ALL but L-7

CE 331 Environmental Engineering-I

19-11-2013

L-1

Chapter 1:

Short Notes on:

Military + Civil Eng.

↓ ME ↓ CSE ↓ EEE ↓ Civil

Civil
↓
Sanitary
*
Public Health
↓
Environmental Eng

Chlorella + water borne

1.4 Ecology and Environment:

1.5 Biodegration

- Easier, cheap treatment   Energy X

1.7 Climate Change:

L-3 21-1-2014

1.7 Climate Change:

L-3 28-1-2014

Different Sources of water:

Infiltration gallery – series of wells on, – canal beside river.

Artesian well – water pressure থাকলে, Bore hole করলে spring like source from depths of soil

Dug well – 3 ft dia min^m.

Essential Elements of Water Supply System

Chapter 3: Water Requirement

3.2 Factors Affecting per capita consumption

$$\frac{Q_{yearly}}{365 \times P} = q$$ litre/person/day

gallon/person/day

* Specific consumption in Asian cities:

- Size of the city.
- Characteristics of the people.
- Climate Condition.
- Commerce and Industries.
- Pressure of Water.
- Quality of Water.
- Sewerage facilities
- Water rate and metering.
- Nature of supply. —— intermediate / Continuous.
- Availability of the private supplies.
- Efficiency of the management.
- Number of Inhabitants

3.3 Consumption categories :

Domestic use in Bd – 2-3%
→ Agriculture (Max^m)

11-2-2014

L-4

Prediction of population:

i) Uniform growth rate (Arithmatic Progression) method.

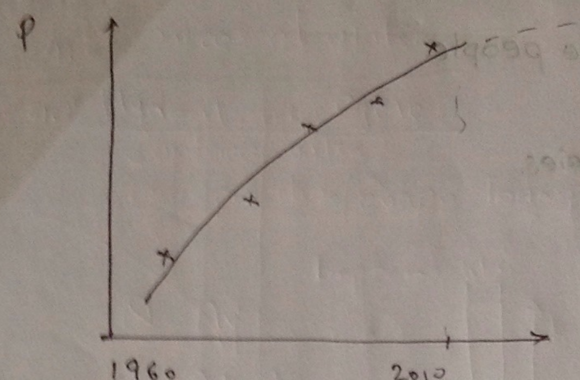
ii) Uniform % growth rate method. — usually measured for decade

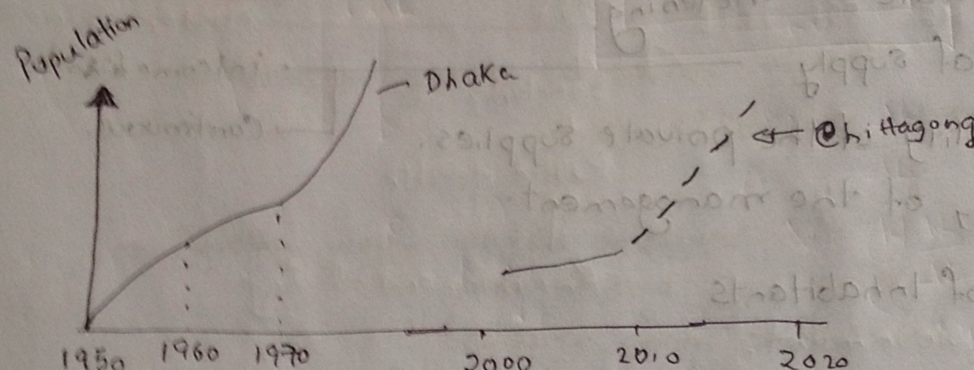
$\therefore P_f = P_p(1+r)^{10}$ → 10 years
↳ $r = 2\% = .02$

iii) Graphical extension method

iv) Least square parabola method

[code এ দেয়া value, that is min^m. If one wants to go below min^m, explanations must be provided]





Least square parabola method:

