armfield

GROUND WATER FLOW UNIT

S11
issue 6

This bench-mounting apparatus is capable of demonstrating, on a small scale, the hydrological principles of ground water flow and the applications of these to certain engineering constructions. The demonstrations are of interest to geologists and geographers concerned with sub-surface water flows.
The equipment is valuable in any practical coursework related to water resource engineering. Demonstrations of flood risks associated with land drainage works, the use of wells for water abstraction, de-watering and the drainage of lakes and polders are all readily performed.
The Armfield Ground Water Flow Unit allows simple three dimensional flow situations to be set up quickly and measurements of piezometric levels taken at appropriate positions within the model.

DEMONSTRATION CAPABILITIES

- *Hydraulic gradients in ground water flow, including the effect of permeability. (Fig. 1)*
- *Cone of depression for a single well in an unconfirmed aquifer. (Fig. 2)*
- *Abstraction from a single well in a confined aquifer. (Fig. 3)*
- *Cone of depression for two wells. (Fig. 4)*
- *De-watering of an excavation site using two wells. (Fig. 5)*
- *Draining of a polder or lake. (Fig. 6)*

In addition to the above demonstrations, for which the appropriate instructional information and accessories are supplied, instructors and students of engineering hydrology may readily construct further model situations for study.

Applied Hydraulics and Hydrology

DESCRIPTION

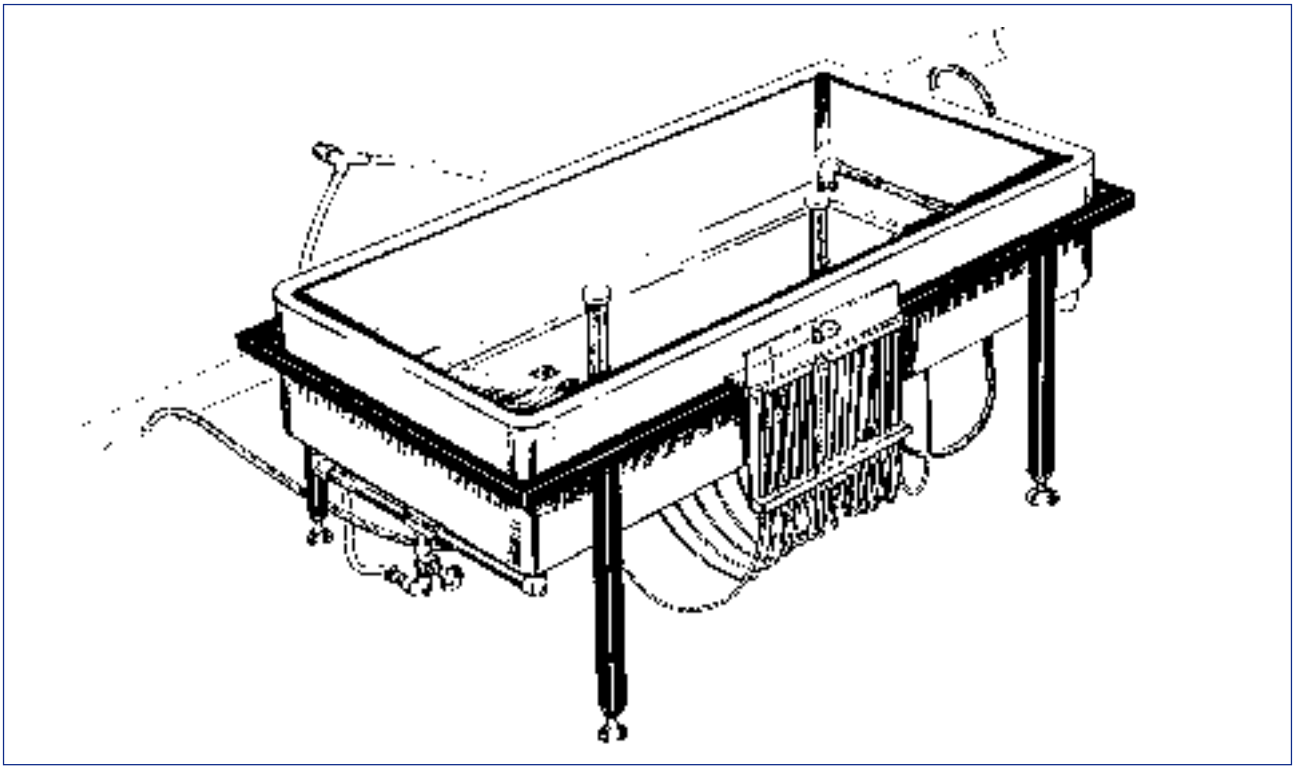
The sand tank is manufactured in glass reinforced plastic for durability in service and is located in a painted mild steel frame which is designed for standing on a laboratory bench.

