INFILTRATION SYSTEMS:
TECHNICAL STANDARD 3.9:

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

Scottish Borders COUNCIL

Scottish Borders COUNCIL

Building Standards (Scotland)Regulations ENVIRONMENT 2004

January 2011

INFILTRATION SYSTEMS:

MANDATORY STANDARD 3.9

Building Standards
SCOTTISH BORDERS COUNCIL

INFILTRATION SYSTEMS:
TECHNICAL STANDARD 3.9:

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

The assessment of the ground conditions and the testing for porosity should be carried out by a competent person for example an architect, building surveyor, civil engineer or contractor. All competent persons must hold professional indemnity insurance for this type of work.

Assessing the suitability of the ground for an Infiltration system.

An infiltration system serving a private *wastewater* treatment plant, septic tank or for *greywater* should be *constructed* in ground suitable for the treatment and dispersion of the *wastewater* discharged. This can be achieved by following the guidance below.

A ground assessment and soil percolation test should be carried out to determine the suitability of the ground. The following three step procedure should be followed:

1. Ground Assessment

Carry out a preliminary ground assessment. The following check list indicates the actions that should be taken and the type of information that should be collected:

- Consult SEPA, verifier and the Environmental Health Officer as required;
- Consult SEPA's latest groundwater protection policy;
- Identification of the underlying geology and aquifers;
- Whether the ground is liable to flooding;
- Nature of the sub-soil and groundwater vulnerability;
- Implication of plot size;
- Proximity of underground services;
- Ground topography and local drainage patterns; **The infiltration system should be laid on relatively level ground to avoid possible outcropping through a slope .The system should also be kept far enough away from retaining walls to avoid the possibility of effluent leaking through the wall.**
- Whether water is abstracted for drinking, used in food processing or farm dairies;
- Implication for, and of, trees and other vegetation;
- Location of *surface waters* and terrestrial ecosystems.

The preliminary assessment may indicate that the ground is unsuitable for the installation of an infiltration system, in which case an alternative disposal method should be considered. If in doubt about the suitability of the site please contact the Building Standards Surveyor for that area.

2. Trial Holes. (See Diagram 1)

A trial hole should be dug to determine the position of the water table and soil conditions. This trial hole will enable the sub-soil type to be determined. The trial hole should be a minimum of 2 m deep, or a minimum of 1.5 m below the invert of the proposed distribution pipes. The trial hole should be left covered for a period of 48 hours before measuring any water table level.

The trial hole must be inspected by a Building Standards Surveyor in order that the position, depth of any water table and ground conditions can be recorded.

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

Subsoils that overlay bedrock allow water to move through the pore spaces between the grains of material of which they are composed. They are the first line of defence against pollution and act as a protecting filtering layer. Where these materials are unsaturated, pollution attenuation processes are often enhanced. Water flows through much of Scotland's bedrock via fissures. Attenuation of contaminants is limited in these cases. For safe and effective dispersal of the *wastewater*, the groundwater and bedrock should be at least 1 m below the bottom of the distribution pipes. It should also be noted that it is the seasonally highest level of the water table that should be determined for the infiltration area

3. Percolation Tests.

To determine the type of infiltration system and the area of ground required, percolation tests should be carried out. These percolation tests should be carried out using either of the following methods:

- Expert examination of the soil distribution analysis, using the method described in BS 1377: Part 2: 1990; or

- Expert in-situ testing using either the Constant Head or Tube Permeameter as described in CEN/TR 12566–2–2005; or