Numerical analysis [illegible]

$$y = a + bx + cx^2$$

$$y = a + bx + cx^2$$

$$\sum y = a + b\sum x + c\sum x^2$$

$$\sum xy = a\sum x + b\sum x^2 + c\sum x^3$$

$$\sum x^2 y = a\sum x^2 + b\sum x^3 + c\sum x^4$$

	x	y (×1000)	x^2	x^3	x^4	xy	x^2y
1910	-5	23.2	25	-125	625	-116	580
1920	-4	31.4	16	-64	256	-125.6	502.4
1930	-3	39.8	9	-27	81	-119.4	358.2
1940	-2	50.2	4	-8	16	-100.4	200.8
1950	-1	62.9	1	-1	1	-62.9	62.9
1960	0	76	0	0	0	0	0
1970	1	92	1	1	1	92	92
1980	2	105.7	4	8	16	211.4	422.8
1990	3	122.8	9	27	81	368.4	1105.2
2000	4	131.7	16	64	256	526.8	2107.2
2010	5	151.7	25	125	625	758.5	3792.5
	$\Sigma x = 0$	887.4	110	0	1958	1432.8	9224

Sol^n: $y = a + bx + cx^2$

$= 76.64 + 13x + 0.3974x^2$

$$\boxed{y = -71.3 + 13x + 3.71x^2}\ ?$$

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25-2-2014

4.2 Sources of water

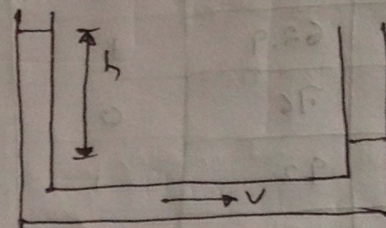
4.3 Hydrologic Cycle.

Surface water

Transpiration/Evapo-transpiration.

