Experiment No. 9

“To study the water abstraction from a number of neighbouring wells”

Apparatus Name: Advanced Hydrological Apparatus

HYDROGEOLOGY LAB

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING

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Procedure:

This experiment is carried out using an unconfined aquifer with water inflow at both ends of the tank. The method of superposition applies only to small drawdown values, it is suggested that small Qo values should be used.

Draw the required flows from each well in turn, measuring the drawdown produced in each case with the manometers. Now establish the combined well flow (both wells at the same time) and measure the resulting water table drawdowns. It should be possible, according to the principle of superposition, to synthesize this combined water table pattern by adding the values obtained with each well flow independently. For this experiment the drawdown close to the well should not exceed 25% of the saturated thickness of the aquifer before drawdown.

It is also of interest to explore the drawdown due to much larger abstractions from these wells. Although the superposition principle will not apply, it is possible to determine the effect of a nearby abstraction on the cone of depression of another well and to relate the size of these interactions to the relative flows discharged by the wells.

1) Dewatering an Excavation Site:

A deep excavation for the purposes of foundation construction or other belowground activity will frequently penetrate below the natural rest level for the water table in that area. If the excavation is in permeable ground this will constitute an aquifer and the excavation will fill with water to the local water table level due to ground water flow.

One method of keeping such an excavation dry is to sink a ring of wells around the outside of the excavation site and to lower the water table locally by pumping the well system.

In this experiment, the small square open-ended ring is used to form the sides of the excavation by sinking it in the sand between the two well positions and removing the sand inside down to the lower level of the ring wall. If the sand in the catchment tank is now saturated by admitting water via the inlet control valves, the “excavation site” will fill with water. Now lower the water table by opening the well drain control valves until the excavation dries out. Plot a profile along the centreline of the tank showing the position of the water table (from the manometer readings) in relation to the wells and excavation cross-section

Normally, of course, more than two wells would be used and so in this case difficulty may be experienced in getting the bottom of the excavation site completely dry.

2) Draining a Polder or Lake:

This situation differs from the excavation dewatering problem in that the drainage takes place from the floor of the polder. This means that ground water flows into the polder, is collected in a ring ditch near the wall and pumped out from one or more points. In this experiment the polder bank is represented by the large rectangular open-ended ring which is positioned to enclose the two wells. The sand is removed from inside as before and a circular ditch formed in the bottom to link both wells (Figure 4).

The sand is now flooded, and the well control valves are opened until the polder is drained and the inlet valves adjusted to keep the water table elsewhere at the sand surface. It is possible to carry out this experiment without using the square ring, by forming a natural

polder bank with the sand at a stable slope (Figure 4). The position of the water table should be determined from the manometer tubes and profiles plotted to show this in relation to the ground surface and well positions.

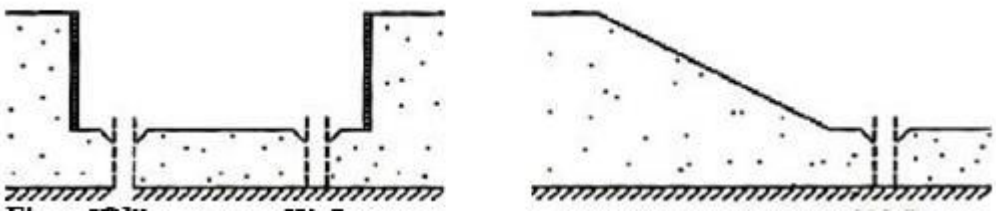

Figure 4

Observations and Calculations:

Volume Collected (well 1) L	Time to Collect (well 1) sec	Q0 (well 1) m^3/s	Volume Collected (well 2) L	Time to Collect (well 2) sec	$^{o}0$ (well 2) m^3/s	Tapping Position m	Manometer Readings m	H m	S (= H - manometer reading)

Assignment:

a) Did the results observed fit with the results predicted by theory? Suggest reasons for any differences.