Percolation Tests (Falling Head)

At least one percolation test will normally be required for every soakage device that is constructed.

Boreholes/Test Pits must be deep enough and in the correct location. The ability of the ground to accept stormwater can vary enormously within soakage areas, even within individual properties. Because of this, at least one percolation test will normally be required for every soakage device that is constructed.

If drilling is impossible, then percolation tests can be carried out in test pits.

➢ Boreholes/Test Pits

Percolation tests are normally carried out in boreholes. These may be bores drilled in rock using a drilling rig or bores drilled in soil using a hand auger or post hole auger. If drilling is impossible due to ground conditions, then percolation tests can be carried out in test pits. Boreholes and test pits should be constructed according to the following guidelines:

1. Boreholes of 100 mm to 150 mm diameter should be bored to at least 1 m below the bottom of the intended soakage device.

2. Hint: the source water volume needs to be higher than the bore hole capacity. For example, if the bore diameter is 150mm and depth is 1m then the bore will hold = 0.018 m^3 or 18 liters of water. So more than 18 liters of water is needed to perform the test.

3. Drilling should be continued until the permeable layer is reached where the soil is silty or has gravel in it. The borehole/test pit base should be below, passing the clay layer to achieve effective drainage.

4. Testpits should only be constructed if drilling is not possible. The pits should be excavated to the level of the proposed soakage device, have a minimum base area of 1 m^2 and be laid back at a suitable angle to prevent caving-in and erosion during the test.

5. Boreholes and test pits should be logged (that is, geological layers and soil types should be recorded).
6. It is advisable to perform the test during wintertime when the ground water level is high.

7. Water-table levels should be recorded at the time of excavation (if observed). If the fieldwork is carried out between October and May (spring – autumn), winter water table levels should be estimated at 1.0 m higher than observed water table levels.

8. The locations of boreholes and test pits should correspond with the position of the proposed soakage devices.

➢ Preparation of Boreholes/Test Pits for Percolation Tests

1. Ground conditions must emulate winter conditions.

2. Boreholes in soil should be prepared for testing by carefully scratching the sides with a sharp-pointed tool to remove any smeared soil surfaces and to provide a natural soil interface through which water may infiltrate.

3. All loose materials should be removed from the hole.

4. If collapse of a drilled borehole seems likely, a PVC pipe should be inserted into the hole to prevent collapse. If scouring of a test pit seems likely, about 50 mm of sand or fine gravel should be added to the pit to protect the bottom from scouring or sediment blinding.

5. Holes in soil areas must be thoroughly pre-soaked to emulate winter conditions. In spring, summer or autumn (October to May), holes must be kept full for a minimum of 17 hours prior to testing. This will normally provide adequate time for the soils surrounding the hole to become saturated. During wet winter conditions, holes must be kept full for a minimum of 4 hours.

6. Holes in rock areas must be pre-soaked to ensure that any cavities in the rock are filled before testing begins. The hydrant must be open at a high flow rate for a minimum of 10 minutes before testing begins.

➢ Falling-Head Percolation Tests

1. Falling-head tests are most suitable for soils of medium to low permeability.
2. Falling-head percolation tests determine the percolation rate of an area by filling a borehole with water and recording the rate at which it drains away. This test method is most suitable for use in soils with medium to low permeability.

3. Equipment required to carry out a falling head test includes a suitable water supply, tape measure or water dipper, stopwatch, a copy of WORKSHEET 1 and pen for recording information. A torch may also be useful.

To carry out a falling head percolation test on a borehole:

4. Thoroughly pre-soak the hole. Holes in soil areas must be thoroughly pre-soaked to emulate winter conditions. In spring, summer or autumn (October to May), holes must be kept full for a minimum of 17 hours prior to testing. This will normally provide adequate time for the soils surrounding the hole to become saturated. During wet winter conditions, holes must be kept full for a minimum of 4 hours.
5. Fill the hole to within 0.75 m of ground level and record the drop in water level against time at evenly spaced intervals of no greater than 30 minutes, until the water level is around 0.25 m from the base of the hole or 4 hours has passed. Where the hole drains quickly, the test should be repeated several times.

6. Graph the results according to the method on WORKSHEET 1 and derive the percolation rate in L/m2/min from the minimum slope of the curve.

WORKSHEET 1. FALLING-HEAD PERCOLATION TEST

W1

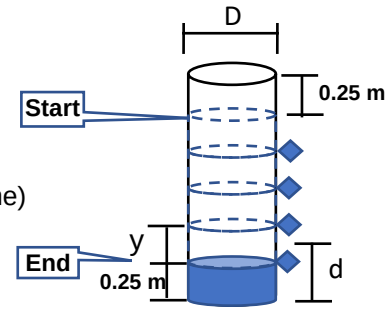
Site Address: _____ Completed by: _____

Date of test: _____Signature: _____

Attach the following:

- ☐ Log of hole showing depth and soil type
- ☐ Site-plan showing the location of the hole
- ☐ Graph of water level against time

(tick when attached)



Ensure the following procedures are followed:

- ☐ Hole is kept full for 17 hours prior to test (for pre-soaking during wintertime)
- ☐ Hole is kept full for 4 hours prior to test (for pre-soaking summertime)
- ☐ Drop in water level is recorded at intervals of 30 minutes or less
- ☐ Test is continued for 4 hours or until hole is empty
- ☐ Stop test or refill hole when water level is 0.25m above the base of the bore
- ☐ Percolation rate is determined from the minimum slope of the curve

(tick when complete)

(b) Water Depth(m)	Time (min)

Water Depth(m)	Time (min)

- d is the distance between the midpoint of the last two readings and the base of the borehole. d needs to be in free draining layer. If not, then wall area can be ignored.
- y is the depth difference between last two points.

Bore dimensions: (Circular Shape)

a) diameter = D =_____m

b) depth difference = y =_____m

c) midpoint distance from base = d =_____m

d) water volume = **0.785** x **D** x **D** x ***y*** = Vy

e) wall area A1= **3.142** x **D** x **d** A1

f) base area AB= **0.78** x **D** x **D** AB

g) Total area AT= **A1** + **AB** AT

or,

Pit dimensions: (Square Shape)

a) Length = L =_____m b) Width = W =_____m

c) depth difference = y =_____m

d) midpoint distance from base = d =_____m

e) water volume = **L** x **W** x **y** = Vy

f) wall area A1 = **2** x **W** x **d** = A1

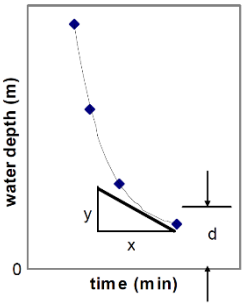
g) wall area A2 = **2** x **L** x **d** = A2

h) base area AB= **L** x **W** = AB

i) Total area AT= **A1**+ **A2**+**AB** = AT

- x is the time difference or interval between last two points in minutes.

Fill the box X with time difference between last two points. Divide Vy by AT and X to get percolation rate P.



Percolation rate = $\frac{\text{Vy X 1000}}{\text{AT} \times \text{X}}$ for "y" = P L/m^2/Min