OBJECTIVES OF WATER SUPPLY SYSTEMS:

- To provide wholesome water to the consumer for drinking purpose.
- To supply adequate quantity of water to meet the least minimum needs of the individuals.
- To make adequate provisions for emergencies like fire-fighting, festivals, meeting, etc.
- To make provisions for future demand due to increase in population, increase in standard of living, storage and conveyance.
- To prevent pollution of water at source, storage and conveyance.
- To maintain the treatment units and distribution system in good condition with adequate staff and material.
- To design and maintain the system that is economical and reliable.

PLANNING OF WATER SUPPLY SYSTEMS:

Planning for water supply means determining how water is being delivered to residents and businesses, assessing issues with the supply of potable water, and setting a course of action for the pro per management and protection of potable water resources.

DESIGN PERIOD:

The future period for which a provision is made in the water supply scheme is known as design period.

It is expressed in years.

- During design period, the structures, equipment and components should be adequate to serve the requirements.
- As per normal procedure water works is designed for a period of 30 years.

Influencing factors:

- Useful life of pipes, equipment and structures.
- The anticipated rate of growth. If rate is more, design period will be less.
- The rate of inflation during the period of repayment of loans when inflation rate is high, a longer design period is adopted.
- Efficiency of the component units. The more the efficiency, the longer will be design period.

IMPOUNDING RESERVOIRS:

It is a basin constructed in the valley of a stream or river for the purpose of holding stream flow so that the stored water may be used when supply is insufficient.

They have the following two functions:

(i) To impound water for beneficial use.

(ii) To retard flood.

Two functions may be combined to some extent by careful operations.

An impounding reservoir presents a water surface for evaporation. This loss must be considered. Possibility of large seepage loss must also be considered. If it is economically impossible to prevent them, the project may have to be abandoned or move it to a more favorable site. There will be some loss by seepage through and under the dam itself.

POPULATION FORECASTING METHODS:

When the design period is fixed the next step is to determine the population of a town or city population of a town depends upon the factors like births, deaths, migration and annexation. The future development of the town mostly depends upon trade expansion, development industries, and surrounding country, discoveries of mines,construction of railway stations etc may produce sharp rises, slow growth, stationary conditions or even decrease the population. For the prediction of population, it is better to study the development of other similar towns, which have developed under the same circumstances, because the development of the predicted town will be more or less on the same lines.

Following are the population forecasting methods

i. Arithmetical increase method
ii. Geometrical increase method
iii. Incremental increase method
iv. Simple graph method
v. Decrease rate of growth method
vi. Comparative graph method
vii. The master plan method

ARITHEMATICAL INCREASE METHOD

This method is based on the assumption that the population is increasing at a constant rate. The rate of change of population with time is constant. The population after 'n' decades can be determined by the formula.

$$\mathbf{P_n = P_0 + n\bar{x}.}$$

where

P_0 → population at present

n → No. of decades

$\bar{x}$ → Constant determined by the average of increase of 'n' decades

GEOMETRICAL INCREASE METHOD

This method is based on the assumption that the percentage increase in population from decade to decade remains constant. In this method the average percentage of growth of last few decades is determined, the population forecasting is done on the basis that percentage increase per decade will be the same.

INCREMENTAL INCREASE METHOD

This method is improvement over the above two methods. The average increase in the population is determined by the arithmetical method and to this is added the average of the net incremental increase once for each future decade.

DECREASING RATE OF GROWTH METHOD

The method is applied to a city that owns a limiting saturation population. In this type, the rate of growth is a function of its population deficit.

COMPARATIVE GRAPH METHOD

In this method, population curve of different cities with similar population growth is studied. The different factors that are taken into consideration are:

The likeness of Economic Base

Proximity of geography

Access to similar transportation systems

MASTER PLAN METHOD

The master plan is prepared for next 25 to 30 years for the city. master plan the city is divided into various zones such as residence, commerce and industry.

FACTORS INFLUENCING POPULATION GROWTH:

ECONOMIC DEVELOPMENT

Countries that are in the early stages of economic development tend to have higher rates of population growth. In agriculturally based societies, children are seen as potential income earners. From an early age, they can help with household tasks and collecting the harvest. Also, in societies without state pensions, parents often want more children to act as insurance for their old age. It is expected children will look after parents in old age. Because child mortality rates are often higher, therefore there is a need to have more children to ensure the parents have sufficient children to look after them in old age.

