# 2800K1 Guelph Permeameter

The Guelph Permeameter is an easy to use instrument to quickly and accurately measure in-situ hydraulic conductivity. Accurate evaluation of soil hydraulic conductivity, soil sorptivity, and matrix flux potential can be made in all types of soils. The equipment can be transported, assembled, and operated easily by one person. Measurements can be made in 1/2 to 2 hours, depending on soil type, and require only about 2.5 litres of water.

Measurements can be made in the range of 15 to 75 cm below the soil surface. The Guelph Permeameter comes as a complete Kit consisting of the permeameter, field tripod, borehole auger, borehole preparation and cleanup tools, collapsible water container, and vacuum test hand pump, all in a durable carrying case. Accessory attachments are available to extend the measurement capability of the permeameter. Depth attachments increase the depth of operation by 80 cm. The maximum practical operating depth is 315 cm. Ring attachments allow ring infiltrometers measurements with 10 cm and 20 cm diameter rings. A tension adapter allows measurements to be made under tensional and very low tension (negative head) conditions.

## THEORY OF OPERATION

The Guelph Permeameter is an in-hole Constant-Head Permeameter, employing the Marriotte Principle. The method involves measuring the steady-state rate of water recharge into unsaturated soil from a cylindrical well hole, in which a constant depth (head) of water is maintained.

A constant head level in the well hole is established and maintained at the level of the bottom of the air tube by regulating the position of the bottom of the Air Tube, which is located in the centre of the Permeameter. As the water level in the reservoir falls, a vacuum is created in the air space above the water. The vacuum can only be relieved when air of ambient atmosphere pressure, which enters at the top of the Air Tube, bubbles out of the Air Inlet Tip and rises to the top of the reservoir. Whenever the water level in the well begins to drop below the Air Inlet Tip, air bubbles emerge from the tip and rise into the reservoir air space. The vacuum is then partially relieved and water from the reservoir replenishes water in the well. The size of opening and geometry of the Air Inlet Tip is designed to control the size of air bubbles in order to prevent the well water level from fluctuating.

When a constant well height of water is established in a bored hole in the soil, a "bulb" of saturated soil with specific dimensions is rather quickly established. This "bulb" is very stable and its shape depends on the type of soil, the radius of the well and head of water in the well. The shape of the "bulb" is included in the value of the C factor (Reynolds et al., Groundwater Monitoring Review 6:1:84-95, 1986) used in the calculations.

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## Specifications

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| Auger Cutting Diameter: | 6.0 cm (2-3/8 inches) |
| Well Height Range: | 2.5 cm to 25 cm |
| Hydraulic Conductivity Range: | $10^{-4}$ to $10^{-7}$ m/sec ($10^{-2}$ to $10^{-5}$ cm/sec) |
| Collapsible Water container Capacity: | 11.36 litres (3.0 gallons) |
| Maximum Permeameter Capacity: | 3.18 litres (0.84 gallons) |
| Overall Carrying Case Size: | 132.08 cm (50 inches) long by 44.45 cm (17.5 inches) wide by 15.24 cm (6 inches) deep |
| Overall Carrying Case Weight: | 11 kg (25 lbs) |
| Depth Range, Standard Unit: | 15 to 75 cm (Note: with Extension Tubes, measuring depths can be increased) |
| Combined Reservoir cross-sectional area (X value): | 35.22 $cm^2$ (±0.18 $cm^2$ standard deviation) |
| Inner Reservoir cross-sectional area (Y value): | .16 $cm^2$ (±0.04 $cm^2$ standard deviation) |