- Excavate a **minimum** of two percolation holes, not less than 5 m apart along the line of and below the proposed invert level of the effluent distribution pipe. Each hole should be 300 mm square to a depth of 300mm. Where deep drains are necessary, the holes should conform to this shape at the bottom but may be enlarged above the 300 mm level to facilitate safe excavation. Fill the 300 mm square section of the holes to a depth of at least 300 mm with water and allow them to seep away overnight. It is important to saturate the soil surrounding the test holes to simulate day to day conditions in an operational drainage field. Next day, refill the test sections of the percolation holes with water to a depth of at least 300 mm and observe the time (t) in seconds, for the water to seep away from 75% to 25% full level. Divide this time by 150 mm. The answer gives the average time in seconds (Vp) required for the water to drop 1mm. Take care when making the tests to avoid unusual weather conditions such as heavy rain, severe frost or drought. **To obtain consistent results carry out the test at least 3 times for each percolation hole and take the average figure.** The floor area of a sub-surface drainage trench required to disperse effluent from ***treatment plants or septic tanks*** may be calculated from the following formula:
  A= P x Vp x 0.25

  A is the area of the sub-surface drainage trench, in m^2, P is the number of persons served by the tank; and Vp is the percolation value obtained, as described above, in secs/mm. For *wastewater* that has received the benefit of secondary treatment followed by settlement, this area may be reduced by 20%, i.e.
  A = P x Vp x 0.2 (See Diagram 2)

To determine the length of the soakaway trench divide the area required by the width of the trench which should be between 300mm and 900mm with 2.0m of undisturbed ground between trenches

The percolation test results should be recorded on the pro forma sheet attached to these guidance notes and this should be sent to the Building Standards Surveyor. (See Diagram 3)

INFILTRATION SYSTEMS:
TECHNICAL STANDARD 3.9:

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

Location of Infiltration Fields – Pollution

An infiltration system serving a private *wastewater* treatment plant or septic tank should be located to minimise the risk of pollution. An infiltration field should be located in accordance with the following guidance:

- **At least 50 m** from any spring, well or borehole used as a drinking water supply; and
- **At least 10 m** horizontally from any watercourse (including any inland or coastal waters), permeable drain, road or railway.

Location of Infiltration Fields – Damage to Buildings

Research has shown that there are no health issues that dictate a safe location of an infiltration field relative to a *building*. However damage to the *foundations* of a *building* is likely to occur where discharge is too close to the *building*. It is sensible to ensure that any water bearing strata directs any effluent away from the *building*. To prevent any such damage therefore, every part of an infiltration system serving a private *wastewater* treatment plant or septic tank should be located **at least 5 m** from a *building*. An infiltration system should also be located **at least 5 m** from a *boundary* in order that an adjoining plot is not inhibited from its full development potential.

However the ground strata or permeability of the soil may influence this dimension and it may be reduced slightly where the strata direct any groundwater away from the *foundations* or if the soil is free draining. Indeed, to preserve the structural integrity of the *building*, it may be prudent to increase the dimension where ground conditions would allow *wastewater* to collect around the *building's foundations*.

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

Step 1: Trial Holes:

1. A trial hole should be dug in the vicinity of the proposed infiltration system to determine the position of the water table and soil conditions.

2. The trial hole should be a minimum of 2 metres deep or a minimum of 1.5 metres below the invert of the proposed distribution pipes. The trial hole should be left covered for a period of 48 hours before measuring any water table level.

3. The ground water below the infiltration system must be at least 1 metre below the bottom of the distribution pipes. It should be noted that it is the seasonally highest level of water table that should be determined for the infiltration area - see diagram 1.

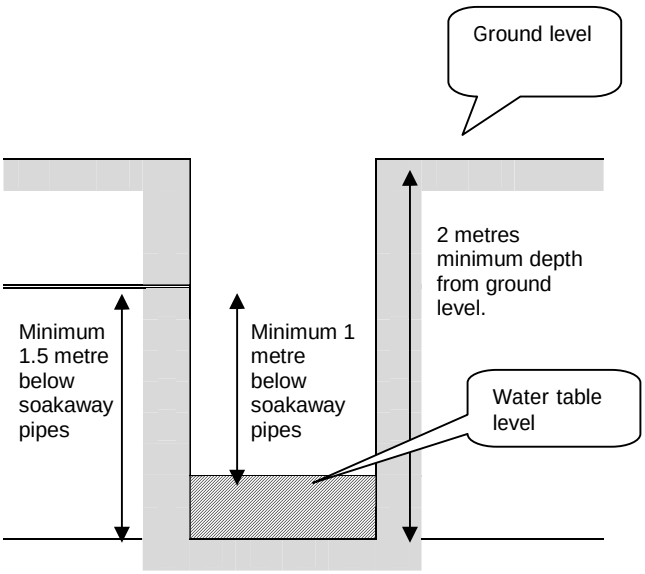


Diagram 1.

