

The Water Crisis

Next to air, water is the basis of life. The history of civilisation has been influenced greatly by water. Civilisations have grown, where water was available plenty and they have decayed, where the water resource dried up or became undependable. There are many causes of such decay but water has been a major one. Availability of productivity and also the health and quality of life of the people. Water is essential to produce the surpluses that fuel progress. So we need to make all parts of India, flowing with water, even more than "milk and honey".

The water crisis has affected earlier civilizations and is affecting the present one also. But the present civilisation has given man the powers to tamper with planet, on a scale never before even visualised. If earlier civilisations decayed from lack of water, because of the wrong doings of the populations developed elsewhere. Now we have a global civilisation and if we make a mistake, the disaster can also be global.

The water crisis is basically different from say the oil crisis. Water is a renewable resource in our time scale, oil is not. The water crisis is primarily a distribution problem distribution in space and time.

The planet and its Water Cycle: -

The total quantity of water on our planet Earth is very nearly constant and it keeps circulating through what is called the water or hydrologic cycle. Water from land and sea, evaporates into the atmosphere, forms clouds falls back to earth as rain or snow, and then into rivers and streams and back to the sea and air. So the water strictly is a fixed resource, but we cant really destroy it on any significant scale – we can only spoil it; yet it will keep purifying itself.

The total quantity of water on our planet is estimated at 1.36×10^9 km³. Almost 97% of this is in the oceans and is salty. Of the balance 3% that is sweet. Only 0.7% is in liquid form. The rest is present as ice, mostly near the poles and in high mountains. Of the 0.7% that is potentially potable. 0.6% is present as ground water and the rest 0.1% is in the lakhs, rivers and as vapour in the air.

This clearly establishes the importance of the groundwater. Let us now look at the quantities of water involved in the water cycle. The unit used is mhm – million hectare meters that is one million hectares of land covered with water one meter deep. This mhm is ten times bigger than a cubic kilometer or is 1010m². The whole land surface in the world gets an annual precipitation of approx 10,000 – 12,000 mhm of water. India gets 400 mhm out of these (ref.: Our water Resources by Dr.Rama, TIFR, Bombay) Of these 400, 230 mhm evaporates, including through plants, 110 is flowing directly into streams and is called runoff about 60 mhm goes into the ground recharges the groundwater and overflows into streams, rivers and ultimately into sea/ air cycle. Compared to these, the potable water requirement of the total population of India, @ liters 50/ per capita per day works out to 1.4 mhm per annum. The average precipitation in India is 1000 mm/ year, adequate to raise two crops per year. This clearly establishes that the water crisis is really a problem of distribution of water in space and time.

The nature of the land surface and sub-surface plays an important part in water storage and distribution. For this purpose India can be considered in three parts:

- 1) The Himalayan zone
- 2) The Gangetic river basin (and other basins)
- 3) The peninsular part of India.

The Himalayan part is geographically the youngest (approx. 2-3 crore years). Because it has many streams fed by melting snow, the problem is how to divert the streams (some water from them) to the human habitations, so that the water reaches in a clean state. The freezing temperatures and frequent landslides are the problems to be tackled. To this is added the instability caused by the denudation of the forests.

The Gangetic plains zone is a different picture all together. Composed mostly of aluvium (earth deposited by flowing water), there is a vast mostly amount of underground water, almost all over. The land being nearly flat, the problem is often, the salination of the land, due to excessive water and lack of drainage.

The Peninsular India, is mostly a hard rock area and geologically old. It was part of the old Gondwanaland Continent. The peninsular India broke off from that now extinct continent, (Antartica, Australia, Africa & South America were also part of the formation of the Himalayas. The portion of the ocean in between was filled up by the silt from the rivers coming from the north, which continued to flow in their course during the rise of the Himalayas and poured their silt in the low land in between the Gangetic and other river basins.

A good part of the peninsular India is the Deccan Trap. This makes 85% of Maharashtra. This part is made up of lava flows from now extinct volcanoes. Over millions of years, the lava flows coming in successive eruptions, formed long stretches of layers upon layers, all nearly horizontal and parallel. The flows consisted mainly of two types the viscous flows with gas entrapped, and the relatively thin has free flows. These on solidification at different rates, formed different kinds of rock formations. The weathering chemical and physical erosion, of these rocks, by rain, sun and wind, produced the valleys and valleys and the river basins, the less eroded parts being the presently seen hills. This is the reason, why so many hills in Maharashtra have a tabletop appearance and we can see the ancient volcanic flows like a layered cake, when we see these mountains from a distance.