SOCIAL AND CULTURAL FACTORS

India and China (before one family policy) had strong social attachments to having large families. In the developed world, smaller families are the norm.

AVAILABILITY OF FAMILY PLANNING

Increased availability of contraception can enable women to limit family size closer to the desired level. In the developing world, the availability of contraception is more limited, and this can lead to unplanned pregnancies and more rapid population growth.

DEATH RATES

Level of medical provision. Often death rates are reduced before a slowdown in birth rates, causing a boom in the population size at a certain point in a country's economic development. In the nineteenth and early twentieth century, there was a rapid improvement in medical treatments which helped to deal with many fatal diseases. Death rates fell and life expectancy increased.

URBANISATION

Rural to urban migration happened in the past centuries in richer nations and is happening today in poorer nations. It has a significant impact upon population growth because it can impact upon the birth and death rates of a country. As a country becomes increasingly urbanised the birth rate tends to rise and death rates tend to fall. The birth rates rise because people have more access to medical care in cities than in rural areas thus infant mortality falls and birth rate rises. This is a short term change, as development occurs over longer periods of time in the urban area birth rates can fall as it is then easier to deliver family planning.

Death rates fall in urban areas because it is cheaper and more economic to provide medical and education services, and to ensure more reliable food supplies. This means that people get more educated, better fed and can be treated when sick. This is often not the case in more remote rural areas so death rates fall in urban areas. The net effect of this is population growth.

VARIOUS TYPES OF WATER DEMANDS:

While designing the water supply scheme for a town or city, it is necessary to determine the total quantity of water required for various purposes by the city. As a matter of fact the first duty of the engineer is to determine the water demand of the town and then to find suitable water sources from where the demand can be met. But as there are so many factors involved in demand of water, it is not possible to accurately determine the actual demand. Certain empirical formulae and thumb rules are employed in determining the water demand, which is very near to the actual demand.

Following are the various types of water demands of a city or town:

i. Domestic water demand

ii. Industrial demand

iii. Institution and commercial demand

iv. Demand for public use

v. Fire demandvi. Loses and wastes

The details of the domestic consumption are

a) Drinking -- 5 litres

b) Cooking -- 5 litres

c) Bathing -- 55 litres

d) Clothes washing -- 20 litres

e) Utensils washing -- 10 litres

f) House washing --10 litres

DOMESTIC WATER DEMAND

The quantity of water required in the houses for drinking, bathing, cooking, washing etc is called domestic water demand and mainly depends upon the habits, social status, climatic conditions and customs of the people. As per IS: 1172-1963, under normal conditions, the domestic consumption of water in India is about135 litres/day/capita. But in developed countries this figure may be 350 litres/day/capita because of use of air coolers, air conditioners, maintenance of lawns, automatic household appliances.

INDUSTRIAL DEMAND

The water required in the industries mainly depends on the type of industries, which are existing in the city. The water required by factories, paper mills, Cloth mills, Cotton mills, Breweries, Sugar refineries etc. comes under industrial use. The quantity of water demand for industrial purpose is around 20 to 25% of the total demand of the city.

INSTITUTION AND COMMERCIAL DEMAND

Universities, Institution, commercial buildings and commercial centers includingoffice buildings, warehouses, stores, hotels, shopping centers, health centers, schools,temple, cinema houses, railway and bus stations etc comes under this category.

DEMAND FOR PUBLIC USE

Quantity of water required for public utility purposes such as for washing and sprinkling on roads, cleaning of sewers, watering of public parks, gardens, public fountains etc comes under public demand. To meet the water demand for public use, provision of 5% of the total consumption is made designing the water works for a city.

FIRE DEMAND

Fire may take place due to faulty electric wires by short circuiting, fire catching materials, explosions, bad intension of criminal people or any other unforeseen mishappenings. If fires are not properly controlled and extinguished in minimum possible time, they lead to serious damage and may burn cities. All the big cities have full fire- fighting squads. As during the fire breakdown large quantity of water is required for throwing it over the fire to extinguish it, therefore provision is made in the water work to supply sufficient quantity of water or keep as reserve in the water mains for this purpose. In the cities fire hydrants are provided on the water mains at 100 to 150 m apart for fire demand. The quantity of water required for fire fighting is generally calculated by using different empirical formulae. For Indian conditions kuichings formula gives satisfactory results.

