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ANALYSIS OF PUMPING TEST RESULTS OF NORTH WEST AQUIFER USING NUMERICAL TECHNIQUES.

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C O N T E N T S

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A B S T R A C T

This report is intended to analyse the pumping test results of North West aquifer using numerical techniques. The pumping test results were taken from Water Resources Board, Sri Lanka. These pump tests were carried out during the period March 1980- March 1981. In analysing the flow to a pumped well, the radial flow can be represented by a differential equation, which is derived from Darcy's law. There are various approaches to solve this differential equation of radial flow to an aquifer. These methods are dependent on the type of aquifer and the condition of flow. Therefore suitable method should be selected for a particular problem.

Most of these approaches are graphical methods. A numerical method was introduced by K.R. Ruston (Ruston, K.R. & Chan, Y.K. 1976). In graphical methods, the differential equation of radial flow are solved using analytical expressions. Generally these analytical expressions contain infinite integrals and summations of higher transcendental functions. Therefore the evaluation of of these analytical expressions is sometimes difficult. But the values of aquifer parameters can be obtained by matching the theoretical curves derived from analytical expressions with the field data.

The same differential equation can be solved by using numerical techniques. In one such technique a discrete space - discrete time model is introduced to represent the radial flow in an aquifer. Thus, the same differential equation for radial flow can be replaced by the discrete space - discrete time numerical model. The number of assumptions can be reduced in using numerical techniques compared to the graphical methods. In addition to that, most of the actual field conditions can be included in to a single numerical solution. These field conditions are leakage, variable saturated depth, water within abstraction well, boundary conditions etc.

Pumping test results are analysed by graphical methods and numerical method. Under graphical methods, Huntush method I and Walton's method are used. (Kruseman, G.P., De Ridder, N.A., 1970). In the numerical method discrete space - discrete time model is used, neglecting the vertical flow component. In this numerical method, Backward difference formulation is used and the equations are solved by the Gaussion elimination.

The values of aquifer parameters obtained by both methods are compared and agreement between these methods are observed. The values of the aquifer parameters are changed and the behaviour of the draw down is observed. The sensitivity analysis is important when adjusting the aquifer parameters to fit the field data curve.

With so many variables graphical methods are inapplicable but most of these variables can be included in a single numerical solution. Therefore the limits of the application of graphical methods are narrow compared to the numerical method.

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LIST OF SYMBOLS AND ABBREVIATIONS

a	$\log_e r$
A	Area represented by node n
A_{well}	Cross Sectional area of the pumping well
B	Leakage factor
BASE	Total thickness of the unconfined and confined aquifer
C	Hydraulic resistance of semipervious layer
D(N)	Draw down of node n at present
H	Initial ground water head of the confined aquifer
h	Ground water head of the confined aquifer at present
H(N)	Hydraulic Resistence between node n and n+1
K	Coefficient of permeability
K_o	Modified Bassel function of the seconed kind and zero order
K_r	Coefficient of permeability in the radial direction
L	Leakage factor
m	=SD= Saturated thickness of aquifer
OD(N)	Draw down of node n at previous time step
Q_{pump}	Well discharge rate
q	Recharge per unit area
r	Radial co-ordinate
R(Max)	Maximum radius
R(N)	= r_n = Radial distance of node n from pumping well
R(2)	=r_2= r_{well}= radius of pumping well
S	Confined Storage coefficient
s	draw down
sm	draw down at steady state(maximum)
sp	Inflection point
T	The time in days since pumping started
T(N)	Time Resistance of node n
W(u,r/L)	Well function of u

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