$$Q = Av$$

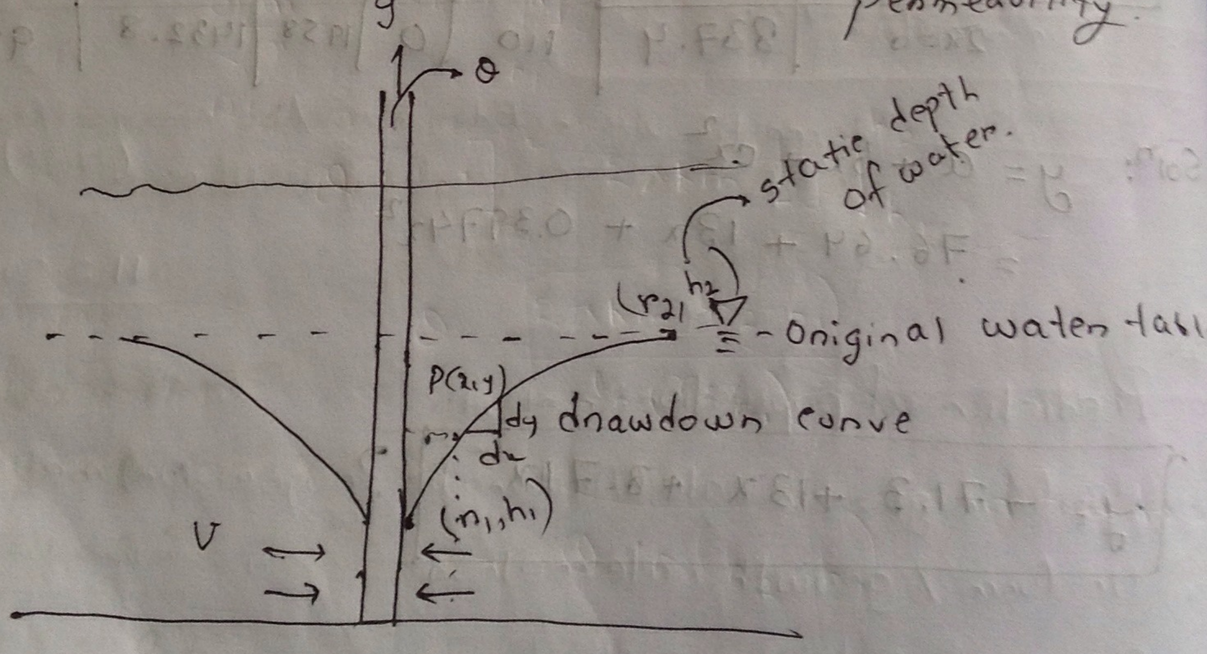
$$= AK\frac{\Delta h}{\Delta L}$$



$$V \propto \frac{\Delta h}{\Delta L}$$

$$V = K\frac{\Delta h}{\Delta L}$$

K → coefficient of permeability



$Q = AV$ $\qquad V = K\frac{\Delta h}{\Delta L}$

$= K\frac{dy}{dx}$

$\therefore Q = AK\frac{dy}{dx}$ $\qquad A = 2\pi xy$

$= (2\pi xy)\, K\frac{dy}{dx}$

$\Rightarrow Q\int_{r_1}^{r_2}\frac{dx}{x} = 2\pi K\int_{h_1}^{h_2} y\,dy$

or $Q\left[\ln(x)\right]_{r_1}^{r_2} = 2\pi K\left[\frac{y^2}{2}\right]_{h_1}^{h_2}$

$\Rightarrow Q\ln\left(\frac{r_2}{r_1}\right) = \pi K(h_2^2 - h_1^2)$

$\therefore Q = \frac{\pi K(h_2^2 - h_1^2)}{\ln(r_2/r_1)}$ ⟶ For Unconfined

Assumptions:

i) Direction of flow horizontal.

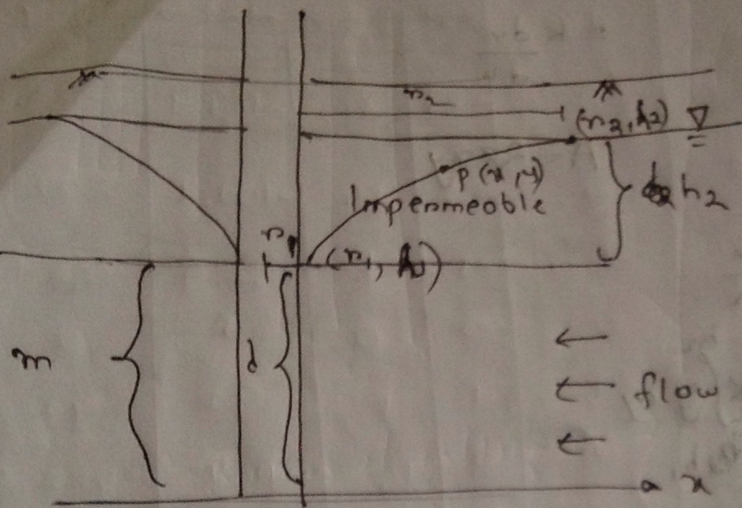
ii) Uniform rate of flow from surrounding.

iii) Flow towards the well.

Maths প্রমাণ

L-6

4-3-2014



$$A = 2\pi x y = 2\pi x m$$

$$Q = vA$$

$$= K\frac{dy}{dx} \times 2\pi m x$$

$$Q\int_{r_1}^{r_2} \frac{dx}{x} = 2\pi K m \int_{h_1}^{h_2} dy$$

$$Q\left[\ln x\right]_{r_1}^{r_2} = 2\pi K m \left[y\right]_{h_1}^{h_2}$$

$$Q = \frac{2\pi K m (h_2 - h_1)}{\ln(r_2/r_1)}$$

$$Q \propto (h_2 - h_1)$$ — draw down

The observation made on a 37.5 cm diameter ordinary well are given below:

Rate of pumping = 2,500 l/min

Draw down, in a test well 12 m away from the well = 2m

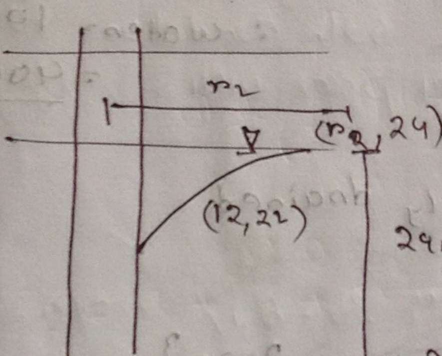
" " another " 24m " " " = 0.6m

Static head/vertical depth from water table to the bottom of the well = 24m.