$Q=3182\sqrt{p}$

Where ‘Q’ is quantity of water required in litres/min

‘P’ is population of town or city in thousands

LOSES AND WASTES

All the water, which goes in the distribution, pipes does not reach the consumers.

The following are the reasons

1. Losses due to defective pipe joints, cracked and broken pipes, faulty valves and fittings.

2. Losses due to, consumers keep open their taps of public taps even when they are not using the water and allow the continuous wastage of water

3. Losses due to unauthorized and illegal connections

While estimating the total quantity of water of a town; allowance of 15% of total quantity of water is made to compensate for losses, thefts and wastage of water.

FACTORS AFFECTING PER CAPITA DEMAND:

The following are the main factors affecting for capita demand of the city or town.

a) **Climatic conditions:** The quantity of water required in hotter and dry places is more than cold countries because of the use of air coolers, air conditioners, sprinkling of water in lawns, gardens, courtyards, washing of rooms, more washing of clothes and bathing etc. But in very cold countries sometimes the quantity of water required may be more due to wastage, because at such places the people often keep their taps open and water continuously flows for fear of freezing of water in the taps and use of hot water for keeping the rooms warm.

b) **Size of community:** Water demand is more with increase of size for town because more water is required in street washing, running of sewers, maintenance of parks and gardens.

c) **Living standard of the people:** The per capita demandof the town increases with the standard of living of the people because of the use of air conditioners, room coolers, maintenance of lawns, use of flush, latrines and automatic home appliances etc.

d) **Industrial and commercial activities :** As the quantity of water required in certain industries is much more than domestic demand, their presence in the town will enormously increase per capita demand of the town. As a matter of the fact the water required by the industries has no direct link with the population of the town.

e) **Pressure in the distribution system:** The rate of water consumption increase in the pressure of the building and even with the required pressure at the farthest point, the consumption of water will automatically increase. This increase in the quantity is firstly due to use of water freely by the people as compared when they get it scarcely and more water loss due to leakage, wastage and thefts etc.

f) **System of sanitation:** Per capita demand of the towns having water carriage system will be more than the town where this system is not being used.

g) **Cost of water:** The cost of water directly affects its demand. If the cost of water is more, less quantity of water will be used by the people as compared when the cost is low.

VARIATIONS IN DEMAND:

The per capita demand of town is the average consumption of water for a year. In practice it has been seen that this demand does not remain uniform throughout the year but it various from season to season, even hour to hour.

SEASONAL VARIATIONS

The demand varies from season to season. In summer the water demand is maximum, because the people will use more water in bathing,cooling,lawn watering and street sprinkling. This demand will becomes minimum in winter because less water will be used in bathing and there will be no lawn watering. The variations may be up to 15% of the average demand of the year.

DAILY VARIATIONS

This variation depends on the general habits of people, climatic conditions and character of city as industrial, commercial or residential. More water demand will be on Sundays and holidays due to more comfortable bathing, washing etc as compared to other working days. The maximum daily consumption is usually taken as 180% of the average consumption.

HOURLY VARIATIONS

On Sundays and other holidays the peak hours may be about 8 A.M. due to late awakening where as it may be 6 A.M. to 10 A.M. and 4 P.M. to 8 P.M. and minimum flow may be between 12P.M. to 4P.M. when most of the people are sleeping. But in highly industrial city where both day and night shifts are working, the consumption in night may be more. The maximum consumption may be rise up to 200% that of average daily demand. The determination of this hourly variation is most necessary, because on its basis the rate of pumping will be adjusted to meet up the demand in all hours.

LABORATORY PROCEDURE TO FIND OUT PHYSICAL, CHEMICAL, BIOLOGICAL:

CHARACTERISTICS OF WATER:

Characteristics of water are physical, chemical and bacteriological which defines water quality.

