Problem 1

Given: housing types and population density

Wastewater generation rate = 200 Lpcd

Find: Peak wastewater flow rate + Infiltration

<u>Solution</u>

1 km^2 = 100 ha

Hosing types	Area (km^2)	Population density (person/ha)	Population
A	0.20	30	600
B	0.30	35	1050
C	0.15	50	750
D	0.10	65	650

Total population = 3050 person

Total area = 750 ha

$Q_{avg.}$= 3050 (0.2) = 610 m^3/d

Q_{max} = P.F. $Q_{avg.}$

P.F. = $1 + \frac{14}{4+\sqrt{P}}$ (population in thousands)

P.F. = $1 + \frac{14}{4+\sqrt{3.05}}$ = 3.4

Q_{max} = 3.4 (610) = 2074 m^3/d

To determine peak infiltration, go to figure at page 18,

Assuming new sewers (use curve B)

For an area of 750 ha the peak infiltration = 6 m^3/ha.d

Maximum w.w. flow = max. daily flow + max. infiltration

= 2074 m^3/d + 6 m^3/ha.d (750 ha)

= 6574 m^3/d

Problem 2

Given: P = 200,000 , w.c. = 50,000 m^3/d

Steel factory produces 1500 tons of steel per day

w.c. of the factory = 40,000 gal/(ton of steel)

Find: - Daily w.c. of the steel factory

- Compare with the city's requirement

Solution

Converting: 1 gal = 3.785 L

Daily w.c. of steel factory , Q_{avg} = 40,000 (1500)

= $6 (10^7)$ gal/d

= $6 (10^7) (3.785/1000)$

= 227100 m^3/d

The ratio of the daily use of the factory = 227100/50000 = 4.54 more time of the city's requirement

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Problem 3

Given: p = 150,000 capita , w.c. = 200 Lpcd

Find: find the capacity of water distribution system for the city

= $Q_{max.\ daily}$ + Fire demand

Solution

> The water distribution system (the pipe network) should be designed to provide the larger of:
>
> - The maximum hourly demand
> - The maximum daily demand + Fire demand (page 13)

$Q_{avg.}$ = 150,000 (200) = $3(10^7)$ L/d = 30,000 m^3/d

$Q_{max.\ daily}$ = 1.8 (30,000) = 54,000 m^3/d

$Q_{max.\ hourly}$ = 2.7 (30,000) = 81,000 m^3/d

> Fire demand, Q_F (m^3/day) = $320\ C\ \sqrt{A}$, A in m^2
>
> Not more than 32 m^3/min (in general)
>
> Not more than 23 m^3/min (for one-story construction)

> Or, Q_F (m^3/h) = $231.48\sqrt{p}\ \left(1 - 0.01\sqrt{p}\right)$, p in thousands
>
> Not more than 1500 m^3/hr (page 13)

Fire demand , Q_F (m^3/h) = $231.48\sqrt{150}\ \left(1 - 0.01\sqrt{150}\right)$

= 2489 m^3/hr > 1500 m^3/hr

Select 1500 m^3/hr

Fire duration = 10 hr (for a day) (from table 2-4)

The capacity of the city = $54,000\ (m^3/d) + 1500\ (m^3/hr) * 10\ (hr/d)$
$= 69,000\ m^3/d < Q_{max\ hourly}\ (81,000\ m^3/d)$

The design capacity for the city = $81,000\ m^3/d$