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A STUDY ON INSTITUTIONAL WATER DEMAND FOR MANAGEMENT OF WATER UTILIZATION

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Abstract*— Water is one of the most important consumable substance on the earth. All the plants and animals must have water to survive. Without it, there can be no life on the earth. Every living thing requires water. The water that is safe for drinking is called portable water. Apart from drinking, people have many other demands of water such as domestic, industrial, institutional demands, wastage and leakages etc. but the fresh water content is 2.5 to 2.75% of total water, including snow and ice. Consequently, as world's population is constantly growing, the demand of water is increasing day to day. As a civil engineer it is our major task to rectify these problem to supply required water demand. In this study we selected our college, sree Venkateswara College of engineering as a study area, as it is getting scarcity of water, due to some reasons. For find out the causes of water scarcity, we are conducting assessment program in the year 2018.

Keywords— Water ,demands, constantly growing, Consequently, assessment program.

Introduction

Water is one of the most important consumable substances on the earth. All the plants and animals must have water to survive. Without it, there can be no life on the earth. Every living thing requires water. The water that is safe for drinking is called portable water. That is a transparent, tasteless, odourless, and nearly colorless chemical substance, which is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms. Its chemical formula is **H_2O**, meaning that each of its molecules contains one oxygen and two hydrogen atoms connected by covalent bonds. Water is the name of the liquid state of H_2O at standard ambient temperature and pressure. It forms precipitation in the form of rain and aerosols in the form of fog. Clouds are formed from suspended droplets of water and ice, its solid state. When finely divided, crystalline ice may precipitate in the form of snow. The gaseous state of water is steam or water vapour. Water moves continually through the water cycle of evaporation, transpiration (evapotranspiration), condensation, precipitation, and runoff, usually reaching the sea. Water plays an important role in the world economy. Approximately 70% of the freshwater used by humans goes to agriculture. Fishing in salt and fresh water bodies is a major source of food for many parts of the world. Apart from drinking, people have many other demands of water such as domestic, industrial, institutional demands, wastage and leakages etc. but the fresh water content is 2.5 to 2.75% of total water, including snow and ice. Consequently, as world's population is constantly growing, the demand of water is increasing day to day. As a civil engineer it is our major task to rectify these problem to supply required water demand. But….world's water resources are finite. Human activities are leading to depletion of resources and pollution is increasing at alarming rate. Water related natural hazards are most destructive to human life and property as in climatic changes and global warming. In this study we selected our college, sree Venkateswara College of engineering as a study area, as it is getting scarcity of water, due to some reasons. For find out the causes of water scarcity, we are conducting assessment program in the year 2018. This paper summarizes the guiding principles of demand management and present some successful application examples of demand management measures from SVCN that covers a wide range of environmental and socio economic conditions in an effort to identity the critical factors for efficient planning and implementation of demand management plans and aiming to reduce the scarcity of water and supply the optimum water to the consumer, without any fluctuations

I. DATA COLLECTION AND STUDY

It involves detailed investigation of distribution, pumping systems, Water intake source. And also assessing the population growing rate water demand per day, peak hourly demand, storage capacity, required in distribution system, water quality etc.

A. STUDY OF WATER INTAKE SOURCE

It involves detailed investigation type of source, factors governing the selection of a particular source of water, quality of water, types of storage capacity etc.

1. TYPE OF SOURCE

- Surface source:- Surface sources are those sources of water in which the water flows over the surface of the earth, and is thus directly available for water supplies. Such as….
  - Natural ponds and lakes;
  - Stream and rivers; and
  - Impounding reservoirs
- Subsurface source:- The water which gets stored in the ground water reservoir through infiltration is known as the underground water.

Factors governing the selection of a particular source of water:

1. The quantity of available water.
2. The quality of available water.
3. Distance of the source of supply.

IN OUR COLLEGE is selected water intake source is underground water because there is no pure surface water is available, also above factors are keep in mind to take surface water.