Step 2: Arrangements for porosity test:

1. Fill the 300 x 300mm section of the hole to a depth of at least 300mm with water and allow it to seep away overnight. It is important to saturate the soil surrounding the test hole to simulate day-to-day conditions in an operational drainage field.

2. Next day re-fill the test section with water to a depth of at least 300mm and observe the time (t) in seconds, for the water to seep away from 75% to 25% full level. Record the results in the enclosed table shown on page 3.

3. Divide this time by 150 mm, the answer gives average time in seconds (Vp) required for the water to drop 1 mm.

4. Carry out the test at least 3 times on each hole and take the average figure from the results.

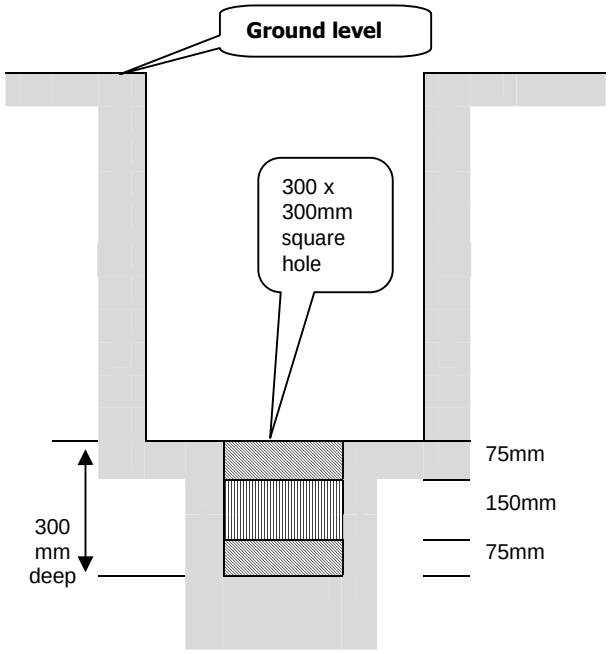


Diagram 2.

The floor area of a sub-surface drainage trench required to disperse effluent from septic tanks may be calculated from:-

A = P x Vp x 0.25

Vp is the percolation value obtained described above in seconds per mm.
P is the number of occupants served by the septic tank.

For:-
- *wastewater* that has received secondary treatment followed by settlement, or
- for *grey water*

This area may be reduced by 20% [i.e. A = P x Vp x 0.25 x 0.80].

INFILTRATION SYSTEMS:
TECHNICAL STANDARD 3.9:

PROCEDURE FOR ASSESSING GROUND CONDITIONS BY PERCOLATION TEST

Diagram 3

SITE ADDRESS: **REFERENCE No:**

Water Table level at time of test:
(Metres below Ground Level):

TEST	HOLE	TIME (SECONDS)	WATER DEPTH	Vp TIME (SECONDS) DEPTH(mm)
1	A			
	B			
	C			
Weather Conditions				
2	A			
	B			
	C			
Weather Conditions				
3	A			
	B			
	C			
Weather Conditions				
			AVERAGE Vp: (must not exceed 140)	

NB: In any event, a minimum length of soakaway drain of 30 metres, regardless of the calculation, is recommended.

COMMENTS:

I confirm that the Porosity Test have been carried out in accordance with the guidance in Mandatory Standard 3.9 of the Technical Handbook.

Signed: Date:

Name & Address (print):

E-mail:
Telephone No:

PERCOLATION TEST CALCULATIONS:

The area of the soakaway may be calculated from the formula: -

A = p x Vp x 0.25m sq.
where

A is the area of trench required to effectively deal with the quantity of effluent.

