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ESTIMATION OF WATER DEMAND IN GAUTAM BUDDH NAGAR

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ABSTRACT:-

Determination of water demand is indispensable when it comes to the design of a proper water work project. An accurate estimation of water demand helps to determine the quantities of water and moments when the water will be used therefore generating various demand patterns. The demand arises mainly for residential, institutional, industrial and public uses. Water consumption in a community is characterized by several types of demand, including domestic, public, commercial, and industrial uses. Domestic demand includes water for drinking, cooking, washing, laundering, and other household functions. Public demand includes water for fire protection, street cleaning, and use in schools and other public buildings. Commercial and industrial demands include water for stores, offices, hotels, laundries, restaurants, and most manufacturing plants. There is usually a wide variation in total water demand among different communities. This variation depends on population, geographic location, climate, the extent of local commercial and industrial activity, and the cost of water.

In this research, an effort has been made to explain the water demand in water supply system in the Smart city of Greater Noida, UP. In this research the various aspect of water supply systemhave been e-xplained and there practice as well their quality of water supply system. This study helps in to identify the practice of ADR in India and.

KEY WORDS:-demand, Estimation, consumption, population, geographic location

INTRODUCTION: -

Water use or demand is expressed numerically by average daily consumption per capita (per person). In the United States the average is approximately 380 litres per capita per day for domestic and public needs. Overall, the average total demand is about 680 litres per capita per day, when commercial and industrial water uses are included. (These figures do not include withdrawals from freshwater sources for such purposes as crop irrigation or cooling operations at electric power-generating facilities.) Water consumption in some developing countries may average as little as 15 litres per capita per day. The world average is estimated to be approximately 60 litres per person per day.

In any community, water demand varies on a seasonal, daily, and hourly basis. On a hot summer day, for example, it is not unusual for total water consumption to be as much as 200 percent of the average demand. The peak demands in residential areas usually occur in the morning and early evening hours (just before and after the normal workday). Water demands in commercial and industrial districts, though, are usually uniform during the work day. Minimum water demands typically occur in the very early or predawn morning hours. Civil and environmental engineers must carefully study each community's water use patterns in order to design efficient pumping and distribution systems.

The different types of water demands and their variations are briefly described in this article.

Types of Water Demands:-i) Domestic Water Demand

ii) Industrial Water Demand

iii) Institutional and Commercial Water Demand

iv) Demand for Public

v) Fire Demand

vi) Waste and Theft

1. Domestic Water Demand- Domestic water demand accounts for 55 to 60% of the total water consumption. As per IS 1172-1983, the domestic consumption in India accounts for 135-lpcd (litres/capita/day)

2. Industrial Water Demand - The per capita consumption of industries is generally taken as 50-lpcd.

3. Institutional and Commercial Water Demand - On an average, per capita demand of 20 lpcd is required to meet institutional and commercial water demand. For highly commercialized cities, this value can be 50 lpcd.

4. Public and Civil Use - The per capita consumption for public and civic use can be taken as 10 lpcd. This water is used for road washing, public parks, sanitation etc.

5. Fire Demand - Per capita fire demand is ignored while calculating the total per capita water requirement of a particular city because most areas have fire hydrants placed in the water main at 100 to 150 meters apart. The fire demand is generally taken as 1-lpcd.

6. Waste and Thefts - This consumption accounts for 55-lpcd. Even if the waterworks are managed with high proficiency, a loss of 15% of total water consumption is expected.

There are different variations in water demands which are calculated for the specific design of pipe mains, service reservoirs, source of supply, distribution system and pumps.

Variations in Water Demand:-

1. Maximum Daily Consumption

Maximum Daily Consumption = 180% of Average Daily Demand = 1.8q

Maximum daily consumption is the design water consumption for source of supply and pipe mains.

