AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
IRREGATION AND HYDRAULICS DEPARTMENT

FLOW THROUGH POROUS MEDIA IN THE VICINITY OF WELL POINTS SYSTEM

By

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ .

صدق الله العظيم
البقرة - ٣٢

بسم الله الرحمن الرحيم

To My Parents, Wife
And Sisters

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of master of science in civil engineering.

The work included in this thesis was carried out by the author in the department of hydraulics and irrigation, Ain Shams University from September 1990 to October 1993.

No part of this thesis has been submitted for a degree of a qualification at any other University of institution.

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ABSTRACT

An electrical analogue is employed to simulate the well points dewatering system. The used model expresses fairly the ground water table for all conducted runs of the experimental work. In this research work the optimal spacing between wells for both the U.S. and D.S. sides of wells location for various pumping conditions is studied. A comparison between the effect of one row system and two rows system is also investigated.

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LIST OF SYMBOLS

Symbol	Definetion	Dimensions
a	the distance between wells	L
A	Cross sectional area	L^2
b	the length of considered strip a long the row	L
C	dimensionless coefficient	-
D	the distance between any point perpendicular to the center line of wells at D.S. side	L
d_{10}	the diameter such that 10 % by weight of grains are smaller than the diameter	L
E	young's moduls of the soil	$ML^{-1}T^{-2}$
g	gravity acceleration	LT^{-2}
h_1	the water level in the inflow reservoir of filter	L
h_2	the water level in the exit resevoir of filter	L
h_o	the potential drop at any point due to gravity flow	L
h_e	the height of ground water table above the impervious stratum	L
h_s	the elevotion at the flow region intersects the well	L
h_w	the water height in the well	L
Δh	excessive potential drop at point of the same distance l_u due to pumping	L

I	Electric current per unit area	$K_o^{0.5} M^{0.5} L^{1.5} T^{-2}$
i_o	the potential gradient before pumeping	-
i_u	the up stream potential gradient after pumping	-
i_d	the down stream potential gradient after pumping	-
K	the hydraulic conductivity	LT^{-1}
$K_{XX} = K_X$	the average by hydraulic conductivity in X direction	LT^{-1}
$K_{YY} = K_Y$	the avarage hydraulic conductivity in Y direction.	LT^{-1}
k	the permeability of porous medium	L^2
L	the filter length	L
m	the distance between the two pumping rows	L
N	the number of the wells in the width (b)	-
n	the porosity	-
P_i	the interganular pressure	$ML^{-1} T^{-2}$
ΔP	the change of intergranular pressure due to the dewatering	$ML^{-1} T^{-2}$
q	Darcy's velocity	LT^{-1}
q_s	the specific discharge vector in s direction	LT^{-1}
q_x	the component of q_s in X direction	LT^{-1}
q_y	the component of q_s in Y direction	LT^{-1}
Q	the discharge	$L^3 T^{-1}$

R_n	Reynold's number	-
r	the distance between any point in the effected zone to the center of the well	L
t	time	T
U	the distance between any point perpendicular to the centerline and U.S. side	L
V	the actual velocity	LT^{-1}
$\partial v/\partial x$	The voltage gradient	$K_o^{-0.5} M^{0.5} L^{-0.5} T^{-1}$
X	the space variable	L
Y	the space variable	L
Z	the space variable	L
Ø	the potential function (Piezometric head)	L
$\frac{dØ}{dS}$	the potential gradient vector	-
$\frac{dØ}{dX}$	the component of the hydraulic vector in X direction	-
$\frac{dØ}{dY}$	the component of the hydraulic vector in Y direction	-
ρ_s	the mass per unit volume of soil	ML^{-3}
ρ_w	the mass per unit volume of flowing water	ML^{-3}
μ	dynamic viscosity of fluid (water)	$ML^{-1}T^{-1}$
θ	the angle of the tangent to the phreatic surface	-
ø	the potential function (piezometric head)	LT^{-1}

$\propto$	Relative potential gradient at U.S. case of one row	-
β	Relative potential gradient at D.S. case of one row.	-
γ	Relative potential gradient at D.S. case of two rows.	-
δo	Specific conductivity	$K_o L^2 T^{-1}$