Vp is the percolation value calculated from dividing the time taken to soakaway (in seconds) by the depth of the test hole (in millimetres).

P is the total expected number of people likely to use the property.

Since a total of 9 tests are taken when three holes are tested, the average Vp value is used in the calculation (AVp) This is worked out by dividing the total Vp figure by 9.

An infiltration system serving a private *wastewater* treatment plant or septic tank should be designed and *constructed* to suit the conditions as determined by the ground into which the treated *wastewater* is discharged. An infiltration system should be designed and *constructed* in accordance with the following guidance:
Fast percolation rates - Where the percolation value (as demonstrated by the percolation test) is not more than 15 secs/mm, in accordance with the requirements of SEPA;

Normal percolation rates - Where the percolation value (as demonstrated by the percolation test) is more than 15 secs/mm and not more than 100 secs/mm, as:

a. a piped infiltration trench system in accordance with national annex NA of BS EN 752: 2008, using perforated, rigid pipes with a smooth internal surface; or
b. a piped infiltration bed system in accordance with the diagram below; or
c. any system described under ‘slow and very slow percolation rates’.

Slow percolation rates - Where the percolation value (as demonstrated by the percolation test) is more than 100 secs/mm and not more than 140 secs/mm, as:

a. a reed bed complying with the requirements of the BRE, Good Building Guide, GBG 42, Parts 1 and 2 together with a piped infiltration system described in Sub-clauses a and b with a normal percolation rate, or a suitable outfall; or
b. a *constructed* wetland, other than a reed bed, to a professionally prepared design and *constructed* by specialist contractor(s); or
c. a proprietary filtration system designed, *constructed* and installed in accordance with the conditions of a *notified body*; or
d. any other equivalent filtration system designed by a specialist in this subject and *constructed* by specialist contractor(s).

Having calculated the area of the trench the length of trench may be calculated by dividing the area of soakaway required by the width of trench proposed.

NB: In any event, a minimum length of soakaway drain of 30 metres, regardless of the calculation, is recommended.

INFILTRATION SYSTEMS:
TECHNICAL STANDARD 3.9:

Scottish Borders COUNCIL

PROCEDURE FOR ASSESSING SOAKAWAY REQUIREMENTS FROM PERCOLATION TEST

X Minutes			30	45	60	75	90	105	120	135	150	165	180	195	210	225	240
Y Seconds			1800	2700	3600	4500	5400	6300	7200	8100	9000	9900	10800	11700	12600	13500	14400
Vp time divided by 150 (mm)			12.0	18.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0	66.0	72.0	78.0	84.0	90.0	96.0
4 person	Septic Tank Size 2720 L	M^2	*12.0*	18.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0	66.0	72.0	78.0	84.0	90.0	96.0
		M	*20.0*	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0	150.0	160.0
5p	2900 L	M^2	*15.0*	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0	82.5	90.0	97.5	105.0	112.5	120.0
		M	*25.0*	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
6p	3080 L	M^2	18.0	27.0	36.0	45.0	54.0	63.0	72.0	81.0	90.0	99.0	108.0	117.0	126.0	135.0	144.0
		M	30.0	45.0	60.0	75.0	90.0	105.0	120.0	135.0	150.0	165.0	180.0	195.0	210.0	225.0	240.0
7p	3260 L	M^2	21.0	31.5	42.0	52.5	63.0	73.5	84.0	94.5	105.0	115.5	126.0	136.5	147.0	157.5	168.0
		M	35.0	52.5	70.0	87.5	105.0	122.5	140.0	157.5	175.0	192.5	210.0	227.5	245.0	262.5	280.0
8p	3440 L	M^2	24.0	36.0	48.0	60.0	72.0	84.0	96.0	108.0	120.0	132.0	144.0	156.0	168.0	180.0	192.0
		M	40.0	60.0	80.0	100.0	120.0	140.0	160.0	180.0	200.0	220.0	240.0	260.0	280.0	300.0	320.0
9p	3620 L	M^2	27.0	40.5	54.0	67.5	81.0	94.5	108.0	121.5	135.0	148.5	162.0	175.5	189.0	202.5	216.0
		M	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0	247.5	270.0	292.5	315.0	337.5	360.0
10p	3800 L	M^2	30.0	45.0	60.0	75.0	90.0	105.0	120.0	135.0	150.0	165.0	180.0	195.0	210.0	225.0	240.0
		M	50.0	75.0	100.0	125.0	150.0	175.0	200.0	225.0	250.0	275.0	300.0	325.0	350.0	375.0	400.0