Figure 1: Showing water percentage

2. QUALITY OF WATER:-

Human or animal wastes, industrial chemicals, pharmaceuticals, and other types of pollutants sometimes contaminate water from rivers, lakes, underground aquifers, and other sources. Fortunately, engineers and scientists have developed innovative solutions to make water potable (safe to drink).

IN SVCN COLLEGE has available sub surface water that able to test those are safely drinking or not. We are conducting tests for that water are PH value test, turbidity test, alkalinity test etc. as shown in below;

- **PH test:**

The hydrogen ion concentration is important quality parameter of natural waters and waste waters. Natural waters are alkaline due to presence of carbohydrates and PH charges due to biological activity, temperature, disposal of industrial waste, acid mine drainage waste etc. waste water adverse hydrogen ion concentration is very difficult to treat by bacteria. If PH value of water is <6.8 , methane producing bacteria will not survive. If PH<6.5 , starts corrosion in pipe , there by releasing toxic metal like zinc, lead , cadmium.(PH<4.2 acidic, PH>8.3 basic).

Table 1: PH TEST

S.No	Colour of the sample using		PH of wet sample
	Methyl orange indicator	Phenolphthalein indicator	
1.	colour less	Colourless	4.2-8.3 [neutral]

- The PH value of the water sample is safe for drinking because it is neutral.

- **Turbidity test:**

Turbidity is the measurement of suspended solids is not usually performed on samples for natural water bodies for portable water supplies. For such water, a test for turbidity is commonly used. When light passed through a sample having suspended particles, some of the light is scattered by the particles. The scattering is generally proportional to the turbidity.

Table 2: TURBIDITY TEST

S.No	Sample	Turbidity value in NTU
1	Water sample	5.4

- The turbidity value is also safe for drinking.

4. MOUNT OF WATER DRAWN FROM BORE WELL

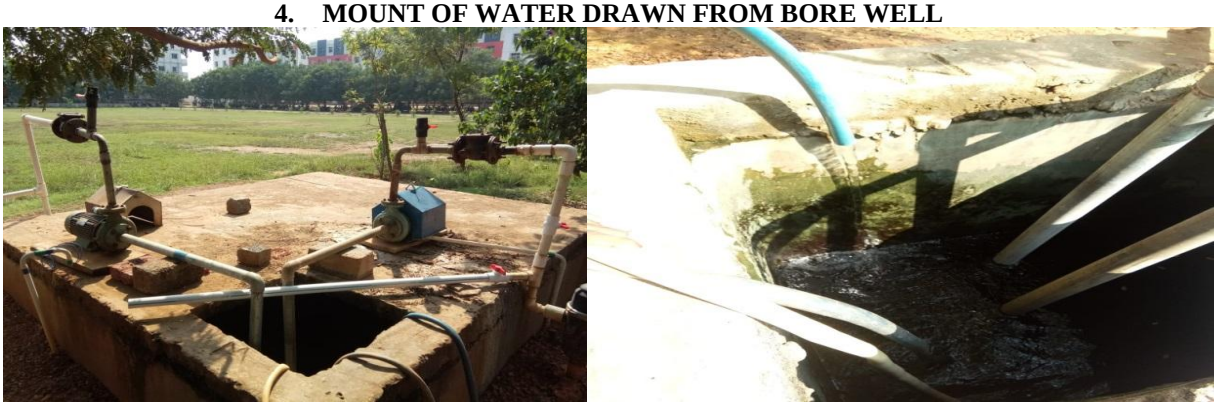


Figure 2: Showing sump water

In SVCN college has 3 submersible pumps are arranged. The pump which is provided at ground is considered as "pump 1". The pump which is provided at TTC car shed is considered as "pump 2". The pump which is provided at TTC right entrance is considered as "pump 3".