Physical Characteristics

- Turbidity
- Colour
- Taste and Odour
- Temperature

Turbidity:

If a large amount of suspended solids are present in water, it will appear turbid in appearance. The turbidity depends upon fineness and concentration of particles present in water. Originally turbidity was determined by measuring the depth of column of liquid required to cause the image of a candle flame at the bottom to diffuse into a uniform glow. This was measured by Jackson candle turbidity meter. The calibration was done based on suspensions of silica from Fuller's earth. The depth of sample in the tube was read against the part per million (ppm) silica scales with one ppm of suspended silica called one Jackson Turbidity unit (JTU). Because standards were prepared from materials found in nature such as Fuller's earth, consistency in standard formulation was difficult to achieve. These days turbidity is measured by applying Nephelometry, a technique to measure level of light scattered by the particles at right angles to the incident light beam. The scattered light level is proportional to the particle concentration in the sample. The unit of expression is Nephelometric Turbidity Unit (NTU). The IS values for drinking water is 10 to 25 NTU.

Colour:

Dissolved organic matter from decaying vegetation or some inorganic materials may impart colour to the water. It can be measured by comparing the colour of water sample with other standard glass tubes containing solutions of different standard colour intensities. The standard unit of colour is that which is produced by one milligram of platinum cobalt dissolved in one litre of distilled water. The IS value for treated water is 5 to 25 cobalt units.

Taste and Odour:

Odour depends on the contact of a stimulating substance with the appropriate human receptor cell. Most organic and some inorganic chemicals, originating from municipal or industrial wastes, contribute taste and odour to the water. Taste and odour can be expressed in terms of odour intensity or threshold values. A new method to estimate taste of water sample has been developed based on flavor known as' Flavour Profile Analysis' (FPA). The character and intensity of taste and odour discloses the nature of pollution or the presence of microorganisms.

Temperature:

The increase in temperature decreases palatability, because at elevated temperatures carbon dioxide and some other volatile gases are expelled. The ideal temperature of water for drinking purpose is 5 to 12 °C - above 25 °C, water is not recommended f or drinking.

Chemical Characteristics:

- pH (Power or Percentage of Hydrogen)
- Acidity
- Alkalinity
- Hardness
- Chlorides
- Sulphates
- Iron
- Solids
- Nitrates

pH (Power or Percentage of Hydrogen):

pH value denotes the acidic or alkaline condition of water. It is expressed on a scale ranging from 0 to 14, which is the common logarithm of the reciprocal of the hydrogen ion concentration. The recommended pH range for treated drinking water is 6. 5 to 8.5.

Acidity:

The acidity of water is a measure of its capacity to neutralise bases. Acidity of water may be caused by the presence of un-combined carbon dioxide, mineral acids and salts of strong acids and weak bases. It is expressed as mg/ Lit in terms of calcium carbonate. Acidity is nothing but representation of carbon dioxide or carbonic acids. Carbon dioxide causes corrosion in public water supply systems.

Alkalinity:

The alkalinity of water is a measure of its capacity to neutralise acids. It is expressed as mg/Lit in terms of calcium carbonate. The various forms of alkalinity are (a) hydroxide alkalinity (b) carbonate alkalinity (c) hydroxide plus carbonate alkalinity (d) carbonate plus bicarbonate alkalinity, and (e) bicarbonate alkalinity, which is useful mainly in water softening and boiler feed water processes. Alkalinity is an important parameter in evaluating the optimum coagulant dosage.

Hardness:

If water consumes excessive soap to produce lather, it is said to be hard. Hardness is caused by divalent metallic cations. The principal hardness causing cations are calcium, magnesium, strontium, ferrous and manganese ions. The major anions associated with these cations are sulphates, carbonates, bicarbonates, chlorides and nitrates. The total hardness of water is defined as the sum of calcium and magnesium concentrations, both expressed as calcium carbonate in mg/L. Hardness are of two types, temporary or carbonate hardness and permanent or non carbonate hardness.

Temporary hardness is one in which bicarbonate and carbonate ion can be precipitated by prolonged boiling. Non- carbonate ions cannot be precipitated or removed by boiling, hence the term permanent hardness. IS value for drinking water is 300 mg/L as CaCO3.

Chlorides:

Chloride ion may be present in combination with one or more of the cations of calcium, magnesium ,iron and sodium. Chlorides of these minerals are present in water because of their high solubility in water. Each human being consumes about six to eight grams of sodium chloride per day, a part of which is discharged through urine and night soil. Thus, excessive presence of chloride in water indicates sewage pollution. I.S value for drinking water is 250 to 1000 mg/L.

