Water supply & sewerage

Lect.#3

Variation in Rate of Water Consumption

Goodrich formula to estimate the maximum rates

$$p = 180 * t^{-1}$$

Where:

p:percentage of the annual average rate

t: length of the period in days (from 1/12 to 360days)

Variation in Rate of Water Consumption

If we apply the Goodrich formula

When :

t=1days → p=180%=1.8

t=7days →p=148%=1.48

t=30days → p=128%=1.28

t=1hr → p=1.8*1.5=2.7

Note: For the maximum hourly rate use 150% from the average of that day

Variation in Rate of Water Consumption

$Q_{av.annual}$ =200 lit/day

$Q_{max\ daily}$ =200*1.8=360 lit/day

$Q_{max\ hourly}$ = 200*1.8*1.5= 540 lit/day

Example:

Ultimate population density 15,000 capita/km^2.

Area=120,000 m^2

The average consumption flow=600 lit/capita/day

Required:

Estimate the maximum daily flow rate to be supplied to that area in m^3/day.(neglect fire demand)

Solution:

Population=15000capita/km^2 * 120000m^2* (1km^2/10^6)=1800capita

$Q_{av.anu.=}$ 600 lit/capita/day*1800*capita* 1m^3/1000 lit

=1080 m^3/day

$Q_{max\ hourly}$ =1.8*1080 = 1944 m^3/day

Example 2: A city having population of 60000, average daily demand 325Lpcd, required:

1.Average daily demand as m3/day

2. Max. daily demand as m3/day

3. Min. daily demand as m3/day

4. Max. daily demand per person as Lpcd

5. Min. daily demand per person as Lpcd

6. Capacity of water treatment plant(quantity treated water as m3/day)

7. The required flow for designing water distribution net pipes as m3/sec

8. Water demand per year.

Solution:

1. $Q_{av.}$ =60000*325=195*10^5lit/day=195*$10^2$$m^3$/d
2. Q_{max} = 200%*195*10^2=39000 m^3/day
3. Q_{min} =50%*195 *10^2=9750 m^3/day
4. Max. Q.= (39000*1000)/60000=650lit/ capita/day
5. Min. Q.= (9750*1000)/60000=162.5 lit/capita/day
6. Flow=Q.max
7. Assume middle city

Q_{design} = 325*2.5=812.2 Lpcd

= (812.5/1000)*60000=48750 Lpcd

= 13.54 m^3/sec

8. Q_{av}= 195*10^2 m^3/day *365 =7117500 m^3/year