Table 3: PUMP CAPACITY

PUMP	YIELD IN LITERS PER HOUR
Pump 1	1515.388
Pump 2	1212.288
Pump 3	1363.82

B. STORAGE CAPACITY:

Storage of water within the premises of a building is usually necessary, because the pumping supplies are usually not available round the clock. Such storage may also help in meeting static faire demand; and to provide uninterrupted water supply in the building in case the ground water supply is shut off for repairs, or if there is a power failure. Storage may also help to supplement the direct supply in case of peak demand.

1. TYPES OF STORAGE CAPACITY

These are two types of storage capacity

- **Overhead storage**

When the water supply is available at sufficient pressure round the clock, as torise to the highest floor, then no overhead storage is required, and all the water supply fixtures can be connected with the direct supply line. However, in India, most of the city water supplies are confined only to a few hours in the morning and evening. Due to this reason, it becomes imperative to store water in overhead tanks,particularly for its use in toilets and urinals. This requirement depends upon the number of sanitary fixtures in the building and may vary from city, depending upon the living standards of the occupants of the building.

- **Underground storage**

If the water pressure in the mains is insufficient to reach the overhead tank. The water collected in the underground tank is then pumped up to the overhead tank. The capacity of underground storage tank should be the net difference between the daily peak demand and during hours of supply



Figure 3: Showing sump water

Estimation of storage capacity:

THE water storage capacity for a abuilding will depend on the FOLLOWING FACTORS:

- Hours of supply
- Rate of supply

- Demand pattern in the building
- Fire storage required etc.

The storage tanks are providing in SVCN College is both sub surface tank and overhead tank. The water first collected in underground sump. After that water is pump to overhead tank and then supplying to distribution pipes.

2. SIZES OF STORAGE TANKS

Table 4:The sizes are as shown below:

S.No	Ground Sump Storage	Capacity of tanks				Pump efficiency
1	Ground sump	13865.54lit				Pump1 -20cm/hour Pump2-16cm/hour Pump3-18cm/hour =540 mm/hour =4091.47 lit/h
2	Overhead tank	1st tank	2nd tank	3rd tank	4th tank	Pump 1 -360mm/h Pump 2 - 120mm/h
		3000lit	2000lit	5000lit	5000lit	
		5ooolit		10000lit		
						= 480 mm/h =3636.86 lit/h

C. **STUDY OF POPULATION**

Determination of population is one of the most important factors in the planning. The data about the present population of a city or town can always be obtained from the records of the municipality or civic body.

1. POPULATION FORECASTING

There are several methods for population forecasting such as arithmetical increase method, geometrical increase method, incremental increase method etc.

Table 5: In our college has population as shown in below;

YEAR	2015	2016	2017	2018
POPULATION	2200	2200	2200	2200

2. DESIGN PERIOD

A water supply scheme includes huge and costly structures, which cannot be replaced or increased in their capacities, easily and conveniently. For example, the water mains including the distributing pipes are lied underground, and cannot be replaced or added easily, without digging the roads or disrupting the traffic. In order to avoid these future complications. This future period or the number of years for which a provision is made in designing the capacities of the various components of the water supply is known as design period.

Table 6: The design period for different components of a water supply scheme is;

S.NO	ITEM	DESIGN PERIOD IN YEARS
1	Storage by dams	50
2	Intake works	30
3	Pumping • Pump house • Electric motor and pump	 30 15
4	Distribution system	30

3. WATER DEMAND

The quantity of water required for the public utilities is called as water demand there are various forms of demands such as domestic demand, industrial and institutional demand we are study the institution of SVCN College. As per is 1172-1963, under normal condition the water required over an average this value is taken as 20 lit/had/ day and for highly commercialized cities it may be 50 lit/head/day. A water supply system is generally designed to provide the demand at guaranteed minimum pressures, for 24 hours a day and 365 days per year.



