray irrigation	LPED irrigation
1	Gravels and sands	Structureless (massive)	> 3.0	5 (see Note 2)	5	(see Note 3)
2	Sandy loams	Weakly structured	> 3.0			4
		massive	1.4 – 3.0			
3	Loams	High/ moderate structured	1.5 – 3.0	4 (see Note 1)	4	3.5
		Weakly structured or massive	0.5 – 1.5			
4	Clay loams	High/ moderate structured	0.5 – 1.5	3.5 (see Note 1)	3.5	3
		Weakly structured	0.12 – 0.5			
		Massive	0.06 – 0.12			
5	Light clays	Strongly structured	0.12 – 0.5	3 (see Note 1)	3	2.5 (see Note 4)
		Moderately structured	0.06 – 0.12			
		Weakly structured or massive	< 0.06			
6	Medium to heavy clays	Strongly structured	0.06 – 0.5	2 (see Note 2)	2	(see Note 3)
		Moderately structured	< 0.06			
		Weakly structured or massive	< 0.06			

NOTES:

1 For Category 3 to 5 soils (loams to light clays), the drip irrigation system needs to be installed in an adequate depth of topsoil (in the order of 150 – 250 mm of *in situ* or imported good quality topsoil) to slow the soakage and assist with nutrient reduction.

2 For Category 1, 2, and 6 soils, the drip irrigation system has a depth of 100 – 150 mm in good quality topsoil (see CM1 and M3.1).

3 LPED irrigation is not advised for Category 1 or Category 6 soils – drip irrigation of secondary effluent is the preferred irrigation method.

4 LPED irrigation for Category 5 soils needs a minimum depth of 250 mm of good quality topsoil (see M5 and CM7.1).

M7 IRRIGATION AREA

M7.1 General

The irrigation area shall have an adequate depth of natural good quality topsoil (or imported topsoil if necessary) to store the applied effluent and to support the growth of evergreen vegetation to maximise evapotranspiration.

CM7.1

The natural soil into which irrigation lines are installed should consist of a minimum depth of 150 mm (for subsoil categories 3 to 5) and 250 mm (for subsoil categories 1, 2, and 6) of good quality topsoil (see CM1).

The maximum 'effective' soakage area that should be used for design purposes is 1 m width along the irrigation lines. This applies to where the lines are 1 m or more apart, and in the case of drip systems, is proportionately less where drip lines are closer together. For flat land this effective area is taken as half this width either side of the drip or LPED line and for sloping land it is taken as the full width downslope of each line along the contour.

Design irrigation rates (Table M1) apply to systems on flat to moderate slopes up to 10%.

M7.2 Designated area

The irrigation system shall be located in a designated area to enhance evapotranspiration and its amenity and shall:

(a) Not be used for purposes that compromise the effectiveness of the system or access for future maintenance purposes;

(b) Be used only for effluent application;

(c) Have boundaries clearly delineated by appropriate vegetation or other type of border;

(d) Have no run-off or seepage of effluent beyond the designated area;

and for spray-irrigation systems:

(e) Have no casual access by humans or animals (see T5.2.2); and

(f) Allow no spray to reach areas normally occupied by humans or animals.

CM7.2

Boundary delineation should be designed to deter human and animal access.

M8 SPRAY IRRIGATION

Spray-irrigation systems shall:

(a) Distribute the effluent evenly in the designated area;

(b) Control the droplet size, throw and plume height of the sprinkler system so that the risk of aerosol dispersion and likelihood of wind drift distributing any effluent beyond the designated area are negligible;

(c) Have warnings, complying with AS 1319 or NZS/AS 1319, at the boundaries of the designated area in at least two places, clearly visible to property users, with wording such as 'Recycled Water – Avoid Contact – DO NOT DRINK';

(d) Meet the applicable disinfection criteria, see 5.4.2.5.1; and

(e) Be provided with a buffer area to ensure that any potential spray drift is absorbed within appropriate setback distances.

M9 CONSTRUCTION

M9.1 General

Shallow, pressurised, subsurface drip systems are shown in Figure M1. An example of an above ground spray irrigation system is shown in Figure M2. Details of the LPED system of subsurface irrigation of primary treated effluent are shown in Figure M3. Covered drip systems shall be laid over the topsoil following installation of the irrigation lines and then covered with mulch. All irrigation systems shall be installed in good quality topsoil.