Because of the rocky nature, ground water storage in the Deccan Trap area is less and uneven. Similarly percolation of water into the ground is highly variable. The water crisis is therefore more servers, particularly in the rain shadow region of Deccan platen. Even in this region, the rainfall is approx 400-500 mm and if properly exploited should be adequate for more than one crop per year.

The strategy for tackling the water crisis in these regions should be based on the following three activities.

1. Collection of Data regarding sub-surface geology, water levels and their variation; actual yield and potential of water sources, etc.
2. Implementation of schemes of digging shallow wells (less than 20m), drilling bore wells, building percolation tanks surface water reservoirs a forestation, and construction pipelines for transport of water, mainly drinking water, from surplus to deficit areas.
3. A research and education wing to get the best out of available water through drip irrigation, economical use of water etc.

Data Collection: Correct information is the most important resource in tack ling any crisis. The water crisis is no exception. When the information pool is huge, collation of information – organizing it so that interpretation and use is easy – this becomes a difficult task. Computerization of all the data becomes important. With all the advances in science and technology, we are still heavily dependent, on simple field observations for much of the needed information. This makes an ideal case for voluntary agencies to involve themselves in. Students, even school students could be

trained to make a valuable contribution in building up this national asset, in the form of extensive field data. This activity is not only of national importance but has great educational value for the students involved.

Observation of simple rock types on the surface, in wells and wherever excavation is going on, and recording of this on topographic maps is an important field activity that school students should undertake. Observations & recordings of water level in wells in wells in every village, regularly through the year are also important. These levels when recorded as absolute levels above mean sea level, with the help of topographic maps, can give a lot of information's that enables water table contours to be drawn. This information when recorded on the map gives useful clues on the flow of water underground and the permeability characteristics to some extent.

Among all the geophysical methods used for investigating subsurface geology measurement of electrical resistance of the ground is the least expensive and the more common method, inspite of its many limitations. In principle, the electrodes are hammered into ground (just a few centimeters – deep enough to make a good electric current and so the instrument "reads" a deeper section of the ground. Drawing a graph of electrical resistivity vs. electrode separation and matching the curves with a standard curve helps one to estimate the thickness and electrical resistivity of rock layers below that could give the field pattern. From this one judges, the presence or otherwise of potential water bearing rock zones.

Considering the need of shallow or moderate depth (30-40m) wells, it is possible to train high school students to make these measurements and with some guidance even the general interpretations. The instrument it self also has the potential of being simplified to make it less expensive and a useful tool in the hands of the school students. Some professional geologists and geophysicists will raise their eyebrows a at these suggestions tend to mystify science rather than make it simple to understand and use.

To make the best use of national resources, each state should have a Data Center that will computerize and collate all data obtained from aerial photographs, satellite imagery, field observations, drilling logs and well completion reports etc. Such collected data on collation will bring out conflicts and contradictions within, which could be verified by further spot checks, in the field. All agencies workings in the field of water resource development will contribute to this and also will have access to it.

The design and selection of projects involving digging bore or shallow wells, surface water reservoir or percolation tanks and water grids will be easier and more cost effective, when all earlier information in more easily retrievable. Attention to recharges systems, to ensure the replenishment and even enhancement if ground water supplies, should be stressed. Local participation in field observations will bring out the relationship between the recharge zone and given set of wells. Percolation tanks can make drastic changes for the better in the water though widely known are not much used and could be used for increasing the quantity of impounded water in sites which are good for bounding and percolation but have inadequate catchments areas. This activity can also have a great involvement of the students and the general population and will mutually beneficial. Forestation has a major role in reducing the runoff and increasing ground water recharge. If we locate strategic recharge area for each village drinking drinking water sources, forestation of valuable data on effect of forestation on the water table.

Lastly every one should realize that water is a source and valuable resource and should learn to use it with thrift. Some of the important lessons still to be learnt are

the following - 1) All wastewater from domestic use should be used to irrigate trees. 2) It is economical in water use to use a tap rather than use a mug. The tap should be adjusted for a small flow, just adequate for the purpose – while both hands are free to wash. 3) Properly adjusted tap or fine shower is more economical in water than use of a bucket. 4) Clothes should not be rinsed in running water, but immersed in a bucket and wrung dry between rinses. 5) Utensils for washing should be cleaned of garbage, before washing with water. 6) A tap should be in the closed position even if it is dry. Most people even in drought areas do not realize the importance of these and often waste a lot of water.