Figure 4: Showing sump water

Table 7: THE WATER DEMAND FOR DIFFERENT TYPES CONSUMPTIONS:

S.NO	TYPE OF CONSUMPTION	NORMAL RANGE (LIT/CAPITAL/DAY)	AVERAGE
1	Domestic	65-300	160
2	Industrial • Bath rooms are provided • No bath rooms are provided Schools • Day scholars • Residential	 45-90 30 -60 45 -90 135 – 225	 65 45 70 135
3	Public	20-90	45
4	Wastes and thefts	45-150	62

4. FACTORS EFFECTING RATE OF DEMAND

- **Size and type of institute:**
  In case of large institute high demand. In case of small institute low demand.
- **Climatic condition:**
  If the institute is located in hot climate the water demand is high, in case of cool climate water demand is low.
- **pressure in the supply:**
  The water will be supplied in high pressure, the demand is high. the water will be supplied in low pressure, the demand is low.

5 VARIATIONS IN RATE OF DEMAND:-

It is major important to collect information about factors effecting rate of demand;

Average daily per capita demand=quantity of water required in 12 months/ [365 x Population] lit/ capita/day

=[50/[24x60]x2200x60x10x265]x2200/ [365x2200]
=30494 lit/ capita/ day.

Maximum daily demand = 1.8 x average daily demand
= 1.8 x 30494
= 54889 lit/day

Peak hourly demand = 1.5 x maximum daily demand /24
= 1.5 x 54889/24
=3431 lit/h

One-hour durations are commonly accepted for practical purposes and the instantaneous peak factor within this period of time will be represented by a single value called the *hourly (or diurnal) peak factor*, as shown in Figure

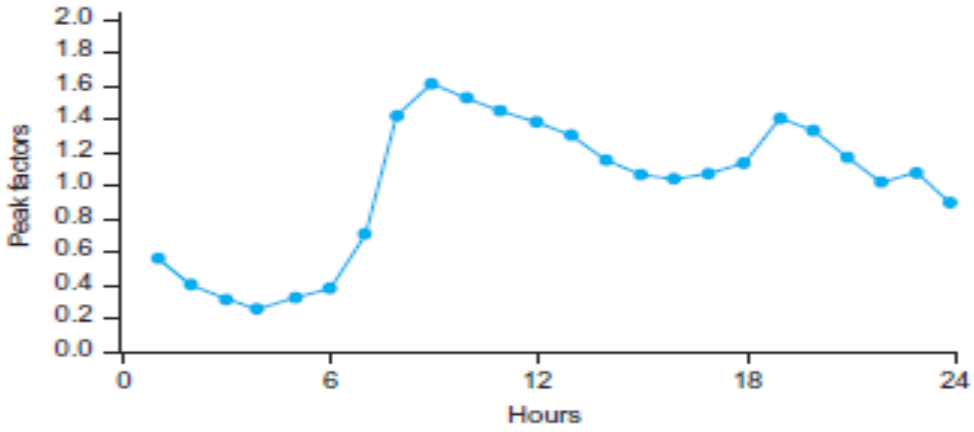


Figure 5: Showing demand graph

Seasonal variations:-

Annual variations in water use are predominantly linked to the change of seasons and are therefore also called *seasonal variations*. The unit consumption per capita normally grows during hot seasons but the increase in total demand may also result from a temporarily increased number of consumers, which is typical for holiday resorts. Figure 2.20 shows the annual pattern in Istria, Croatia on the Adriatic coast; the peaks of the tourist season, during July and August, are also the peaks in water use. The demand peaks during summer, the demand is less in winter is called the seasonal fluctuations.