CM9.1

In drip irrigation all effluent is discharged below the surface into the potential root zone of the vegetative cover. This helps the plants to reduce nutrient loads in the groundwater. Where, necessary good quality topsoil (see M5) should be sourced from a location acceptable to the regulatory authority.

In LPED irrigation systems, effluent is discharged into the shallow and narrow aggregate filled trench system to enable contact with the treatment bacteria in the aerobic upper layer of the soil surrounding trenches and to facilitate nutrient and moisture uptake and evapotranspiration by the vegetative groundcover between trenches.

M9.2 Setbacks

The system shall be installed with appropriate setback distances required by the regulatory authority.

M9.3 Sloping sites

On sloping ground, all irrigation lines shall be installed along the contour unless the line has non-leakage emitters, when lines may run down slope within the manufacturer's specifications. Shallow and narrow trenches for LPED systems shall be carefully constructed along the contour. The ingress of surface and seepage water into the land application area shall be controlled or prevented. A cut-off trench or diversion drain shall be constructed up-slope to divert surface and groundwater away from the irrigated area.

For sloping ground the DIR for subsurface drip irrigation shall be decreased to ensure that effluent migration down slope is taken up adequately within the topsoil and plant root system. See Table M2 for recommended reductions according to slope.

TABLE M2
RECOMMENDED REDUCTIONS IN DIR ACCORDING TO SLOPE

Slope	Reduction in DIR
Flat up to 10%	No reduction
10% to 20%	20%
20% to 30%	50%
> 30%	Advice required from a suitably qualified and experience person
NOTE: See Table 1.1 for conversion of slope per cent grade into slope angle and slope ratio.	

CM9.3

LPED systems are not appropriate on slopes greater than 27% due to uncertainty with even distribution being achieved on steep land.

Covered surface drip and spray irrigation pose risks from effluent run-off in wet weather for slopes > 10%.

M9.4 Distribution Systems

M9.4.1 *LPED irrigation*
Pipes for LPED systems shall be laid in 200 x 200 mm trenches in aggregate of 10 – 15 mm size, clean and free of soil or organic matter (see Figure M3).

The LPED irrigation system shall distribute the effluent uniformly throughout the LPED trenches, with the dosing system consisting of a 25 – 30 mm perforated pipe installed in an 80 – 100 mm distribution pipe.

The final layer of aggregate and the topsoil cover shall not be placed until after the pump pre-commissioning test and even distribution of effluent has been confirmed (see L10).

CM9.4.1
The preferred method of pressurising the LPED lines is to use an automatic sequencing valve system.

The final details of perforated pipe size and squirt holes in the LPED system should be confirmed by hydraulic design.

M9.4.2 *Covered surface drip*
The number of drip emitters shall be determined based on the emitter type and absorption capacity of the soil.

M11 PRE-COMMISSIONING TESTS

M11.1 Drip irrigation

A pre-commissioning test shall be carried out after all on-site components including the pump have been installed, but prior to covering the effluent dripper system (see also 6.2.5). As a minimum the test shall take the following steps:

(a) Fill the pump chamber to 'pump-on' level with water;

(b) Start the pump;

(c) Check the effluent drip emitter system to ensure water flows uniformly from all emitters and that all flushing valves and other fittings are operating correctly;

(d) Record time taken to pump from 'pump-on' level to the 'pump-off' level – desirably approximately 3 minutes;

(e) Follow pump manufacturer's recommendations for commissioning pump;

(f) Check pumping main to ensure there are no leaks and the air release valve is functioning; and

(g) Check that the high-water-level alarm operates.

M11.2 LPED irrigation

The pre-commissioning test shall be carried out as in L10 for pump distribution to trenches and beds.

M12 COMMISSIONING

The on-site system shall be inspected, checked and commissioned according to 6.2.5.

M13 MARKING

The presence of buried pipes shall:

(a) Be indicated, for example, using underground marking tape to AS/NZS 2648.1; or

(b) Be indicated by signage, prominently displayed with the words: 'Sewage effluent pipework installed below. DO NOT DIG.'

M14 REPORTING

An installation and commissioning report shall be produced to include the 'as-built' details of all key system components following installation, the results of construction inspections and the commissioning process. This report shall be provided to the property owner of the on-site system and, if required, to the regulatory authority (see 6.2.5.4).