2. Maximum Hourly Consumption

Maximum hourly consumption = 150% of avg. hourly demand of max.day

= 1.5 x (Maximum daily demand/24)

= 1.5 x (1.8q/24) = 2.7 x (q/24)

Maximum hourly consumption = 2.7 x Annual Average hourly demand

3. Maximum Hourly Demand of maximum day

Maximum Hourly Demand of maximum day = 2.7q

4. Coincident demand or Coincident draft

Maximum daily demand plus fire demand gives the coincident draft. This design water consumption is used for distribution system.

Population forecasting – Geometric Increase Method

In this method, the per decade percentage increase or percentage growth rate (r) is assumed to be constant, and the increase is compounded over the existing population every decade. This method is, therefore, also known as uniform increase method.

P_1= Population after 1 decade

$=P_0 + (r/100)*P_0$ where 'r' is in percent

$=P_0*(1 + r/100)$

P_2= Population after 2 decades

$=P_1 + (r/100)*P_1$

$=P_1*(1 + r/100)$

$=P_0*(1 + r/100)^2$

Proceeding in this way, we can write

$P_n=P_0*(1 + r/100)^n$

Where r = Assumed growth rate(%).

$r = \sqrt[t]{(P_2/P_1)} - 1$

Where P_1= initial known population

P_2 = final known population

t = No. of decades (period) between P_1 and P_2.

The average may again may again be either the arithmetic average i.e.

$= (r_1+r_2+r_3+r_4\ldots\ldots\ldots\ldots rt)/t$

Or the geometric average i.e. $\sqrt[t]{(r_1.r_2.r_3\ldots\ldots\ldots rt)}$

DATA AVAILABILITY & SITE STUDY:-

The previous population records available are listed below-

Year	Population
1991	7,71,000
2001	12,02,030
2011	16,48,115

Urban water needs can be divided into various sectors on the basis of the diverse kind of uses. The water demand of a city has two aspects (a) Domestic water demand (b) water demand at city level. As per Indian Standards (IS 1172-1971), the average domestic consumption in an Indian City is approximately **135 litres** per capita per day (lpcd) in the different activities of daily routine as drinking, cooking, bathing, washing of cloths, utensils, washing and cleaning of houses and residences flushing inwashroom, etc.

As per the data from Central Ground Water Board(CGWB), in Gautam Buddh Nagar water level depleting at an average rate of **1.5meter** every year for the last 5years.

Computation of population of 2021 & 2031by a Geometric Increase Method:-

Year	Population	Increase in population in each decade	Percentage increase in population i.e growth rate (r)
1991	7,71,000	4,31,030	(431030/771000)*100= 55.9%
2001	12,02,030	4,46,085	(446085/1202030)*100= 37.11%
2011	16,48,115		
2021	-----		
2031	-----		

Calculation for population:-

$r_{avg} = \sqrt[t]{(r_1.r_{2)}}$

$r_{avg} = \sqrt[2]{(55.9*37.11)}$

$r_{avg} = 45.54\%$

$P_n = P_0*(1 + r/100)^n$

$= P_0*(1.455)^n$

Population for 2021

$P_{2021} = P_{2011}*(1.455)^1$

$= 1648115*(1.455)^1$

= 23,98,768

Population for 2031

$P_{2031} = P_{2011}*(1.455)^2$

$= 1648115*(1.455)^2$

= 34,89,101

As per the India's average water demand per capita per day i.e.- 135-lpcd.

Water required for the population of the year 2021 is-

V = per capita demand (in litre) per head per day * design population (2021) * 365

