3. DEVELOPMENT OF GROUND WATER

DARCY LAW'S

(i) $\boxed{Q = kiA}$ (For Laminar flow)

where, Q = Discharge

k = Coefficient of permeability

i = Hydraulic gradient = $\frac{\Delta h}{l}$

A = Area of flow.

(ii) $\boxed{\frac{Q}{A} = V = ki}$ where, V = Discharge velocity

(iii) $\boxed{V_S = \frac{V}{n}}$ where, V_S = Seepage velocity

n = Porosity.

(iv) $\boxed{V_S = \frac{k' i D_{10}^2}{Y}}$ where, k′ = Constant having value 400.

i = Hydraulic gradient

D_{10} = Effective size of soil particle

Y = Dynamic viscosity.

(v) $\boxed{k = \frac{C \cdot d^2 \cdot g}{\nu}}$ where, C = Shape factor (which is a function of porosity, packing and grain size distribution).

d = Average size of particle.

ν = Kinematic viscosity.

SPECIFIC YIELD

$\boxed{S_y = \frac{V_{wy}}{V}}$ where, S_y = Specific yield.

V_{wy} = Volume of water yielded under gravity effect.

V = Total volume of water drained.

SPECIFIC RETENTION

$\boxed{S_R = \frac{V_{WR}}{V}}$ where, S_R = Specific retention.

V_{WR} = Volume of water retain under gravity effect.

V = Total volume of water.

$\boxed{S_y + S_R = n}$ where, n = Porosity.

SLOT OPENING

Slot size = $D_{10} \pm 8\%$ of D_{10} of gravel pack material.

Slot size = D_{60} of aquifer design on the basis of finest aquifer.

PACK AQUIFER RATIO (P.A)

$$\text{Pack Aquifer Ratio (P.A)} = \frac{D_{50} \text{ of gravel}}{D_{50} \text{ of aquifer}}$$

$$9 < PA < 12.5 \text{ if } \left(C_u = \frac{D_{60}}{D_{10}}\right) \leq 2.$$

$$12 < PA < 15.5 \text{ if } (C_u > 2)$$

WELL LOSSES

- Jacob-equilibrium formula for confined aquifer,

$$s = \frac{Q}{4\pi T}\left\{\log_e \frac{4Tt}{r^2 A} - 0.5772\right\}$$

where, s = Drawdown in observation well after time t.

r = Radial distance of observation well from main pump well.

T = Coefficient of transmissibility = k.d

A = Coefficient of storage.

- $$s_2 - s_1 = \frac{2.303Q}{4\pi T}\log_{10}\frac{t_2}{t_1}$$

s_2 = Drawdown of observation well at time t_2.

s_1 = Drawdown of observation well at time t_1.

- $$\frac{t_1}{r_1^2} = \frac{t_2}{r_2^2}$$

where, r_1 and r_2 is the distance of drawdown in time t_1 and t_2 respectively.

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