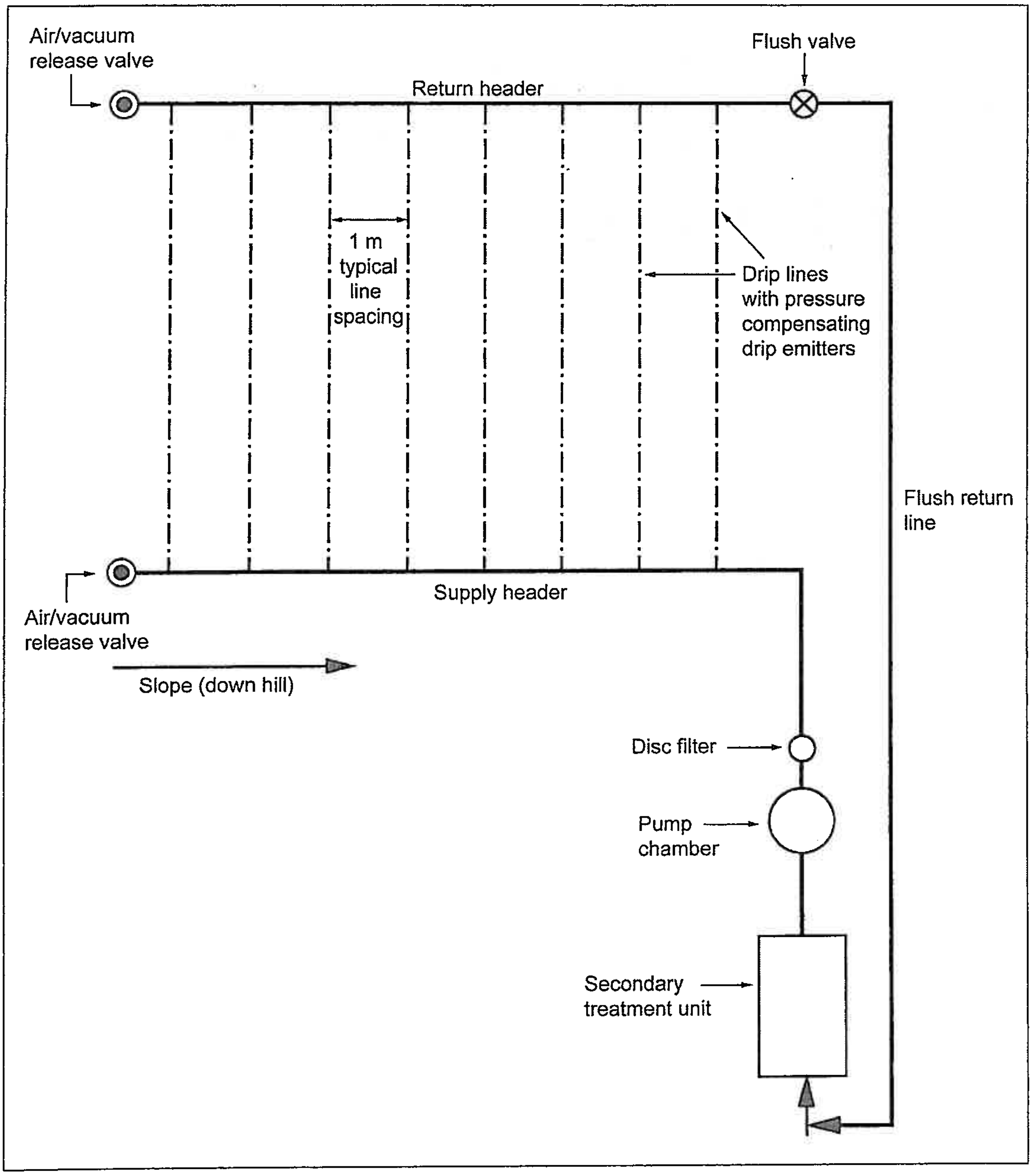


FIGURE M1 DRIP IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS

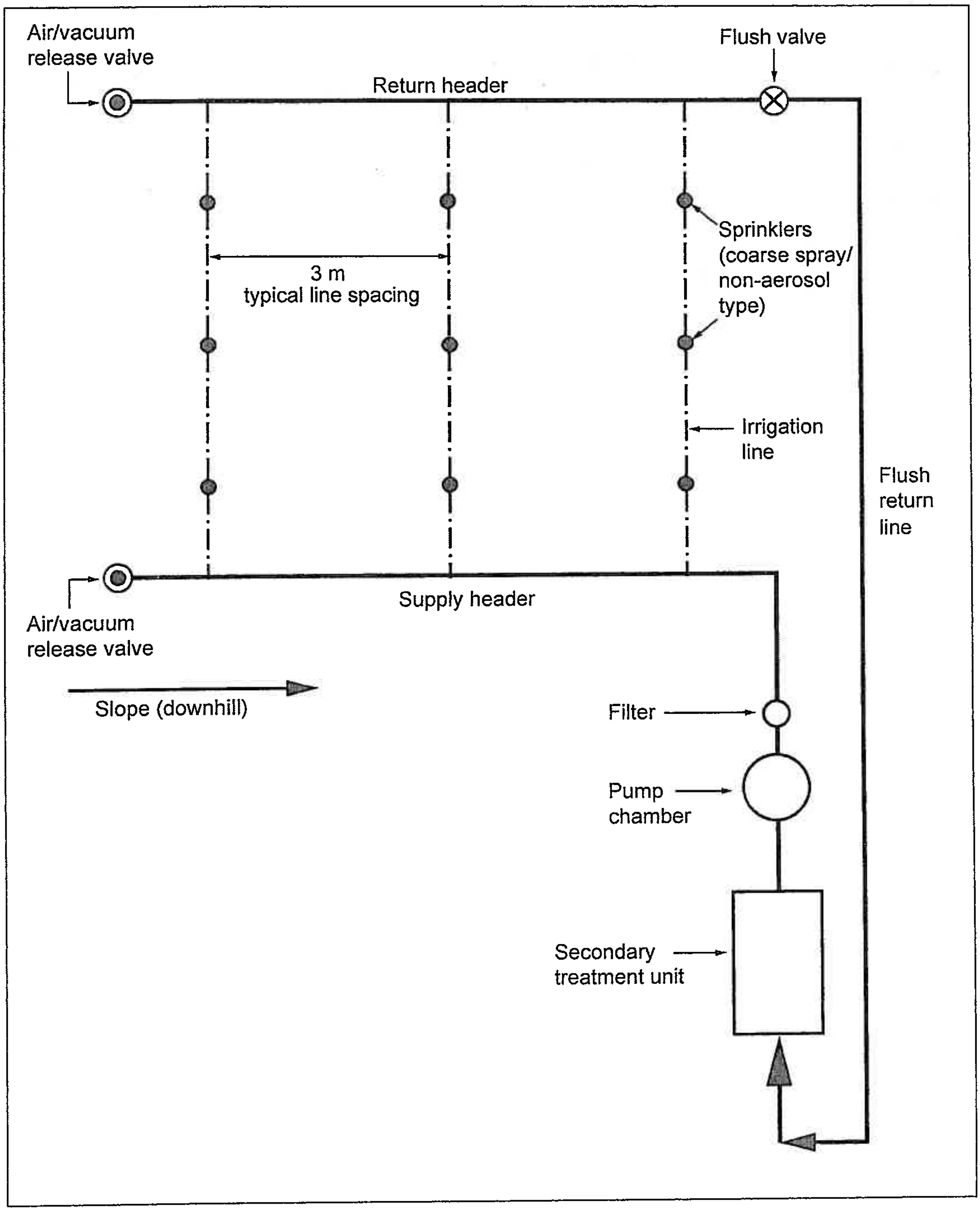
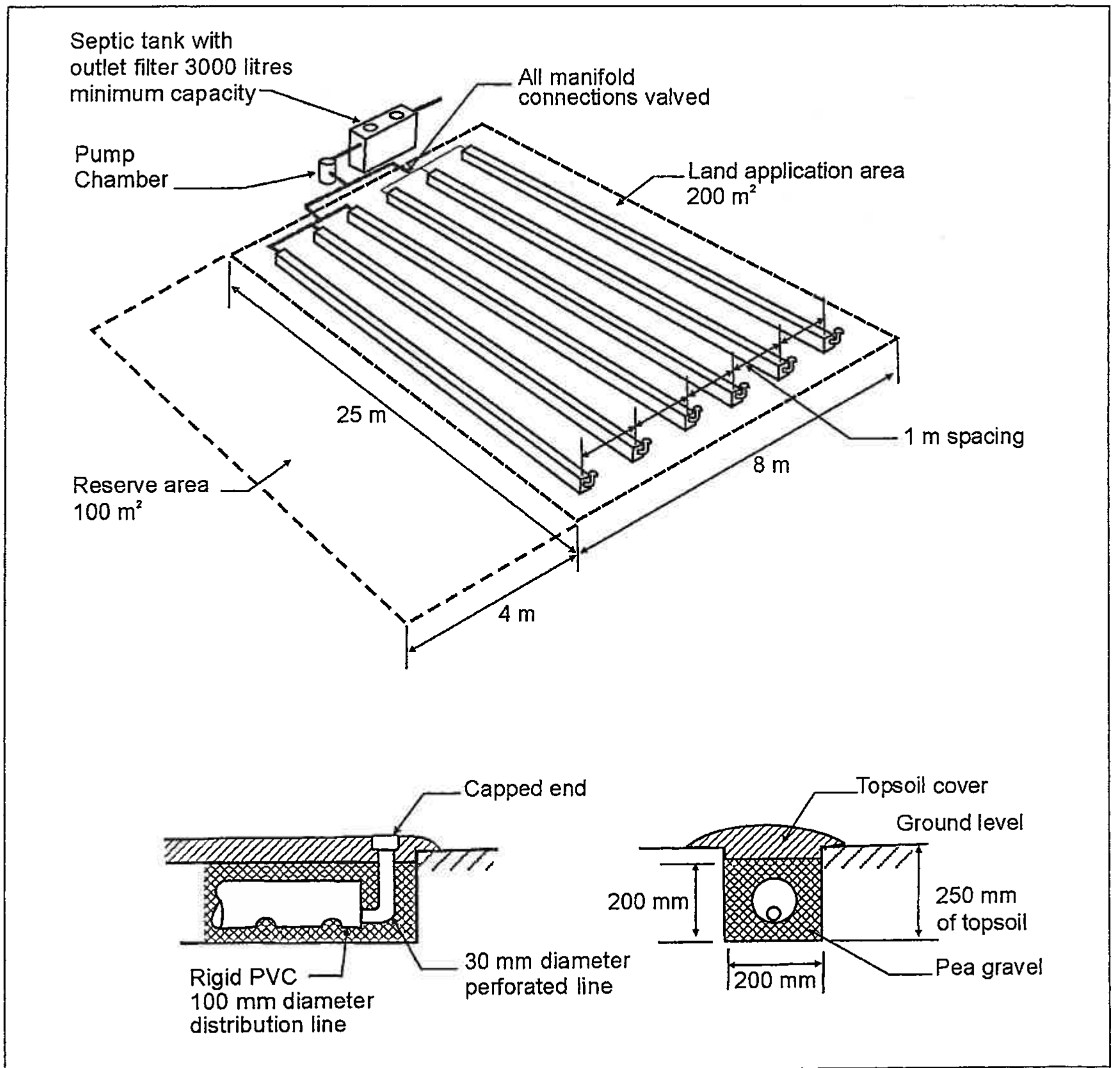