Sulphates:

Sulphates occur in water due to leaching from sulphate mineral and oxidation of sulphides. Sulphates are associated generally with calcium, magnesium and sodium ions. Sulphate in drinking water causes a laxative effect and leads to scale formation in boilers I. t also causes odour and corrosion problems under aerobic conditions. Sulphate should be less than 50 mg/L, for some industries. Desirable limit for drinking water is 150 mg/L. May be extended u pt o 400 mg/L.

Iron:

Iron is found on earth mainly as insoluble ferric oxide. When it comes in contact with water, it dissolves to form ferrous bicarbonate under favourable conditions. This ferrous bicarbonate is oxidised into ferric hydroxide, which is a precipitate. Under anaerobic conditions, ferric ions reduced to soluble ferrous ion.Iron can impart bad taste to the water, causes discolouration in clothes and incrustations in water mains. I.S value for drinking water is 0.3 to 1.0 mg/L.

Solids:

The sum of total foreign matter present in water is termed as' total solids'. Totalsolids are the matters that remains as residue after evaporation of the sample and its subsequent drying at a defined temperature (103 to 105 °C). Total solids consist of volatile (organic) and non-volatile(inorganic or fixed) solids. Further, solids are divided into suspended and dissolved solids. Solids that can settle by gravity are settleable solids. The others are non-settleable solids. I.S acceptable limit for total solids is 500 mg/L and tolerable limit is 3000 mg/L of dissolved limits.

Nitrates:

Nitrates in surface waters occur by the leaching of fertilizers from soil during surface run-off and also nitrification of organic matter. Presence of high concentration of nitrates is an indication of pollution. Concentrations of nitrates above 45 mg/L cause a disease methemoglobinemia. I. S value is 45 mg/L.

Bacteriological Characteristics:

Tests to indentify bacteria

- Standard plate count test
- Most probable number
- Membrane filter technique

Standard plate count test:

In this test, the bacteria are made to grow as colonies, by innoculating a known volume of sample into a solidifiable nutrient medium (Nutrient Agar), which is poured in a petridish. After incubating (35°C f) or a specified period (24 hours), the colonies of bacteria (as spots) are counted. The bacterial density is expressed as number of colonies per 100 ml of sample.

Most probable number:

Most probable number is a number which represents the bacterial density which is most likely to be present. E.Coli is used as indicator of pollution. E.Coli ferment lactose with gas formation with 48 hours incubation at 35°C. Based on this E.Coli density in a sample is estimated by multiple tube fermentation procedure, which consists of identification of E.Coli in different dilution combination. MPN value is calculated as follows:

Five 10 ml (five dilution combination) tubes of a sample are tested for E.Co li. If out of five only one gives positive test for E.Coli and all others negative. From the tables, MPN value for one positive and four negative results is read which are 2.2 in present case. The MPN value is expressed as 2.2 per 100 ml. These numbers are given by Maccardy based on the laws of statistics.

Membrane filter technique:

In this test, a known volume of water sample is filtered through a membrane with opening less than 0.5 microns. The bacteria present in the sample will be retained upon the filter paper. The filter paper is put in contact of a suitable nutrient medium and kept in an incubator for 24 hours at 35°C. The bacteria will grow upon the nutrient medium and visible colonies are counted. Each colony represents one bacterium of the original sample. The bacterial count is expressed as number of colonies per 100 ml of sample.

SOURCES OF WATER:

All the sources of water can be broadly divided into

1. Surfaces sources and

2. Sub surface sources

The surface sources further divided into

i. Streams

Rivers

ii. Ponds

iii. Lakes

iv.Impounding reservoirs etc.

NATURAL PONDS AND LAKES

In mountains at some places natural basin's are formed with impervious bed by springs and streams are known as "lakes". The quality of water in the natural ponds and lakes depends upon the basin's capacity, catchment area, annual rainfall, porosity of ground etc. But lakes and ponds situated at higher altitudes contain almost pure water which can be used without any treatment. But ponds formed due to construction of houses, road, railways conatins large amount of impurities and therefore cannot be used for water supply purposes.