A diffused water inlet/outlet with associated flow control valve is installed at each end of the sand tank. This facility allows the desired water table to be established for the various demonstrations of groundwater flow.

Two wells with control taps in the base of the tank allow studies of abstraction.

Nineteen tappings in the base of the tank arranged in a cruciform configuration are connected to a multi-tube piezometer on the side of the tank. These indicate the profile of the water table in the sand. A sliding cursor permits measurement of any level.

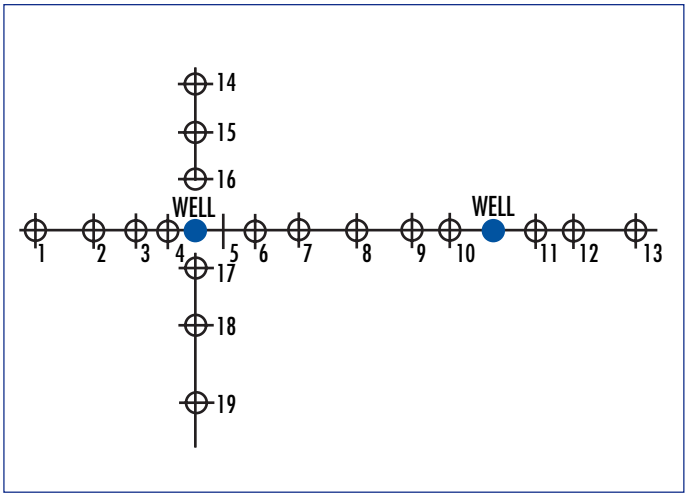
Appropriately sized cylindrical rings are provided as accessories for certain of the demonstrations described above



Groundwater Flow Demonstration Unit

TECHNICAL DETAILS

Tank:-	*Length:*	*990mm*
	Width:	*490mm*
	Depth:	*235mm*
Piezometer:-	*Range:*	*0 to 155mm*
	Calibrated:	*1mm intervals*



Piezometer Positions in Cruciform Arrangement

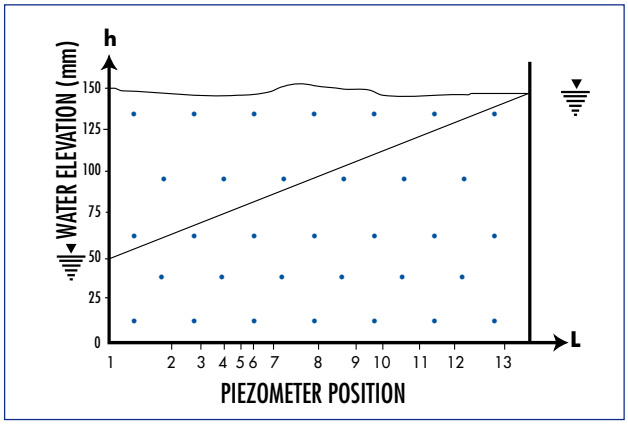


Fig. 1: Typical graph obtained for a hydraulic gradient

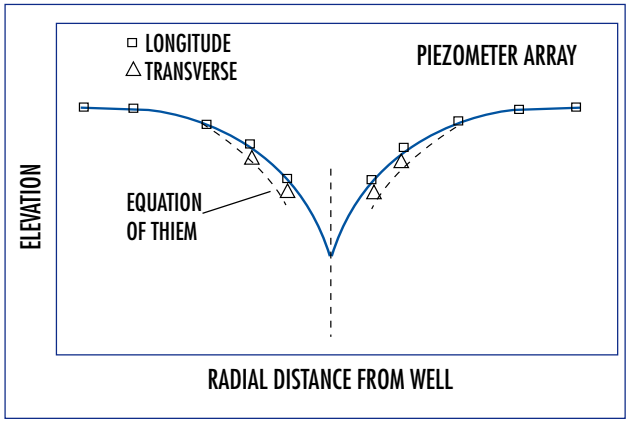


Fig. 2: Cone of depression for a single well in an unconfined aquifer

Hydraulic gradient (Darcy's Law) resulting from groundwater flow between two potentials can be demonstrated visually. Levels in the piezometer tubes are plotted to show a linear profile (fig.1).

Water flowing into a well creates a depression in the water table. The contour of the water table is plotted using the levels in the Piezometer tubes. Results obtained can be compared with Depuit's or Thiem's formulae (fig.2).

Fig.3 shows the construction of a single well in a confined aquifer with radial symmetry.

A profile of the water table can be obtained (fig.4) when using two wells simultaneously. It is possible to compare the result with theoretical results obtained for a single well using the method of superposition.