FIGURE M2 SPRAY IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS



NOTES:

1 Example system sized for 700 L/d and DIR of 3.5 mm/d in soil Category 3 (see Table M1).

2 Preferred dosing method is by a 6-way automatic sequencing valve.

3 Good quality topsoil to 250 mm depth is required.

4 Flexible 100 mm diameter corrugated drainage line can be used in place of rigid PVC.

5 Distribution aggregate of 10 mm to 15 mm size can be used in place of pea gravel.

FIGURE M3 SHALLOW SUBSURFACE LPED IRRIGATION – EXAMPLE SYSTEM

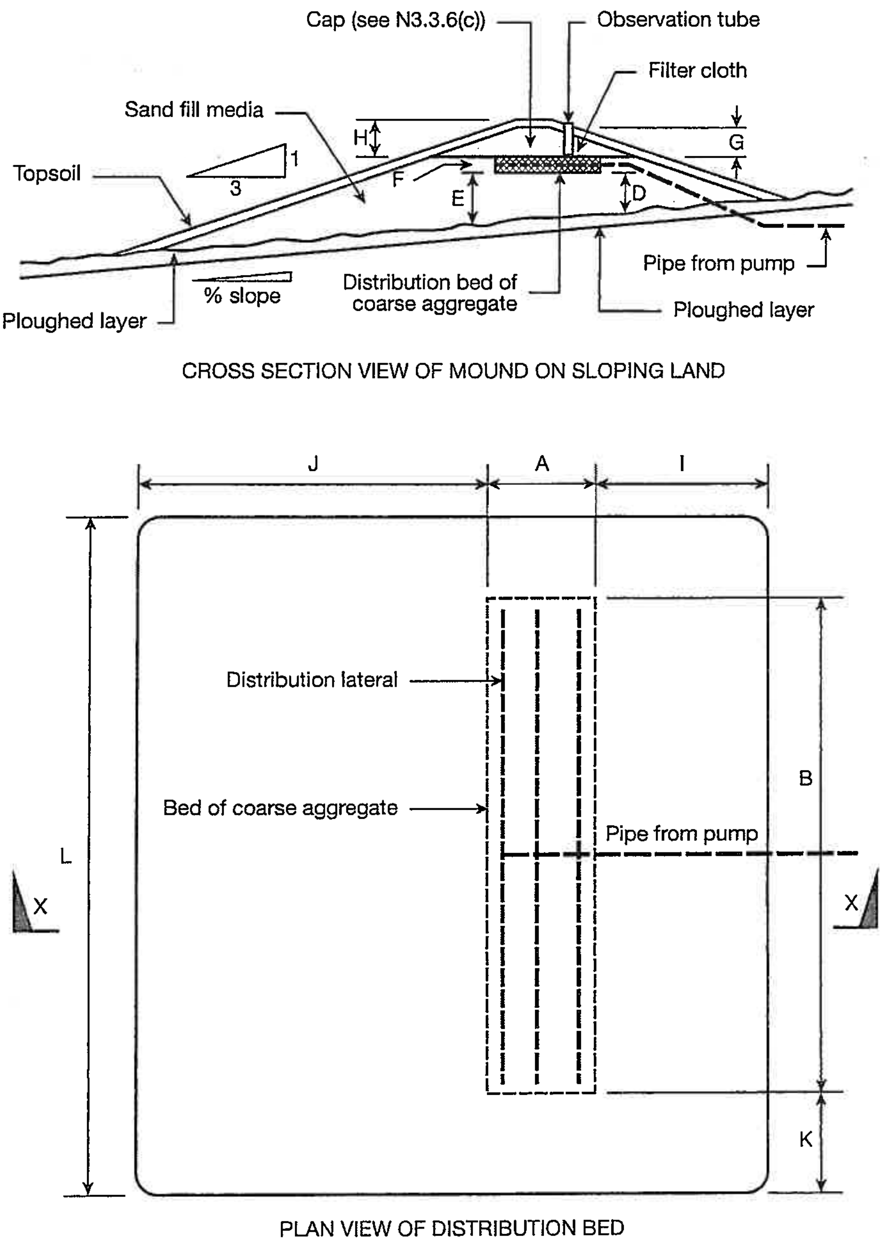
TABLE N1
RECOMMENDED MOUND DESIGN LOADING RATES

<table>
<tr><th>Soil Category</th><th>Soil texture</th><th>Structure</th><th>Indicative permeability (K_{sat})(m/d)</th><th>Design loading rate (DLR) (mm/d)</th></tr>
<tr><td>1</td><td>Gravels and sands</td><td>Structureless (massive)</td><td>> 3.0</td><td>32</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Sandy loams</td><td>Weakly structured</td><td>> 3.0</td><td>24</td></tr>
<tr><td>Massive</td><td>1.4 – 3.0</td><td>24</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Loams</td><td>High/ moderate structured</td><td>1.5 – 3.0</td><td>24</td></tr>
<tr><td>Weakly structured or massive</td><td>0.5 – 1.5</td><td>16</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Clay loams</td><td>High/ moderate structured</td><td>0.5 – 1.5</td><td>16</td></tr>
<tr><td>Weakly structured</td><td>0.12 – 0.5</td><td>8</td></tr>
<tr><td>Massive</td><td>0.06 – 0.12</td><td>5 (see Note)</td></tr>
<tr><td rowspan="3">5</td><td rowspan="3">Light clays</td><td>Strongly structured</td><td>0.12 – 0.5</td><td>8</td></tr>
<tr><td>Moderately structured</td><td>0.06 – 0.12</td><td rowspan="5">5 (see Note)</td></tr>
<tr><td>Weakly structured or massive</td><td>< 0.06</td></tr>
<tr><td rowspan="3">6</td><td rowspan="3">Medium to heavy clays</td><td>Strongly structured</td><td>0.06 – 0.5</td></tr>
<tr><td>Moderately structured</td><td>< 0.06</td></tr>
<tr><td>Weakly structured or massive</td><td>< 0.06</td></tr>
<tr><td colspan="5">NOTE: To enable use of such soils for on-site wastewater land application, special design requirements and distribution techniques or soil modification procedures will be necessary. For any system designed for these soils, the effluent absorption rate shall be based upon soil permeability testing. Specialist soils advice and special design techniques will be required for clay dominated soils having dispersive (sodic) or shrink/swell behaviour. Such soils shall be treated as Category 6 soils. In most situations, the design will need to rely on more processes than just absorption by the soil.</td></tr>
</table>

N3 CONSTRUCTION AND INSTALLATION

N3.1 Site protection

Before on-site construction work is commenced, the site shall be protected from vehicular traffic (to avoid compaction) and shall be isolated or marked out so that other nearby construction activity does not damage the area.