STREAMS AND RIVERS

Rivers and streams are the main source of surface source of water. In summer the quality of river water is better than mansoon.because in rainly season the run-off water also carries with clay, sand, silt etc which make the water turbid. So river and stream water require special treatments. Some rivers are snowfed and perennial and have water throughout the year and therefore they donot require any arrangements to hold the water. But some rivers dry up wholly or partially in summer. So they require special arrangements to meet the water demand during hot weather. Mostly all the cities are situated near the rivers discharge their used water of sewege in the rivers, therefore much care should be taken while drawing water from the river.

IMPOUNDING RESERVOIRS

In some rivers the flow becomes very small and cannot meet the requirements of hotweather. In such cases, the water can be stored by constructing a bund, a weir or a dam across the river at such places where minimum area of land is submerged in the water and max. quantity of water to be stored. In lakes and reservoirs, suspended impurities settle down in the bottom, but in their beds algae, weeds, vegetable and organic growth takes place which produce bad smell, taste and colour in water. Therefore this water should be used after purification. When water is stored for long time in reservoirs it should be aerated and chlorinated to kill the microscopic organisms which are born in water.

SUBSURFACE SOURCES

These are further divided into

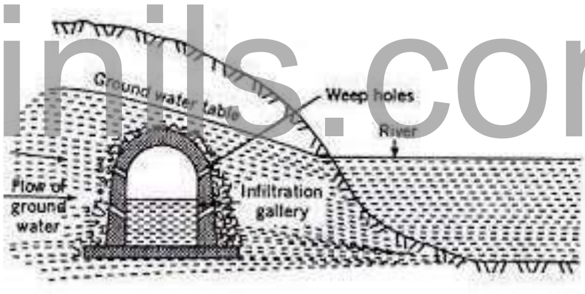
(i) Infiltration galleries

(ii) Infiltration wells

(iii) Springs etc

INFILTRATION GALLERIES

A horizontal nearly horizontal tunnel which is constructed through water bearing strata for tapping underground water near rivers, lakes or streams are called “Infiltration galleries”. The yield from the galleries may be as much as 1.5 x 104 lit/day/metre length of infiltration gallery.



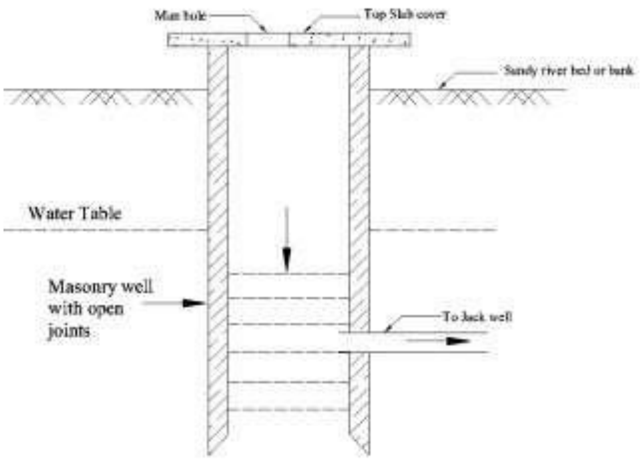
For maximum yield the galleries may be placed at full depth of the acquifer. Infiltration galleries may be constructed with masonary or concrete with weep holes of 5cm x 10cm.

INFILTRATION WELLS

In order to obtain large quantity of water, the infiltration wells are sunk in series

in the blanks of river. The wells are closed at top and open at bottom. They are

constructed by brick masonary with open joints.



Infiltration Well

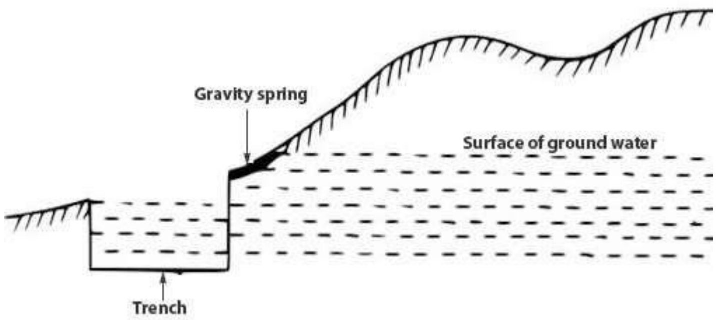
For the purpose of inspection of well, the manholes are provided in the top cover. The water filtrates through the bottom of such wells and as it has to pass through sand bed, it gets purified to some extent. The infiltration well in turn are connected by porous pipes to collecting sump called jackwell and there water is pumped to purification plant for treatment.