$r_2 = ?$

$K = ?$

Sol^n

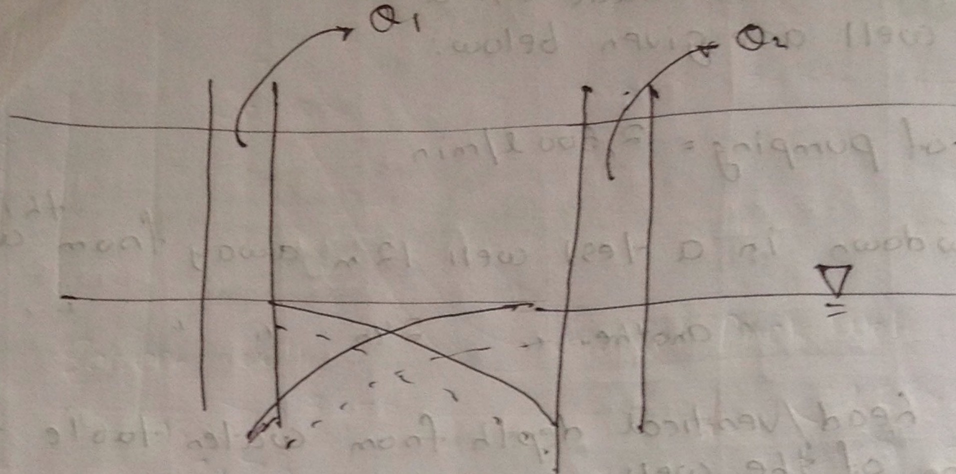


$$Q\int_{12}^{r_2} \frac{dx}{x} = 2\pi K \int_{22}^{24} y\,dy$$

$$Q = \frac{\pi K\left[24^2 - 22^2\right]}{\ln\left(\frac{r_2}{12}\right)} \quad \text{--- (1)}$$

$$Q = \frac{\pi K\left[24^2 - 23.4^2\right]}{\ln\left(\frac{r_2}{24}\right)} \quad \text{--- (2)}$$

$$\boxed{r_2 = 32.7\text{m}}$$



Radius of influence হয় outside থাকবে হয়
হয় না।

$V = 1000 m^2$ porosity = 0.

- Hydraulogic cycle.
- Specific yield / retention

∴ water = 1000 × .4
= $400 m^3$

opp of yield

amount that can be freely drained out due to gravity

if 50%

Water obtainable = $200 m^3$

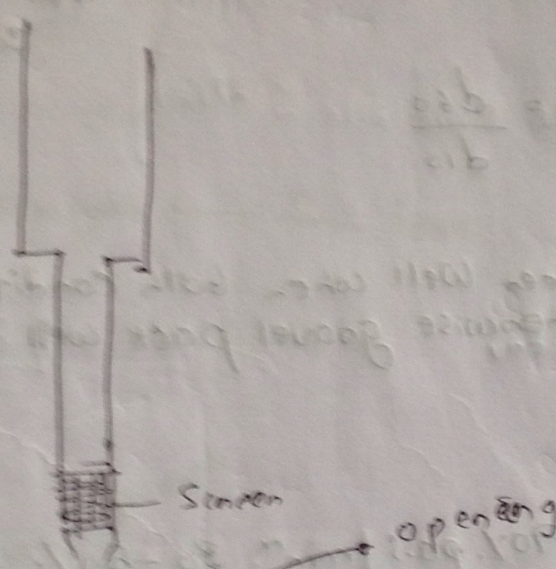
- Water
- Peizometric
- Assumptions

No. 6 hand tubewell

25-3-2014

Design of Pump

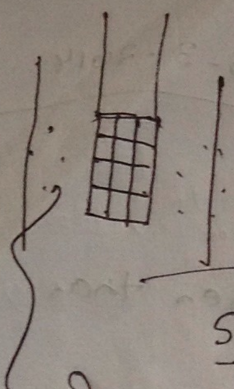
Screen minm 120' নিচে হবে in all areas other than Bogra (rock beneath)



Slot Size = 10 Slot

Deep tubewell – Second aquifer থেকে extract করবে
– In Bd 200' এর নীচে থেকে extract করি

Shallow tubewell – 200' কম depth থেকে extract করা যায়



Screen's size - coarse screen - big slot
fine " - small "

Screen well → Gravel Pack well.

Screen well

$d_{50} \geq 0.25mm$

$C_u > 3$

$$C_u = \frac{d_{60}}{d_{10}}$$

sand ছোট small but more water is to be extracted than, soil replaced with artificial soil, so that large strainers can be used.