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		

FIGURE N1 WISCONSIN MOUND SYSTEM

APPENDIX R
RECOMMENDED SETBACK DISTANCES FOR LAND APPLICATION SYSTEMS
(Informative)

R1 SCOPE

This Appendix provides a summary of information on setback distances compiled from a literature review. Local conditions and sensitive receiving environments may require different setback distances. The tables in this Appendix provide a guide on the setback distances that may be applied to land application areas, based on site constraints identified during the site-and-soil evaluation.

R2 APPLICATION

Table R1 is to be used in conjunction with Table R2 in determining the appropriate setback distances when siting a system. If the site has high constraints for any site feature, then the maximum values indicated in Table R1 should be considered. In practice, the overall setback distance should be based on an evaluation of the items and corresponding sensitive features and how these interact to provide a pathway or barrier to the movement of wastewater to the site feature. The regulatory authority may reduce or increase setback distances at their discretion. Where setback distances cannot be achieved, regulators may consider specific management practices to address potential for off-site export of effluent such as monitoring downstream waters and approved modifications to on-site system design.

The tables provide a guideline for designers and site-and-soil evaluators. Adequate site-and-soil assessment leading to the correct system selection and design sizing procedures in this Standard may reduce the need for the maximum setback distances provided in these guidelines. In some cases the regulatory authority will have policy or guidelines that will override the guideline distances below for their area.

There are a number of minimum setback distances that should be taken into account when siting an on-site land application system. These include necessary clearances from buildings, site boundaries, surface water, water supply bores, water tables, and embankment walls. The minimum distances also depend on potential for adverse health and environmental effects, which specifically impacts on water quality, and therefore vary depending on the site constraints and the quality of the treated wastewater.

Figures R1 and R2 provide examples of on-site system design boundaries and possible site constraints.

TABLE R1

GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES

(to be used in conjunction with Table R2) (continued)

3	Setback distances of less than 3 m from houses are appropriate only where a drip irrigation land application system is being used with low design irrigation rates, where shallow subsurface systems are being used with equivalent low areal loading rates, where the risk of reducing the bearing capacity of the foundation or damaging the structure is low, or where an effective barrier (designed by a suitably qualified and experienced person) can be installed. This may require consent from the regulatory authority.
4	Setback distance from surface water is defined as the areal edge of the land application system to the edge of the water. Where land application areas are planned in a water supply catchment, advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist. Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
5	Highly permeable stony soils and gravel aquifers potentially allow microorganisms to be readily transported up to hundreds of metres down the gradient of an on-site system (see R3, Table 1 in Pang et al. 2005). Maximum setback distances are recommended where site constraints are identified at the high scale for items A, C, and H. For reading and guidance on setback distances in highly permeable soils and coarse-grained aquifers see R3. As microbial removal is not linear with distance, data extrapolation of experiments should not be relied upon unless the data has been verified in the field. Advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist.
6	Setback distances from water supply bores should be reviewed on a case-by-case basis. Distances can depend on many factors including soil type, rainfall, depth and casing of bore, direction of groundwater flow, type of microorganisms, existing quality of receiving waters, and resource value of waters.
7	Where effluent is applied to the surface by covered drip or spray irrigation, the maximum value is recommended.
8	In the case of subsurface application of primary treated effluent by LPED irrigation, the upper value is recommended.
9	In the case of surface spray, the setback distances are based on a spray plume with a diameter not exceeding 2 m or a plume height not exceeding 0.5 m above finished surface level. The potential for aerosols being carried by the wind also needs to be taken into account.
10	It is recommended that land application of primary treated effluent be down gradient of in-ground water tanks.
11	When determining minimum distances from retaining walls, embankments, or cut slopes, the type of land application system, soil types, and soil layering should also be taken into account to avoid wastewater collecting in the subsoil drains or seepage through cuts and embankments. Where these situations occur setback clearances may need to be increased. In areas where slope stability is of concern, advice from a suitably qualified and experienced person may be required.
12	Groundwater setback distance (depth) assumes unsaturated flow and is defined as the vertical distance from the base of the land application systems to the highest seasonal water table level. To minimise potential for adverse impacts on groundwater quality, minimum setback distances should ensure unsaturated, aerobic conditions in the soil. These minimum depths will vary depending on the scale of site constraints identified in Table R2. Where groundwater setback is insufficient, the ground level can be raised by importing suitable topsoil and improving effluent treatment. The regulatory authority should make the final decision in this instance. (See also the guidance on soil depth and groundwater clearance in Tables K1 and K2.)

