

Guelph Permeameter Calculations

Investigator: _____

Date: _____

Location: _____

Test Id: _____

Reservoir Constant (A): _____

Steady flow rate: $Q_1 = A \times R_1/60$ _____ cm/sec $Q_2 = A \times R_2/60$: _____ cm/sec

Method 1: Use this first. Assumes 3 cm borehole, 5 and 10 cm heads

$$K_{fs} \text{ (cm/sec)} = A \times 10^{-5} (6.8R_2 - 9.0R_1) = \frac{\dots}{A} \times 10^{-5} \times (6.8 \frac{R_2}{\dots} - 9.0 \frac{R_1}{\dots}) = \frac{K_{fs}}{\dots} \text{ cm/sec}$$

$$f \text{ (cm}^2\text{/sec)} = A \times 10^{-4} (9.5R_1 - 3.9R_2) = \frac{\dots}{A} \times 10^{-4} \times (9.5 \frac{R_1}{\dots} - 3.9 \frac{R_2}{\dots}) = \frac{\phi}{\dots} \text{ cm}^2\text{/sec}$$

$$a = \frac{K_{fs}}{f} = \frac{\dots}{\dots} = \dots \text{ (1/cm)}$$

Dq = field saturated water content – ambient water content = _____ - _____ = _____

$$S \text{ (sorptivity)} = \sqrt{2\Delta q f} = \sqrt{2 \times \dots \times \dots} = \dots \text{ cm sec}^{-1/2}$$

Method 2 Use this if Method 1 gives negative K_{fs} . Estimate α^* and calculate for R_1 and R_2 .

Results for R_1

$$K_{fs} \text{ (cm/sec)} = \frac{CAR}{2pH^2 + Cpr^2 + \frac{2pH}{a^*}} = \frac{\dots \times \dots \times \dots}{2p \dots^2 + \dots p \dots^2 + \frac{2p}{\dots}} = \dots \text{ cm/sec}$$

$$f \text{ (cm}^2\text{/sec)} = \frac{K_{fs}}{a^*} = \frac{\dots}{\dots} = \dots \text{ cm}^2\text{/sec}$$

Results for R_2

$$K_{fs} \text{ (cm/sec)} = \frac{CAR}{2pH^2 + Cpr^2 + \frac{2pH}{a^*}} = \frac{\dots \times \dots \times \dots}{2p \dots^2 + \dots p \dots^2 + \frac{2p}{\dots}} = \dots \text{ cm/sec}$$

$$f \text{ (cm}^2\text{/sec)} = \frac{K_{fs}}{a^*} = \frac{\dots}{\dots} = \dots \text{ cm}^2\text{/sec}$$

- C: dimensionless shape factor from graph on following page
- A: Reservoir constant
- R: Steady state rate of fall
- H: Steady depth of water in boring
- r: radius of well
- a*:
 - 0.01 compacted structureless, clayey materials —landfill cap, lacustrine, marine clays
 - 0.04 fine-grained, unstructured clay
 - 0.12 structure soil, clays through loams, unstructured medium to fine sand
 - 0.36 coarse-grained sand and gravel, highly structured soil with large cracks

Guelph Permeameter Calculations, General Case

Investigator: _____

Date: _____

Location: _____

Test Id: _____

Reservoir constant:

A: _____

Radius of borehole :

r: _____

Water depth in borehole during first test

H₁: _____

Water depth in borehole during second test

H₂: _____

Shape factor for H₁/r (obtain from graph)

C₁: _____

Shape factor for H₂/r (obtain from graph)

C₂: _____

Steady flow rate: $Q_1 = A \times R_1/60$ _____ cm/sec $Q_2 = A \times R_2/60$: _____ cm/sec

Hydraulic Conductivity

$$G_2 = \frac{H_1 C_2}{p(2H_1 H_2 (H_2 - H_1) + r^2 (H_1 C_2 - H_2 C_1))} = \frac{\dots \times \dots}{p(2 \dots \times \dots (\dots - \dots) + \dots^2 (\dots \times \dots - \dots \times \dots))} = \dots$$

$$G_1 = G_2 \frac{H_2 C_1}{H_1 C_2} = \dots \frac{\dots \times \dots}{\dots \times \dots} = \dots$$

$$K_{fs} \text{ (cm/sec)} = G_2 Q_2 - G_1 Q_1 = \dots \times \dots - \dots \times \dots = \dots \text{ cm/sec}$$

Matrix Flux Potential

$$J_1 = \frac{(2H_2^2 + r^2 C_2) C_1}{2p(2H_1 H_2 (H_2 - H_1) + r^2 (H_1 C_2 - H_2 C_1))} = \frac{(2 \dots^2 + \dots^2 \times \dots) \times \dots}{2p(2 \dots \times \dots (\dots - \dots) + \dots^2 \times (\dots \times \dots - \dots \times \dots))} = \dots$$

$$J_2 = J_1 \frac{(2H_1^2 + r^2 C_1) C_2}{(2H_2^2 + r^2 C_2) C_1}$$

$$f \text{ (cm}^2\text{/sec)} = J_1 Q_1 - J_2 Q_2 = \dots \times \dots - \dots \times \dots = \dots \text{ cm}^2\text{/sec}$$

Use this sheet when borehole differs from 3 cm, H₁ differs from 5 cm or H₂ differs from 10 cm