Gravel Pack well

~~$d_{50} << 0.25mm$~~

~~d_{50}~~ → $d_{50} < 0.25mm$

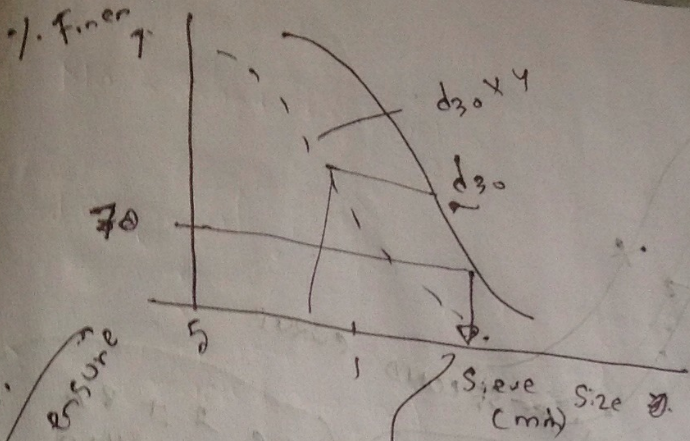
$C_u < 3$

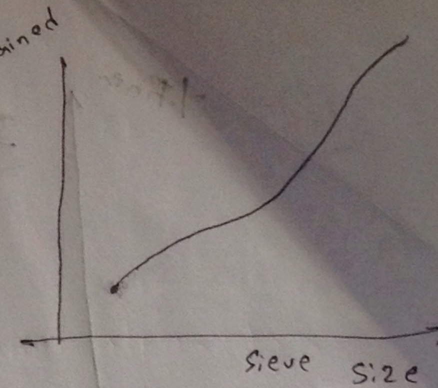
Screen well when both conditions fulfilled otherwise gravel pack well

~~30% এৰ~~

Screen's size = 70% pass, min^m 30-50% retained of the given size.

Gravel Pack well - 90% retain কৰাৰ কাৰণে design কৰিব।





$d_{30} \times 4/5/6$ = points for gravel pack well. then find ensure

Slot size

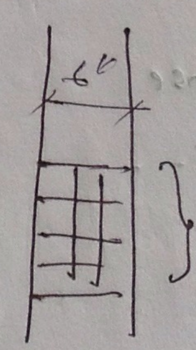
[Maths might come from here.]

$C_u < 2.5$

Find: 10% finer = gravel pack well.

$Q = AV$

$A = \pi D L$

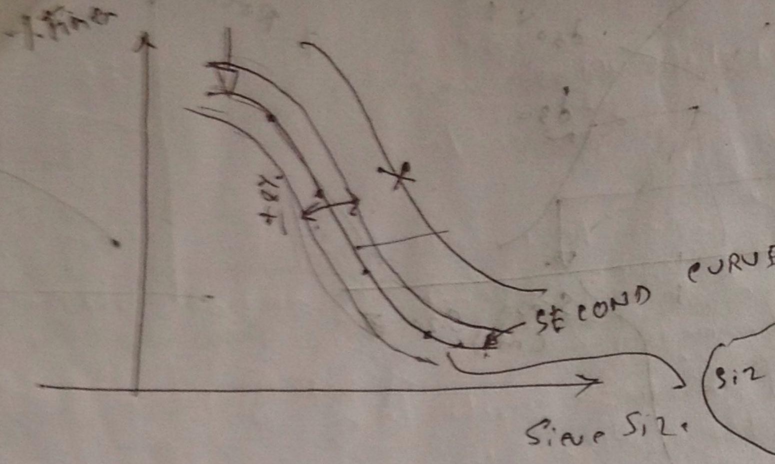


$v = 0.1$ fps (assumed) [design based on this V, as a higher V damages pump]

$Q = AV$

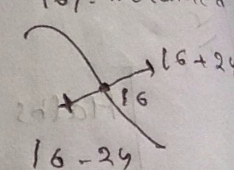
$= \pi \times 6 \times 1$

$= 6\pi$ ft^3/s



size এ ± 8% allow করব

16% retained



[Curve থেকে sieve size এ আসব।]

∴ 8-24%

Cont'd

Art – 1.4 – Ecology and Env

1.5 ×

1.6 ×

1.7 Climate Change

1.7.1 Greenhouse

1.7.2.

1.8 Biodiversity

[1.14.1 Sources of Water Supply

Table 1.1

Fig-1.20

Fig: 1.21