X = Average soakaway time in minutes Y = Average soakaway time in seconds Vp = Y divided by 150 (i.e. time to soakaway 1mm)

M^2 = area of trench bottom M = length of trench at 600mm width

NB Recommended minimum of 30m of 600mm wide trench

INFILTRATION SYSTEMS:

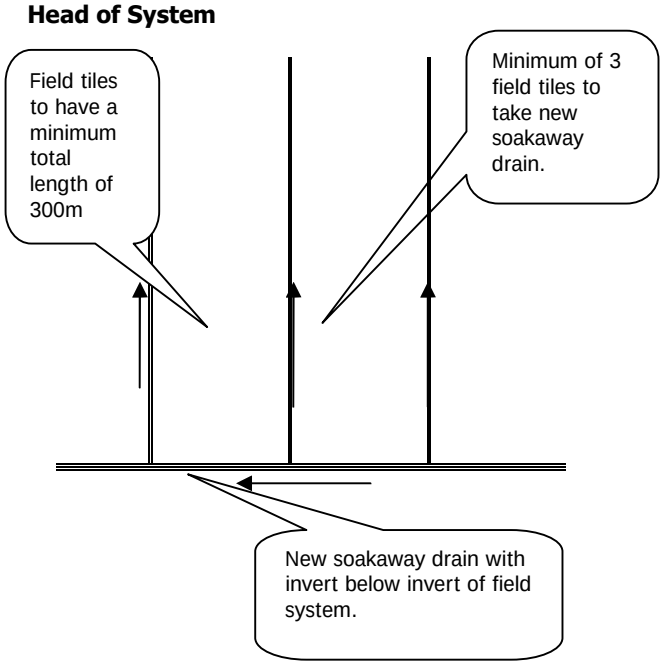
POLICY FOR THE DISCHARGE OF TREATED EFFLUENT TO AN INFILTRATION SYSTEM (AT HEAD OF FIELD DRAINAGE SYSTEM)

Mandatory Standard 3.9 is intended to ensure that wastewater from a building is carried to a suitable point of disposal. Where wastewater treatment is by a septic tank or mini sewage treatment plant it may be possible to discharge the treated effluent to an existing field drainage system and the following guidelines explain how this should be done.

Step 1: Assessment of Filed Drainage system:

- Arrange to have 3 runs of the existing field tiles exposed for inspection by Building Control Staff, please note that normally a minimum length of 300m of field tile is required by SEPA.
- Check that the field tiles are functioning, record their position and direction and ensure that they are falling away from the point of discharge.
- Building Standards will inform the applicant if the field tiles are acceptable for use or not, if they are then the applicant should consult SEPA to request consent to discharge to the tiles. SEPA will require an ordnance survey plan showing the position and direction of flow of the tiles and the point of discharge. Building Control will check with SEPA that they are satisfied with the proposal before approving a building warrant.