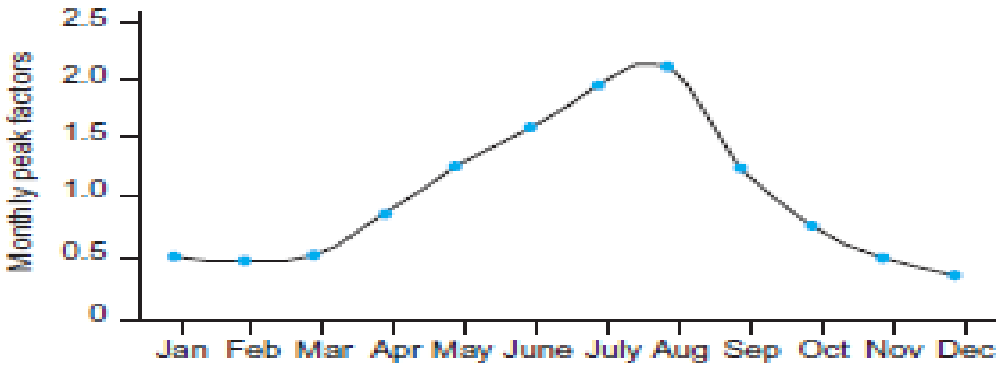


Figure 5: Showing demand graph

Daily variation:-

Generalizing such trends leads to the conclusion that the absolute peak

Consumption during one year occurs on a day of the week, and in the month when the consumption is statistically the highest. This day is commonly called the *maximum consumption day*. In Sundays and Saturdays have less demand, remaining days demand is more.

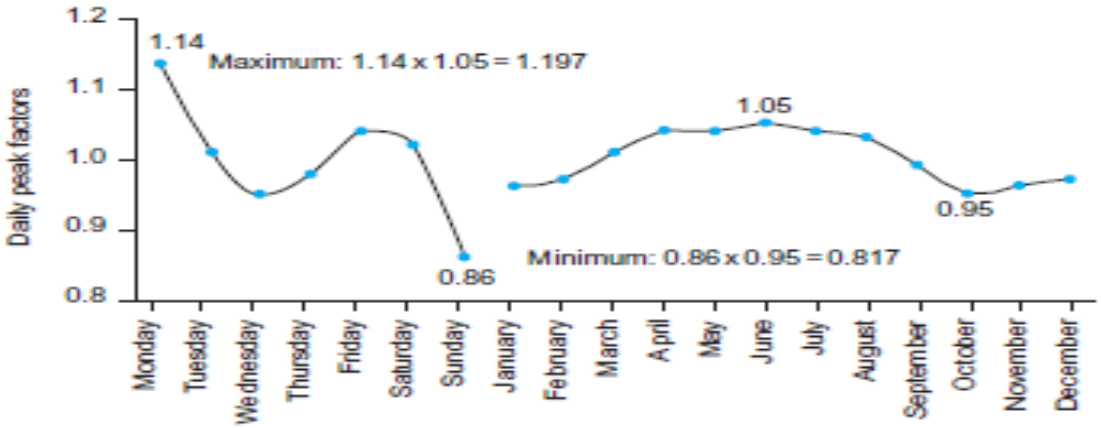


Figure 7: Showing demand graph

Hourly variations:-

The break time and lunch time have high demand, morning and evening time have less demand. During other hours the demand is negligible.

The diagram of the hourly peak factors for the two situations will look as follows:

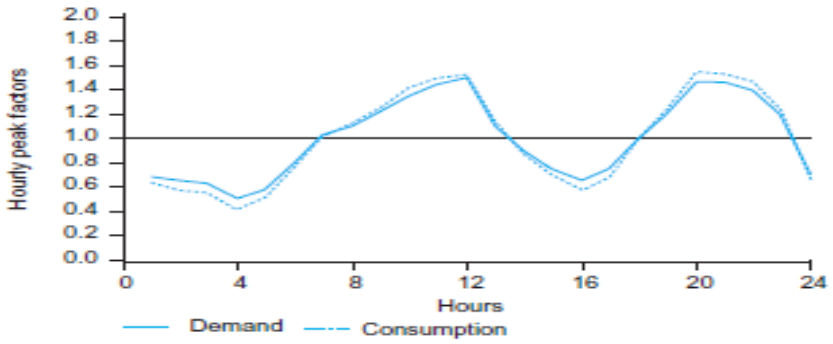


Figure 8: Showing demand graph

II. INVESTIGATE DISTRIBUTION SYSTEM

After the water has been properly treated and made safe and wholesome, it has to be supplied to the consumer. A distribution system may, therefore consist of pipe lines of various sizes for carrying the water to the consumer