A rectangular ring is used to form the sides of an excavation below the level of the water table. Wells are used to lower the water table in the vicinity of the excavation. Thus the excavation is prevented from filling with water (fig.5).

A large rectangular ring is used to create a polder or lake. Water flowing into a ditch near the wall is drained via the two wells. The experiment differs from the de-watering of a site as drainage takes place from the floor of the polder. Fig.6 shows the construction.

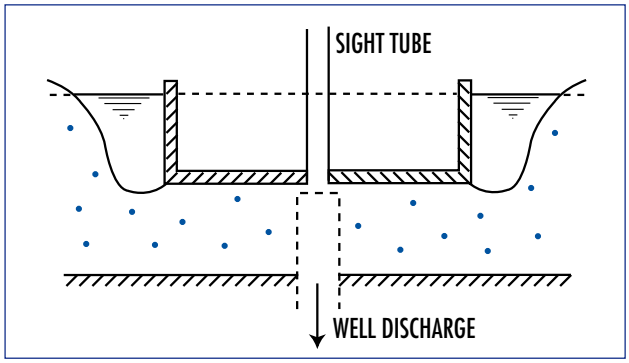


Fig. 3: Setting up a confined aquifer for a single well

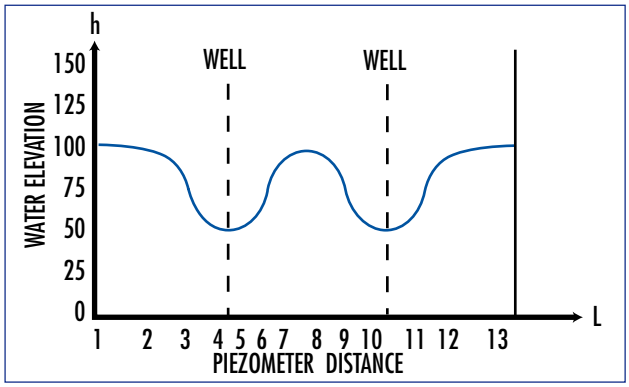


Fig. 5: De-watering an excavation site using two wells

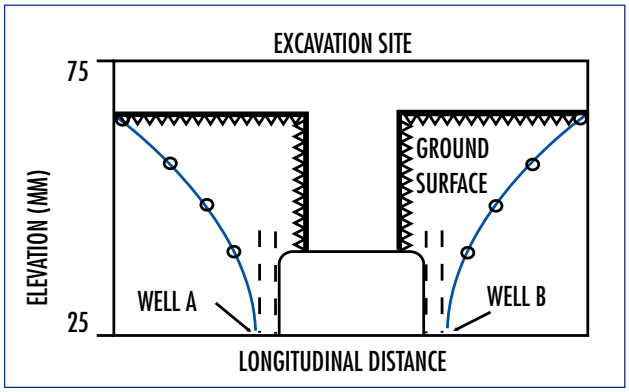


Fig. 4: Typical graph obtained from abstraction from two adjacent wells

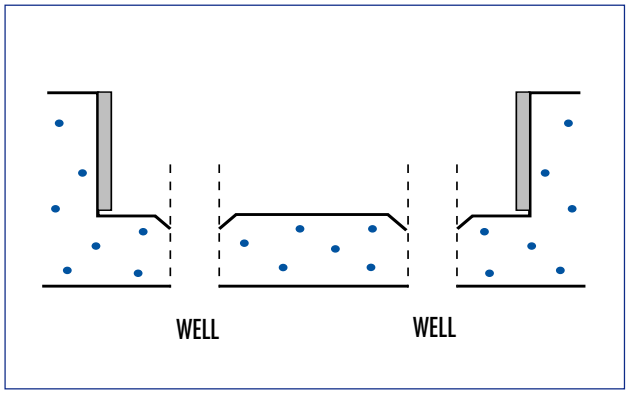


Fig. 6: Setting up a model of draining a lake or polder

ORDERING SPECIFICATION

- ***A bench-standing sand tank capable of demonstrating, on a small scale, the hydrological principles of ground water flow.***
- ***The unit allows simple three dimensional flow situations to be set up quickly and measurements of piezometric levels taken at appropriate positions within the model under study.***
- ***The accompanying instruction manual describes six basic demonstrations of importance in Engineering Hydrology.***

SERVICES REQUIRED

Hydraulics Bench (F1-10)
or cold water supply

Drain for cold water

0.1m³ of clean 0.6-2.0mm washed and graded coarse sand.

OVERALL DIMENSIONS

Length:	*1115mm*
Width:	*585mm*
Height:	*530mm*

SHIPPING SPECIFICATIONS

Volume:	*0.8m³*
Gross weight:	*100kg*

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