Arrangement of Field Tiles – Connection at Head of System

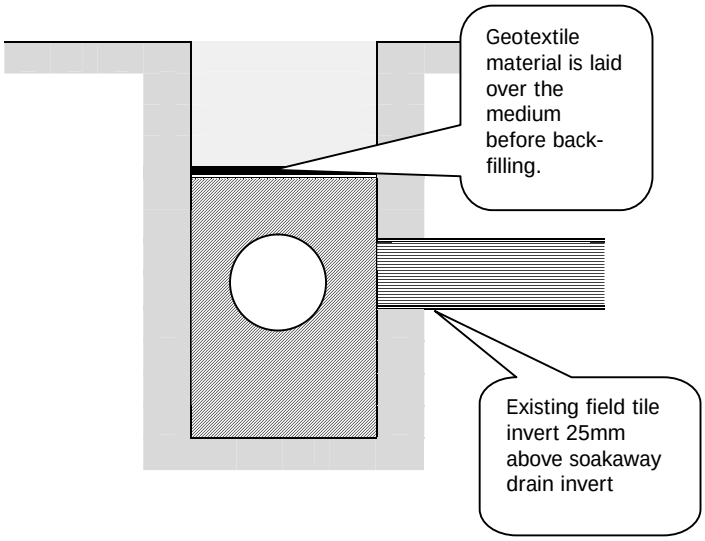


Step 2: Connection Details – at Head of System

The method of connecting into the head of an existing field tiles/drains system should be as indicated here:-

- A 100 mm diameter smooth bored perforated pipe should be laid across the three field tiles as in a soakaway system, i.e. on 150 mm of broken stone, gravel (8 mm up to 32 mm) which should cover the pipe by 50 mm. Geotextile material is laid over the medium before back-filling.
- The invert level of the soakaway drain should be below the existing field tile invert so that when the ground conditions permit the effluent will soakaway to ground and when the water table rises the effluent will overflow into the field drainage system.

Cross Section through Soakaway Drain



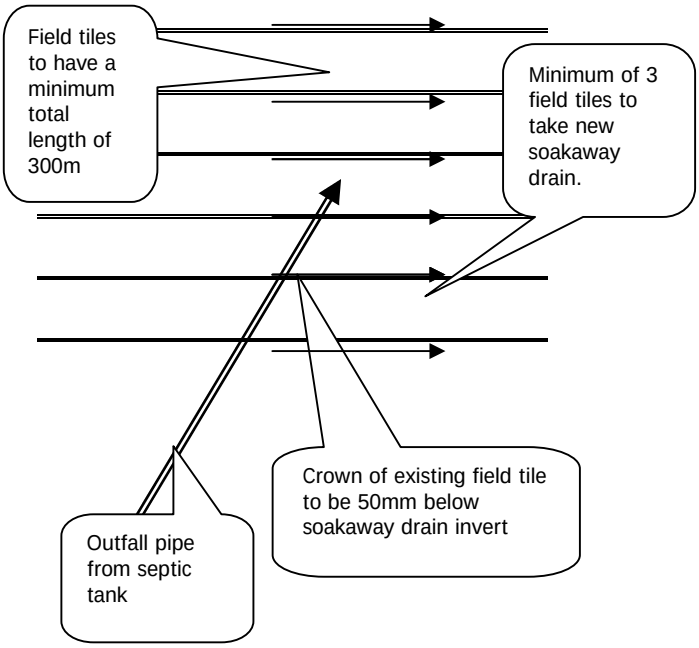
INFILTRATION SYSTEMS:

POLICY FOR THE DISCHARGE OF TREATED EFFLUENT TO AN INFILTRATION SYSTEM (ACROSS FIELD DRAINAGE SYSTEM)

Step 1: Assessment of Filed Drainage system:

- Arrange to have 3 runs of the existing field tiles exposed for inspection by Building Standards Staff, please note that normally a minimum length of 300m of field tile is required by SEPA.
- Check that the field tiles are functioning, record their position and direction and ensure that they are falling away from the point of discharge.
- Building Standards will inform the applicant if the field tiles are acceptable for use or not. If they are the applicant should consult SEPA to request consent to discharge to the tiles. SEPA will require an ordnance survey plan showing the position and direction of flow of the tiles and the point of discharge. Building Standards will check with SEPA that they are satisfied with the proposal before approving a building warrant.