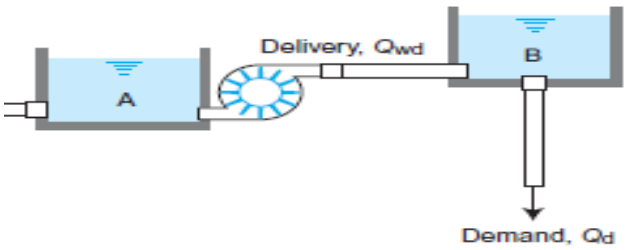




Figure 9: Showing demand of water

A. PUMPING SYSTEM USING UNDERGROUND TO OVERHEAD TANK;

When bore well water pumping supplies are at low pressure, then it became necessary to store water in underground tank. The water collected in the underground tank is finally lifted to the overhead tank.

B. PIPE FITTINGS AND VALVES:

The various pipe fittings, such as bents, crosses, tees, caps, increaser, reducer etc. are frequently used in making service connections and also bigger size mains and sub mains.





Figure 10 : Showing valves

1. GATE VALVES:

Gate valves are used to regulate the flow of water through the pipes. They are similar to gate valves used in dams but are not so large. In large pipe lines, bringing water from the source to the city, they are generally located along the pipe line at interval about 3 – 5 km, so as to divide the pipe line in different sections. For easy repair at any section.

C. LOSS OF WATER:-

Water losses from a distribution system consist of:

1. Leakage and overflow from service reservoir.
2. Leakage from main and service pipe connections.
3. Leakage and losses on outlet taps.
4. Losses in supply lines are mainly due to defective pipe joints, cracked pipes, And loose values and fittings.



Figure 11: Showing leakage valves

Table 8: There are two tanks are there, the losses was as shown below;

S.No	Losses	
1	3cm	Tank 1a- 53 lit/h Tank 1b – 53lit/h
2	2cm	Tank 2a – 51 lit /h Tank 2b – 63 lit/h
	Total	220 lit / h

For 10 hours = 220 x 10

=2200 lit / 10 h

The losses will be within the limit of less than 20% of total consumption. If it is exceed to rectify the problems. In our college has many more water loss can be occur at these ways.

The leakage of water in building distribution is detected by using the discharge difference between the inlet and outlet.

4.4 TYPE OF OUT LETS:-

The every floor has the toilets or waiting halls. In those the more outlets for different requirements. Such as….

Table 9: showing out lets

S.No	Type	No`s
1	Taps	82
2	Urinals	28
3	Wash basin	32
4	Flush	30

III. CONCLUSION AND FUTURE SCOPE

- Total inmates using the water are 2200.
- The average quantity of water required per day 8577.5 lit.
- The full tank capacity for water supply is 15000 lit.
- The full tank water should be used for one and half days but water supply is lagging due to various losses.

The following are the valuable recommendations for reducing scarcity:

- In our college the intake water is very low and is not sufficient, hence better to change the source.
- The intake supply pump capacity is not sufficient to meet the requirement.
- The existed tanks both for inlet and outlet capacity should be increased.
- It is better replace temporary tank to permanent tank of capacity 15000lit to 20000lit
- The more water losses are at outlet taps because of improper closing (negligence's of students), so best for replacing with pressing outlets(taps).
- Number of bents and valves are existed more due to this energy losses of water is more so reduce the valves and bends.

Safe Drinking Water Is Essential:

Over 1 billion people lack access to safe drinking water worldwide. So our aim is improve the ground water give live to the future generation.



Figure 12 scarcity of water

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