TABLE R2
SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES

(used as a guide in determining appropriate setback distances from ranges given in Table R1)

Item	Site/system feature	**Constraint scale** (see Note 1) LOWER ⟵⟶ HIGHER **Examples of constraint factors** (see Note 2)		Sensitive features
A	Microbial quality of effluent (see Note 3)	Effluent quality consistently producing ≤ 10 cfu/100 mL *E. coli* (secondary treated effluent with disinfection)	Effluent quality consistently producing ≥ 10^6 cfu/100 mL *E. coli* (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water (see Note 4)	Category 1 to 3 soils (see Note 5) no surface water down gradient within > 100 m, low rainfall area	Category 4 to 6 soils, permanent surface water <50 m down gradient, high rainfall area, high resource/environmental value (see Note 6)	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 and 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0 – 6% (surface effluent application) 0 – 10% (subsurface effluent application)	> 10% (surface effluent application), > 30% subsurface effluent application	Off-site export of effluent, erosion
E	Position of land application area in landscape (see Note 6).	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, highly porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes, and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

NOTES:

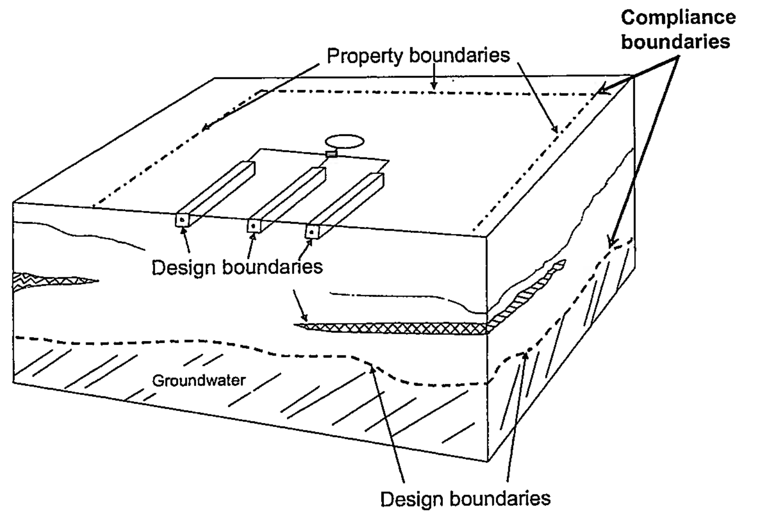
1 Scale shows the level of constraint to siting an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.

2 Examples of typical siting constraint factors that may be identified either by SSE evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.

Table R2 continued on next page ➤

TABLE R2
SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES
(used as a guide in determining appropriate setback distances from ranges given in Table R1) (continued)

3	The level of microbial removal for any on-site treatment system needs to be determined and it should be assumed that unless disinfection is reliably used then the microbial concentrations will be similar to primary treatment. Low risk microbial quality value is based on the values given in ARC (2004), ANZECC and ARMCANZ (2000), and EPA Victoria *(Guidelines for environmental management: Use of reclaimed water* 2003).
4	Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
5	The soil categories 1 to 6 are described in Table 5.1. Surface water or groundwater that has high resource value may include potable (human or animal) water supplies, bores, wells, and water used for recreational purposes. Surface water or groundwater of high environmental value include undisturbed or slightly disturbed aquatic ecosystems as described in ANZECC and ARMCANZ (2000).
6	The regulatory authority may reduce or increase setback distances at their discretion based on the distances of the land application up or downgradient of sensitive receptors.



(Adapted from USEPA 2002)

FIGURE R1 EXAMPLE OF DESIGN AND COMPLIANCE BOUNDARIES FOR APPLICATION OF SETBACK DISTANCES FOR A SOIL ABSORPTION SYSTEM