Arrangement of Field Tiles – Connection across Field Drainage System

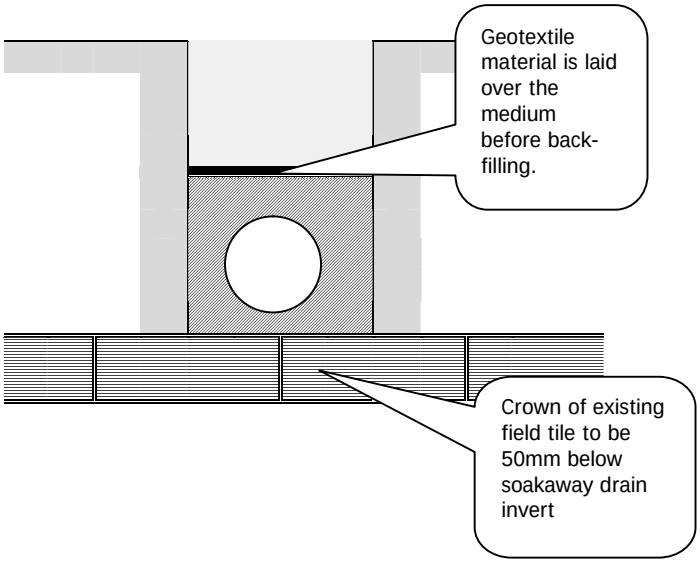


Step 2: Connection Details – across Field Drainage System

The method of connecting into the head of an existing field tiles/drains system should be as indicated here:-

- A 100 mm diameter smooth bored perforated pipe should be laid across the three field tiles as in a soakaway system, i.e. on 150 mm of broken stone, gravel (8 mm up to 32 mm) which should cover the pipe by 50 mm. Geotextile material is laid over the medium before back-filling.
- The invert level of the soakaway drain should be above the existing field tile system with at least 50mm between the crown of the field tile and the soakaway drain invert.

Cross Section through Soakaway Drain



INFILTRATION SYSTEMS:

POLICY FOR THE DISCHARGE OF TREATED EFFLUENT TO AN INFILTRATION SYSTEM (LOCATION RESTRICTIONS)

Mandatory Standard 3.9 is intended to ensure that wastewater from a building is carried to a suitable point of disposal. One method of complying with the requirement is to treat the wastewater with a septic tank or mini sewage treatment plant discharging to an infiltration system (soakaway). Before an infiltration system can be considered the area of ground has to be checked for its suitability and the guidelines below should be followed.

Step 1: Assessment of Plants and Vegetation:

1. Note the type of plants/vegetation growing on the site; they can often be a good indication of the ground conditions.

2. Plants which indicate good drainage conditions throughout the year include bracken, daisy, ragwort, creeping thistle, bluebell, dandelion, wild carrot, cowslip and poppy. Plants which indicate poor drainage conditions throughout the year include soft rush, meadowsweet, marsh thistle, creeping buttercup, jointed rush, marsh ragwort.

Step 2: Assessment of Site Slope and Gradient:

1. Note the gradient of the ground, infiltration systems should not be positioned on steeply sloping sites; they may be positioned on gentle slopes provided they are laid following the contour lines.

2. Infiltration systems should be a minimum of 15 m away from the start of any steeply sloping ground, please consult Building Standards if further clarification is required

3. Infiltration systems should not be sited adjacent to contaminated land as there is a risk that contaminants may be flushed out. Infiltration systems should be sited sufficiently far away from any other soakaway systems so that the overall soakage capacity of the ground is not exceeded. No access road, driveways or paved areas should be located within the disposal area.

Step 3: Risks to Water Supplies / Courses and Distance to Buildings, Boundaries, Roads and Railways.

The infiltration system should be:-

1. At least 50 m away from any spring, well or borehole used as a drinking water supply.

2. At least 10 m horizontally from any water course, permeable drain, road or railway.

3. At least 5 m from a building or boundary.

The local Environmental Health Officer and SEPA should be consulted if there are any concerns regarding potential pollution/contamination.