SPRINGS:

Sometimes ground water reappears at the ground surface in the form of springs. Springs generally supply small springs. Springs generally supply small quantity of water and hence suitable for the hill towns. Some springs discharge hot water due to presence of sulphur and useful only for the curve of certain skin disease patients.

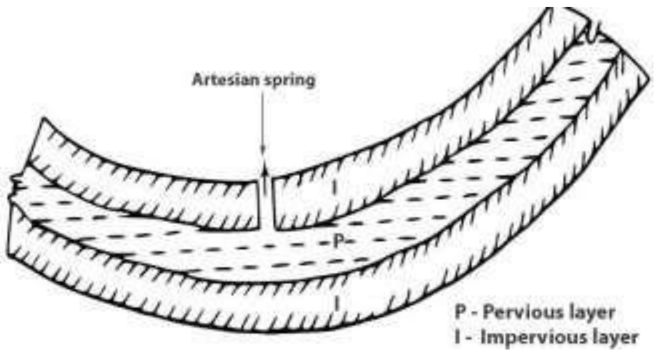
Types of springs:

1.Gravity Springs: When the surface of the earth drops sharply the water bearing stratum is exposed to atmosphere and gravity springs are formed



2. Surface Spring: This is formed when an impervious stratum which is supporting the ground water reservoir becomes out crops

3. Artesian Spring: When the ground water rises through a fissure in the upper impervious stratum when the water-bearing stratum has too much hydraulic gradient and is closed between two imperious stratum, the formation of Artesian spring from deep seated spring



WELLS:

A well is defined as an artificial hole or pit made in the ground for the purpose of tapping water. In India 75 to 85% of Indian population has to depend on wells for its water supply.

The three factors which form the basis of theory of wells are

1. Geological conditions of the earth's surface

2. Porosity of various layers

3. Quantity of water, which is absorbed and stored in different layers.

The following are different types of wells

1. Shallow wells

2. Deep wells

3. Tube wells

4. Artesian wells

Shallow Wells:

Shallow wells are constructed in the uppermost layer of the earth's surface. The diameter of well varies from 2 to 6 m and a maximum depth of 7m. Shallow wells may be lined or unlined from inside. . These wells are also called draw wells or gravity wells or open wells or drag wells or percolation wells. Quantity of water available from shallow wells is limited as their source of supply is uppermost layer of earth only and sometimes may even dry up in summer. Hence they are not suitable for public water supply schemes. The quantity of water obtained from shallow wells is better than the river water but requires purification. The shallow wells should be constructed away from septic tanks, soak pits etc because of the contamination of effluent.The shallow wells are used as the source of water supply for small villages, undeveloped municipal towns, isolated buildings etc because of limited supply and bad quality of water.

Deep Wells:

The Deep wells obtain their quota of water from an aquifer below the impervious layer as shown in fig No. The theory of deep well is based on the travel of water from the outcrop to the site of deep well. The outcrop is the place where aquifer is exposed to the atmosphere. The rain water entered at outcrop and gets thoroughly purified when it reaches to the site of deep well. But it dissolves certain salts and therefore become hard. In such cases, some treatment would be necessary to remove the hardness of water. The depth of deep well should be decided in such a way that the location of out crop is not very near to the site of well. The water available at a pressure greater atmospheric pressure, therefore deep wells are also referred to as a pressure wells.

PHYSICAL AND CHEMICAL CHARACTERISTICS OF WATER ALONG WITH THE STANDARDS:

PHYSICAL CHARACTERISTICS	STANDARDS
Turbidity	5NTU
Colour	5 Hazen units
Taste	Agreeable
Odour	Unobjectionable
Temperature	10° C – 25 °C

CHEMICAL CHARACTERISTICS	STANDARDS
pH	6.5-8.5
Total hardness	300 mg/l
Iron content	0.3mg/l
Chloride content	250mg/l
Nitrogen content	0.15mg/l
Alkalinity	200mg/l