V = 135 * 23,98,768 * 365

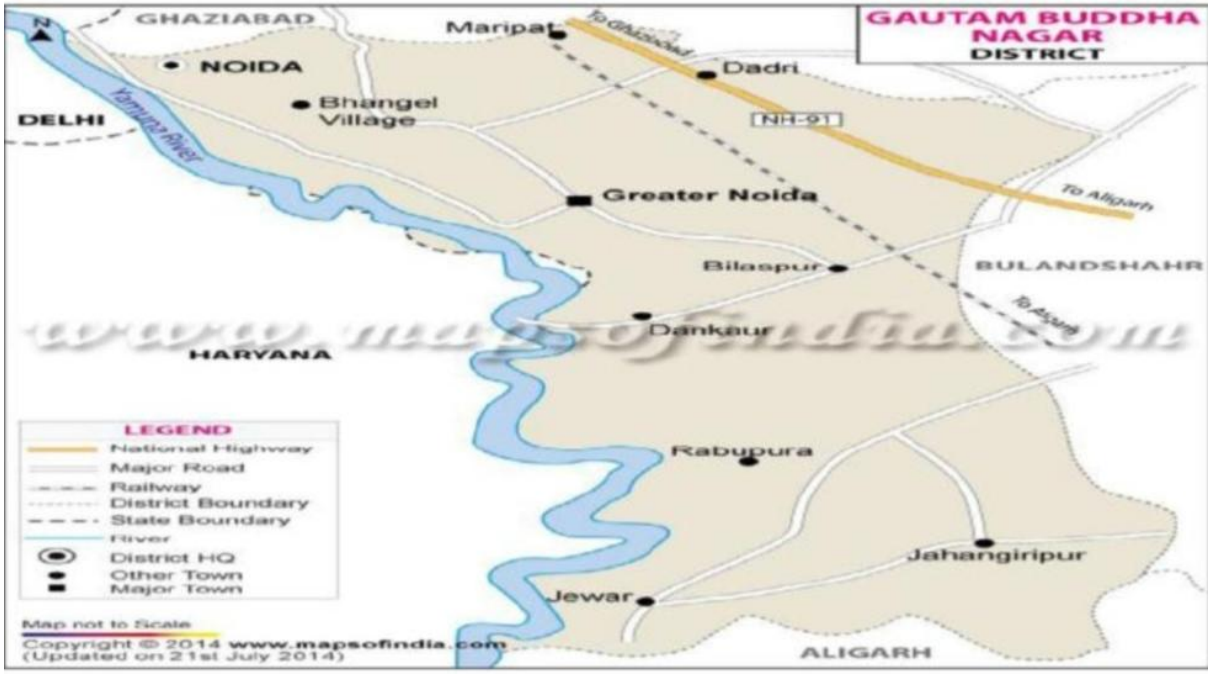
$= 1.18 * 10^{11}$ litres.

Similarly, water required for the population of the 2031 is-

V = per capita demand per head per day * design population (2031) * 365

V = 135 * 34,89,101 * 365

$= 1.72 * 10^{11}$ litres.



Study Area:- Map showing districts of Gautam Buddh Nagar(UP)

GroundWater depletion:-

The Gautam Buddh Nagar could soon follow in the footsteps of parched Delhi and depend on other cities or states for groundwater. Recent data from the Central Ground Water Board(CGWB) shows water level has been depleting in Gautam Buddh Nagar at an average rate of **1.5 meters** every year for the past five years.

In Greater Noida region, according to CGWB the average water table dropped to **11.11 meters** in **2017** from **7.95 meters** in **2013**.

In a recent order, environmentalist restricted ground water usage for building purposes in Greater Noida has been restricted for building upto 5 storey, 750 litres per sqm, upto 10 stores, 1000 litres per sqm, upto20 stores , 1500 litres per sqm and above 20, 2000 litres per sqm in permitted. Environmentalist attribute the depletion to "over-extraction" of Ground water mainly by construction sites. Over concretization is leading lack of Ground water recharge. If conservation doesn't start on war-footing, then water table of the Greater Noida could be fall by **2 metres** annually and lead to crises in coming years.

Ground water recharge at schools, colleges, institutes, hospitals, industries of Greater Noida must be made mandatory.

CONCLUSION

Water use or demand is expressed numerically by average daily consumption per capita (per person). In the United States the average is approximately 380 litres per capita per day for domestic and public needs. Overall, the average total demand is about 680 litres per capita per day, when commercial and industrial water uses are included. (These figures do not include withdrawals from freshwater sources for such purposes as crop irrigation or cooling operations at electric power-generating facilities.) Water consumption in some developing countries may average as little as 15 litres per capita per day. The world average is estimated to be approximately 60 litres per person per day.

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